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Presentation

The 3rd International Congress on Water, Waste and Energy Management (**EWWM**) is organized by academics and researchers belonging to different scientific areas of the C3i/Polytechnic Institute of Portalegre (Portugal) and the University of Extremadura (Spain) with the technical support of ScienceKnow Conferences.

The event has the objective of creating an international forum for academics, researchers and scientists from worldwide to discuss worldwide results and proposals regarding to the soundest issues related Water, Waste and Energy.

This event will include the participation of renowned keynote speakers, oral presentations, posters sessions and technical conferences related to the topics dealt with in the Scientific Program as well as an attractive social and cultural program.

The papers will be published in the Proceedings e-books. The proceedings of the conference will be sent to possible indexing on Thomson Reuters (selective by Thomson Reuters, not all-inclusive) and Google Scholar. Those communications considered of having enough quality can be further considered for publication in International Journals. At the authors' choice, those works not suitable for publication in any of the congress journals will be published in an Extended Abstracts book of the International Congress on Water, Waste and Energy Management, once the Conference has finished.

The Conference will also have a space for companies and/or institutions to present their products, services, innovations and research results. If you or your company is interested in participating of this exhibition, please contact the Technical Secretariat here.

Finally, on behalf of the Organizing Committee, I would like to invite all the Scientific Community to participate in this project, presenting papers or communications related to any of the proposed areas.

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Investigation of Brick Production By Using Construction and Demolition Wastes as Raw Material

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Abstract

Turkey has faced to the problems of the waste storage management of construction & demolition (C&D) wastes since the increasing of urban transformation projects after 2012. It is suggested that Turkey will have about 500 million tons of C&D wastes in the next 20 years. Therefore, the project on specifying the usage criteria of the recycling materials obtained from the C&D wastes put into face by The Ministry of Environment and Urbanism and executed by TUBITAK MRC. One of the applications of the scope of this study is to produce bricks from the wastes of C&D.

In this study, usage criteria of plastered brick waste (PBW), tile waste (TW) and plaster waste (PW) as raw material in brick production is investigated. Optimal usage proportions are decided after laboratory scaled researches. For this purpose, samples are produced by adding different amount of waste (plastered brick, tile, plaster) to brick clay and produced samples are fired in 800°C, 900°C and 1000°C. Shrinkage, water absorption, density, porosity and compressive strength of samples are measured and compared with Turkish Standard (TS), Brick Industry Association (BIA) standards, Ikizler Brick Certificate Of Conformity for Horizontal Hollow brick (IBCC) and reference sample values produced by 100% ripe brick clay (RRBC). According to the experimental results, it is determined that 30% proportion of plastered brick waste, 30% proportion of tile waste and less than 10% proportion of plaster waste can be substituted to brick clay in brick production.

***Keywords*:** *brick production, plastered brick waste, plastered waste, tile waste*

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Alkaline modification effect on triple polymer system prior to flotation

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1. Introduction – Plastic has become the most common material of the modern life due to its durability, light weight and low cost, also makes it problematic when it comes to its end of life. The disposal of plastic wastes is a growing problem all over the world, and recycling is a necessity to solve this problem. Polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET), acrylonitrile butadiene styrene (ABS), polystyrene (PS), polycarbonate (PC) and polyvinyl chloride (PVC) are the kind of plastic wastes disposed [1]. As the chemical structures are different, these plastics should be separated from each other for the recycling process. PET and HDPE are among the most used plastics. They are commonly used together in drinking water bottles. Household and consumer goods are the major applications of ABS. ABS is used in automotive parts, protective helmets, toys, appliances, telephones, cell phones, computers, other office equipment and pipes due to its impact strength, resistance capability and durability. As the chemical structures are different, it was aimed to propose optimal conditions for a froth flotation process which will selectively separate virgin plastics using alkali treatment and a frother only in a triple system consisting of HDPE, PET and ABS.

2. Experimental - In this study, HDPE, PET and ABS were used as virgin plastic granules. The samples of polymers were treated with alkaline solutions. Technical grade sodium hydroxide and tap water were used to prepare alkaline solutions. Virgin polymer samples were mixed for 1 to 10 minutes, and temperature ranges were chosen as 20 to 60 ^{o}C. MIBC were used as frother. Selective froth flotation was accomplished in a modified short column flotation cell having a 5x5x25 cm^3 volume used in a previous study [2]. The bottom of the flotation cell was fitted with a porous glass frit for bubble production. The froth passed through a gutter by overflow. Compressor supplying the air into the flotation column was set to 75 l/h kept constant for each experiment. After conditioning with NaOH, same amount of each plastics were fed to flotation column. Conditioning time with MIBC and flotation time was kept as 5 minutes and 3 minutes respectively. The products of the flotation process were collected and weighed after being visually identified according to their distinct physical characteristics and the same procedure was applied for the sunken products.

3. Results and Discussion - The floatability of the plastic materials were identified with single - binary and triple system in order to achieve selective separation of each plastic. PET, HDPE and ABS were known to be naturally floatable (hydrophobic) materials. Therefore, it was necessary to use an appropriate agent/depressant to achieve selective flotation.

4. Conclusions - As a result of experiments, HDPE was 100% recovered after surface treatment with 50 kg/t of NaOH at 20°C, and 400 g/t of MIBC frother dosage during flotation. The remaining PET+ABS mixture was re-conditioned using 40 kg/t NaOH and then subjected to froth flotation. ABS with recovery higher than 95.5% was obtained after multiple stages of floatation and the remaining product was produced with 95.7% PET content.

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Energy harvesting using an arch-shape microbeam

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1. Introduction –The arch-shaped beam under an external load can experience an instability called snap-through [1], which causes very large and abrupt displacement. As in microelectromechanical systems (MEMS), the beam structure and electrode substrate form an electrostatic structure and the corresponding capacitance is determined by the gap distance. The displacement induced capacitance change generates electric current for a fixed voltage applied on beam and substrate, which thus converts the mechanical energy into electrical one. With the sudden and large displacement change utilizing the snap-through instability, the efficiency of the energy conversion can be high. However, under an electrostatic loading, the beam can also experience another instability called pull-in [2]. When pull-in occurs, the beam collides with substrate, which leads to the stiction failure of the whole device. How to avoid the pull-in instability and at the same time to ensure the occurrence of the snap-through is key to the energy harvesting of such MEMS device. These two types of instabilities are studied, which can provide a reliable design guidance for the device. Poweing is no trivial thing for microdevice and such energy harvesting scheme is de facto an efficient renewable energy source for the MEMS device.

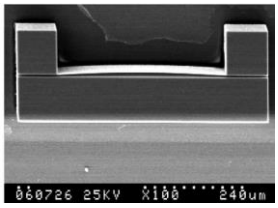

Image 1. SEM photograph of an arch micro-beam

2. Experimental – As seen in Image 1, the micro-beam is made by the Silicon Glass Anodic-bonding and Deep Etching Release (SGADER) process, the Mirau interferometer is used for the experimental measurement.

3. Results and Discussion – Two types of instabilities can be easily distinguished in the experiment as seen in image 2, in which the corresponding voltage of the pull-in instability is always higher.

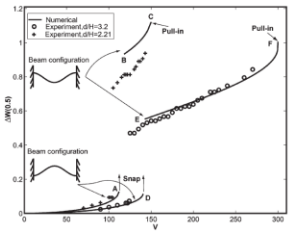

Image 2. Snap-through and pull-in

4. Conclusions – The voltage gap between the pull-in and snap-through is a solid experimental validation for an arch-shaped MEMS to be used for energy harvesting .

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Assessment of decentralized biogas production from anaerobic digestion of hosehold food wastes in Chile

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1. Introduction – Sustainable waste management has become a necessary and mandatory requisite for all societies in order to protect, not only environment but human health as well. Anaerobic digestion (AD) has been consolidate as the most reliable technology for minimizing environmental impact and landfills disposal requirements, when high percentage of organic residues are involved. Despite AD process is well-known, the homogenization of suitable substrates mixtures and the collection logistic still remain as key factors for determining feasibility of AD plants. In particular, Chile produces 382.4 kg (per capita and year)$^{-1}$ and the organic fraction accounts for 2,500 Gg, which is composed of 90 % food waste (FW) [1].

Despite, several different proposals for separate collection of FW have been successfully implemented in other countries with the aim of both reducing CO_2 emissions and increasing renewable alternative energy production in the decentralized or centralized form [2], Chile has not yet developed any strategy regarding this issue. Motivation of population is always the most important key factor with regards to the success of waste management policies, in special for separation at origin. Despite previous authors have analysed the biomethane potential in Chile [3,4] the novelty of this proposal is the utilization of FW in a decentralized form by following the example in other countries [5] with the aim of contributing to the Chilean currently situation in terms of energy and environment protection [6].

2. Experimental – Potential methane yield from FW has been by estimated based on previous researches [3-5,7]. The Chilean FW composition, in terms of VS, has been determined by testing wastes from Chilean canteens placed in Talca. Hence, average potential methane, provided by AD of FW, has been calculated. In addition the avoided CO_2,eq emissions by reducing amount of FW in landfills have been estimated in accordance with reports published by the Ministry of Environment [8] and the so called horizontal carbon fluxes have been calculated by following same equations proposed by Zhou et al. (2014) [9]. Furthermore, the use of methane from AD lead to a reduction of CO_2 emissions by the substitution of fossil fuels which has been also accounted. Data have been categorized by Chilean region and potential fuel savings have been showed based on average natural gas consumption per household.

3. Results and Discussion – The results suggest that AD of FW in Chile might incorporate more than 240 MM Nm^3 methane as substitute for natural gas, when an appropriate separation of waste is performance by using small bioreactors in households in a decentralized form. From this point of view, citizens can be rewarded with important savings which range between 0.9 % and 11.7 % of annual fuel consumption. In addition, this system reduces the amount of MSW that requires collection, transportation and landfills. Thus, 1,3 Gg CO_2 emissions can be avoided yearly.

4. Conclusions - Based on the aforementioned expected results and taken into account that small power units have been successfully installed, mostly in India, China and EU, the promotion of such system by the Chilean government represent an excellent opportunity for the reduction of the external energy dependence, the GHG emissions rate and the impact of the waste produced.

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Brief Scientific CV

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- Dipl. Electrical Engineer, University of La Rioja, Spain. Dissertation: Design of electrical facilities for a novel concrete factory"

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Comparative Analysis of Floods in the Siret Catchment in the Context of Heavy rains fallen in the summer of 2010

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1. Introduction – the year 2010 was one of the most dangerous, from the perspective of catastrophic floods. The months of May-June recorded some of the strongest floods in both Central and Eastern Europe: Poland, Austria, The Czech Republic, Germany, Hungary, Slovakia, Serbia, Ukraine, Slovenia, Bosnia and Herzegovina, Montenegro, Croatia, Romania, and so on. On the Romanian territory, exceptional floods occurred in the rivers of Siret, Prut, Tisa, Somes, Olt, Tarnave, and so on. In Europe, the number of human losses was significant: Poland 25, Romania 6, Slovakia 3, Serbia 2, Hungary 2, The Czech Republic 2, and so on. Siret comprises the largest catchment on the Romanian territory. For this reason, precipitations have followed different patterns in the mountains and in the plateau areas. At the same time, the Siret catchment comprises the highest number of dams in Romania. This study emphasizes the role played by locally, heavy rains at the onset of floods, and the importance of large reservoirs in the mitigation of flood waves. Another purpose of the article is to evaluate the relationship between mountainous rivers (tributaries of Siret) and water supply during floods. Flood waves are controlled by the reservoirs, which take over a part of the excess discharge [1].

2. Experimental - In studying catastrophic floods, a globally available methodology was used. Data were obtained from the Siret Water Basin Administration, based in the city of Bacau. For small rivers or for places without hydrometric stations, measurements were taken for reconstituting the discharges. The assessment of floods worldwide has been analyzed by competent authorities, using modern, as well as fast tools and technology.

3. Results and Discussion - The River crosses Moldavia from the north to the south and it discharges into the Danube, near the city of Galati. During the period, 17th June-10th July, 2010, significant amounts of precipitations in the mountainous basin of Siret were recorded. The floods comprised two periods with four bimodal cycles and they were counted among the strongest on the Romanian territory. The exceptional floods occurred in the rivers of Siret, Suceava, Moldova, Bistrita, Trotus and so on. The most important compound flood wave was determined by the precipitations which fell within the period, 29th June to 1st July 2010, when significant amounts of rain were recorded, sometimes, exceeding 80 mm. The high discharges on the Bistrita River – downstream from the Bicaz dam – were controlled by complex hydro technical works. The maximum discharge for the year 2010 summer floods was recorded at Dragesti hydrometric station: 2,884 m^3/s (historic discharge) compared to the preceding historic discharge of the year 2008 (2,850 m^3/s). The effects of floods were strongest in the counties of Suceava, Neamt, and Bacau. The floods on the main course of the Siret River were analyzed in correlation with the tributaries within the mountainous sector [2].

4. Conclusions - The mountainous rainfalls of 17th June – 10th July, 2010 led to exceptional floods, compared to those of the year 2005 and 2008. The mountainous tributaries of Siret have relatively constant and high flows. They are responsible for some catastrophic floods, because they are supplied by pouring rains during the summer. The torrential character is induced by the influence of the temperate-continental climate of transition, with excessive nuances.

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Efficacy of a Photo-catalyst towards the degradation of a pharmaceutical compound, 4-Aminopyridine by application of response surface methodology

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Abstract:

Present study demonstrates an intensive experimental study on the photo-degradation of pharmaceutical compound (4-Aminopyridine) in batch photo reactor with low energy ultraviolet light (240 nm) and using zinc oxide as catalyst. 4-Aminopyridine has been used for many years, prescribed for people with multiple sclerosis. This study aims to analyze the influence of operating parameters, and their interactive effect on the overall removal efficiency of the targeted component in water by response surface methodology (RSM). Time (A), molar ratio of pollutant to catalyst (B), molar ratio of H_2O_2 to ZnO (C), and pH (D) were chosen as independent variables to optimize the percent removal of 4-Aminopyridine as response. Highest COD removal 97 % was obtained at pH (5.3), ZnO (0.3 gm/l), H_2O_2 (3757 mg) within 49 min treatment time. Model predicted values were found in good agreement with the experimental values, and the behavior of the model equation has supported the experimental observation with minor deviation. Furthermore, the degradation of 4-Aminopyridine was confirmed by the UV-Vis spectrophotometer which showed continuous degradation after every 10 min time interval within an hour study and the FTIR (Fourier transform Infrared) spectrophotometer analysis reveals the modification of the functional groups after photo-catalytic treatment.

Key words: chemical oxygen demand (COD) removal; degradation; experimental value; pharmaceutical; photo reactor; response surface methodology (RSM).

Incorporation of construction and demolition waste in the production of ceramic brick

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1. Introduction – Construction and demolition waste (C&DW) represents a major economic and environmental problem for the construction industry. Large amounts of C&DW are produced, thus requiring alternative ways to the traditional landfill disposal, namely valorisation [1]. The use of C&DW in the manufacture of ceramic products, such as ceramic bricks, might be considered an innovative usage of this material, thus contributing to the reduction of C&DW inadequate disposal, to the preservation of natural resources and to the development of a newly differentiated environmental-friendly product, specially designed for the sustainable building construction market.

2. Experimental - In the present work, samples of natural clay containing up to 20% of C&DW, namely a mixture of stone, cement-based and ceramic elements, were prepared in laboratory and tested for their physical properties (flexural strength, shrinkage and water absorption). Previous characterization of the materials included chemical and mineralogical composition (X-ray fluorescence, X-ray diffraction), thermal behavior (dilatometry, DTA and TGA) and particle size distribution (Laser Granulometer, Wet sieve test). In addition, a semi-industrial test of ceramic brick fabrication with the mixture that allowed the best laboratory result was performed.

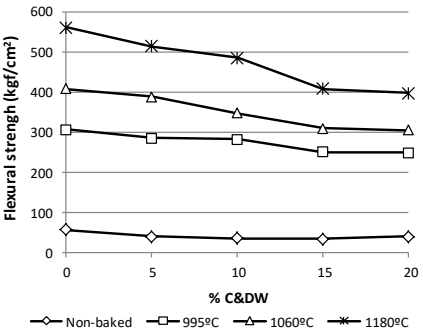

Image 1: Changes in flexural strength on specimens containing different %C&DW

3. Results and Discussion - Image 1 shows that the increasing amount of reject in the specimens reduces flexural strength. This is due to the C&DW's non-plastic character which tends to reduce the plasticity of the ceramic pastes and to turn the extrusion process more difficult. Nevertheless, with the reject-added composition of 20 wt.% this effect seems to be less important. These results are corroborated by shrinkage and water absorption values (data not shown). When C&DW is present, it acts as an inert material, causing a general increase in the porosity due to the release of CO_2 during baking. However, the negative effect of the addition of an inert material on the sintering behaviour might be initially counteracted by the fluxing effect of the addition of CaO, which improves the sintering behaviour [2] thus justifying the better results obtained with the higher C&DW addition in this work. As expected, these physical properties are affected by the sintering temperature.

Table I – C&DW *versus* CMO standard bricks characteristics

Parameter	C&DW brick	Standard brick
Dimensions (LxHxW) (mm)	304 x 237 x 138	298 x 237 x 137
Compressive strength, 970ºC (N/mm²)	5.2	5.4
Water absorption, 970ºC (%)	13.4	12.7

The physical dimensions, the

compressive strength and the water absorption values obtained in this work satisfy the standard brick characteristics previously established (Table I). Moreover, the semi-industrial trial of ceramic brick fabrication did not reveal significant changes to the industrial procedure.

4. Conclusions - Generally, the results showed that the addition of C&DW to the clay did not significantly modify the final properties of the brick, thus showing an excellent alternative to the traditional product and an innovative solution for recycling C&DW

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Removal of Cr^{+6} from leachate using lime treated clay soil as a landfill liner material.

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Abstract:

In the present study, the efficacy of lime treated clay soil used as composite liner system to retard the migration of chromium (Cr^{6+}) contaminated leachate to the lithosphere has been explored. The Cr^{6+} adsorption capacity (226.5 mg/Kg) of the locally available clay soil makes it as a promising barrier material. However the cohesive soil exhibits volume instability due to its swelling and shrinkage properties in contact with moisture and thus accelerates the formation of desiccation cracks in the soil body and destabilizes the function of liner material. The addition of hydraulic lime (by 5% in weight) with the soil arrests the volume instability by including high shrinkage limit (20.12%) and low swelling potential (4.26%) and thus inhibits the formation of desiccation crack within the liner body. The shear strength of the soil increased by two times apart from substantial increment of Cr^{6+} uptake capacity (457 mg/kg). The lime amended clay soil exhibited low volume compressibility, thus limited post construction settlement was expected. The results indicated that the lime treated clay soil could be considered as excellent landfill liner material due to its high uptake capacity and favorable geotechnical properties.

Key words: Chromium (VI); Migration; Soil and groundwater pollution; Clay soil; Lime; Landfill liner.

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Electrokinetic remediation of Chromium (VI) contaminated soil –A novel approach.

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Abstract:

Electro kinetic (EK) remediation is a widely applied method now-a-days for treatment of heavy metal contaminated soil. In this present study, the feasibility of EK technique for extraction of Chromium (VI) from contaminated soil was investigated. In this regard, two sets of experiments were conducted comprising of (i) distilled water as both anolyte and catholyte (DW-EK) (ii) distilled water as anolyte and 0.1 M citric acid as catholyte (CA-EK) with continuous and intermittent voltage gradient of 1.3 VDC per cm at synthetically prepared Cr (VI) concentration of 5 mg/l to study the effect of current variation and acid dosing on removal efficiency. The pH value of catholyte in the CA-EK was controlled within acidic range using HCl buffer solution. It was found that the maximum adsorption of Chromium in the saturated soil was 50 $mg.kg^{-1}$. The addition of citric acid as catholyte enhanced the chromium removal capacity as 86.96% and 95.52% compared to 56% and 86.4% at the anode and cathode section respectively. The higher removal of chromium may be due to the increment of mobility for better ionization or solubility of Chromium ions and its resistivity against the formation of neutral zone in the soil. The presence of citric acid played a significant role on ionization process by varying current density from 0.208 to 1.082 $mA.cm^{-2}$. Due to the control of catholyte within acidic range, pH level within the soil remained within 2.35-2.68 compared to 7.2-8.92 in DW-EK experiments which indicated better ionic movement within the soil and intensified the desorption of Cr (VI).

Key words: Soil contamination; Chromium (VI); Electro kinetic remediation; Distilled water; Citric acid.

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Assessment of heavy metal adsorption potential of lateritic soil used as landfill liner material in waste containment structures.

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Abstract:

Increasing soil and groundwater pollution by heavy metals through anthropogenic reason is a major concern of present environment. The objective of the present study was to assess the potential of lateritic soil to be used as liner material in landfill, effluent drain and effluent pond particularly with respect to subsurface transport of Zn & Cu. In the present study, the adsorption and migration of the two metals (Zn & Cu) through lateritic soil were studied using batch adsorption tests. The laboratory scale batch adsorption experiments were performed to determine adsorption capacity of the soil by carrying out adsorption isotherms and kinetic studies at different initial concentrations (0.5, 1, 5, 10 mg/l) of adsorbate at a fixed pH of 8 and with different adsorbent doses (5, 10, 20, 30 g/L) and an equilibrium contact time of 120 minutes. The soil used as adsorbent in batch adsorption experiments was found to have low hydraulic conductivity of $3.17x10^{-8}$ cm/s, and thus suitable to be used as a liner material in waste containment structures. The linear, Langmuir and Freundlich isotherm models were examined for fitting with the laboratory batch adsorption experimental results. The Langmuir isotherm provided best fit for Zn adsorption test data with R^2 (co-efficient of determination)=0.922 and RMSE(root mean square error) =0.000962 at a soil dose of 5.0 g/L. Similar trend was observed with Cu adsorption test results with R^2= 0.989, RMSE =0.000588 at a soil dose of 5 g/L. The higher values of adsorption capacity (q_{Zn} =1845 mg/kg, q_{Cu} = 1796.8 mg/Kg) of the soil for both the metals indicate good attenuative potential of the soil with respect to Cu & Zn. It was concluded from the present study that the lateritic soil can be used as an effective adsorbent and a barrier material and can be used as a primary liner material in a waste containment structure for retarding the migration of contaminants and thereby protecting the precious groundwater.

Key words: Heavy metals; Soil and groundwater pollution; Lateritic soil; Adsorption capacity; Hydraulic conductivity; Landfill liner.

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Assessment of migratory behaviour of Pb and Ni through laterite soil used as landfill liner in waste containment structure.

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Abstract:

The release of treated and partially treated effluent from electroplating industries directly on land or leakage from waste containment structures is a serious matter of concern due to the migration of contaminants through subsurface environment causing serious depletion of surrounding soil and groundwater quality. In the present study, an attempt has been made to explore the efficacy of locally available laterite soil to attenuate the migration of two heavy metals (Pb and Ni) through subsurface media after release from electroplating industries. Laboratory scale batch and vertical column experiments were conducted to assess the Pb and Ni adsorption capacity and their migratory behavior through the soil. The batch adsorption test results showed the maximum Pb and Ni removal of 98% and 96% respectively at an equilibrium reaction time of 2h for a pH of 8 with initial adsorbates concentration of 10 mg/l. The adsorption capacities of laterite soil were observed at 1857.2mg/kg and 1766 mg/kg for Pb and Ni contaminants respectively. The Freundlich isotherm provided best fit for Pb (co-efficient of determination, R^2= 0.98 and root mean squared error, RMSE=0.06) and Ni (R^2=0.99 and RMSE= 0.05) adsorption test data. The flat shape of the break through curves (BTCs) obtained from vertical column tests also reinforced the fact of good adsorption potential of the soil. The test results indicate that the soil could be used as primary landfill liner in waste containment structures. Numerical modeling using HYDRUS 1D finite difference software package closely simulate the BTCs for both the pollutants and thus the software could be considered as a tool in designing of soil liner thickness.

Key words: Heavy metals; Migration; Lateritic soil; Breakthrough curves; Numerical modeling; Liner thickness.

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Fluorescent sensor-Emerging tool for Selective and sensitive determination of water pollutant

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Abstract

A fluorescent sensor is a molecular system for which the fluorescence properties change very selectively and precisely upon interaction with a foreign chemical species. Since fluorescence is a very sensitive and accurate property of a molecule, using this property analytes can be very selectively and sensitively traced. The construction of a fluorescent chemosensor usually involves two integrated components. One is a signaling fluorophore and another is a guest receptor that possesses a recognition capability, both are connected by a spacer to form a so-called fluorophore–spacer–receptor scaffold as shown in the cartoon picture (Figure 1). When a guest species is bound to the receptor, the photophysical characteristics of the fluorophore, such as fluorescence intensity, wavelength and fluorescence lifetime, change via different mechanisms, and such a change provides a signal which indicates the guest binding (schematic representation shown in Figure 2). A practical approach for the design of new and well-organized chemosensors has been adopted by chemists, using fundamental photophysical mechanisms at the molecular level.

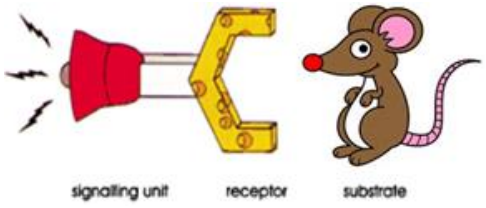

Figure 1: Basic mechanism for fluorosensor.

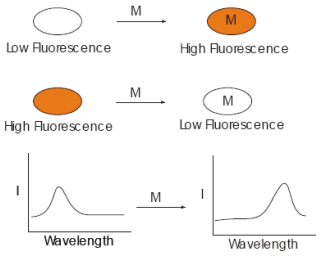

Figure 2: Illustration of Methods of Fluorescence detection

Among the different mechanisms, some important mechanisms are namely, photoinduced electron transfer (PET), fluorescence resonance energy transfer (FRET), excimer formation etc. Today it would be hard to imagine our civilization without industry and industrial metal pollutant. In this talk I shall go through the development of sensors through different photophysical/chemical mechanisms which can be used to detect pollutant metal ions very efficiently and selectively.

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Biopolymers from plant sources as effective eco-friendly corrosion inhibitor for mild steel in acid medium

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1. Introduction – The problem of corrosion is intricately related to wastage of material. On the other hand wastewater or industrial effluents acting as aggressive medium, causes corrosion in the environment. Though corrosion is a spontaneous process, its rate can be mitigated by various means and application of suitable corrosion inhibitor in reducing the aggressiveness of corroding environment is one of the economic ways in this regard. Here, we have presented our work on the application of various biodegradable biopolymers derived from plant sources, like polysaccharides and proteins towards corrosion inhibition of mild steel in acidic medium. We have employed two different polysaccharides, gum arabic (GA) and agar agar (AA) and investigated the synergistic effect between polysaccharide and thiourea (TU) on adsorption of resultant mixed inhibitor system on mild steel surface in 0.5 M H_2SO_4 and subsequently their corrosion inhibition propensity. In addition, we have used zein, an water-insoluble industrial corn protein in association with sodium dodecyl sulfate (SDS, an anionic surfactant) and verified their corrosion inhibitory effect on mild steel in 0.5 M H_2SO_4. Lastly, we have presented the adsorption and corrosion inhibition characteristics of hydrolysate of another plant protein, gluten (found in various cereal grains) on mild steel in 1M HCl medium.

2. Experimental – Two different electrochemical methods, namely potentiodynamic polarization (Tafel extrapolation) and electrochemical impedance spectroscopy (EIS) are employed to determine various corrosion parameters, like corrosion current density (rate of corrosion), corrosion potential, Tafel slopes, polarization resistance and corrosion inhibition efficiency (IE). SEM images of metal surface without and with inhibitor present confirmatory evidence towards corrosion inhibition performance of studied inhibitors. Data from FTIR spectroscopy is used to reveal the functional groups present in inhibitor molecules responsible for interacting with metal surface.

3. Results and Discussion –GA or AA with 1000 ppm concentration is observed to provide only 70-80% IE for corrosion of mild steel in 0.5 M H_2SO_4. But, in association with 10mM of TU, IE increases drastically and reaches above 97% [1]. This may be explained by existence of intermolecular synergism between polysaccharide and TU during co-adsorption on the metal surface which results into greater surface coverage and higher IE. Similarly, SDS micelles do not

show any appreciable extent of inhibition of corrosion of mild steel in 0.5 M H_2SO_4. But polymer-surfactant aggregate comprising zein and SDS exhibits remarkable IE and it is found to depend on polymer-surfactant concentration ratio [2]. Gluten hydrolysate is established to be an efficient corrosion inhibitor for mild steel in 1M HCl [3]. High efficiency is maintained upto 313K and for considerable time of exposure. In most cases, biopolymeric corrosion inhibitors are found to be mixed type, i.e. they inhibit rate of both cathodic reduction reaction, as well as anodic metal dissolution reaction. Also, Langmuir adsorption isotherm model can be successfully applied to explain the adsorption characteristics of biopolymers on metal surface.

4. Conclusions – Various biopolymers derived from plant sources can effectively be used as green corrosion inhibitor due to the presence of suitable functional groups in their polymeric network.

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Adsorption of etodolac from pharmaceutical wastewater

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1. Introduction – The wastewaters of pharmaceutical industries are known with their high pollution capacity and low biodegradability. Pharmaceutical industry is also one of the potential sources of pharmaceutical active compounds (PhACs) in the environment. Since PhACs are designed to intention of performing a biological effect, completely treatment of PhACs by traditional biological wastewater treatment methods could not be possible. Thereby, PhACs, amongst other compounds, are released directly into the environment [1]. Combined treatment methods are required to ensure the discharge standards in terms of organic load like COD or BOD and eliminate the PhACs [2]. Biological treatment (e.g. a membrane bioreactor) plus ozone and/or activated carbon or UV/H_2O_2 or reverse osmosis was investigated by PILLS project. Different adsorption removal rates for different PhACs were reported by using powdered activated carbon (PAC) [3]. In this context, it is worthy to research the elimination of different PhACs. The objective of this study is to investigate the removal of an anti-inflammatory PhAC (etodolac) and organic matter from a real process wastewater by using PAC adsorption before and after Fenton oxidation.

2. Experimental - The wastewater was taken from the cleaning of the tanks of a pharmaceutical industry. The typical wastewater quality characteristics were: UV_{254}, 15.66 cm^{-1}, COD, 17500 mgL^{-1}, etodolac, 511 mgL^{-1} and a pH of 8.2. Fenton oxidation was carried out at H_2O_2/Fe^{2+} molar ratio of 40:1 and 2 h of treatment time. A commercial PAC (WAC i600 M200, Eurocarb Products Ltd) was used. COD, UV_{254} and etodolac concentration were followed to evaluate the performance of PAC adsorption. Experiments were conducted at various time intervals (0.25-48 h) and PAC dosages (1.0 and 20 gL^{-1}). The mechanism of adsorption was studied using kinetic and isotherm models. Also, FTIR spectroscopy was used for characterization of the clean and saturated PAC.

3. Results and Discussion - After Fenton oxidation, the wastewater characteristics were found as UV_{254}, 0.754 cm^{-1}, COD, 2800 mgL^{-1}, etodolac, 0.7 mgL^{-1}. The optimum adsorption equilibrium conditions for real process wastewater and wastewater pre-treated by Fenton oxidation were found as t = 16 h, and m = 10 gL^{-1}. The removal efficiencies for PAC adsorption of real wastewater and wastewater pre-treated by Fenton oxidation is given in Fig. 1. Among the studied three isotherm models, the Freundlich model showed the best fit. The higher R^2 (0.9992 and 0.9997) and closer values of q_{exp} and q_{cal} show that the data fit well with the Type (I) pseudo–second order model. Whereas pore and surface mass diffusion model fitted to wastewater pre-treated by Fenton oxidation, external diffusion model was determined to be the most suitable diffusion model for real wastewater.

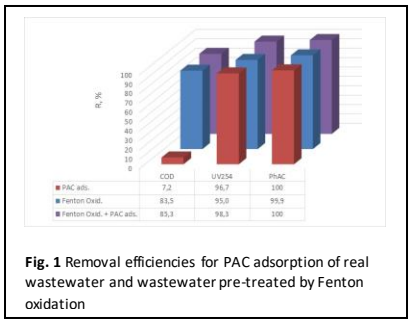

Fig. 1 Removal efficiencies for PAC adsorption of real wastewater and wastewater pre-treated by Fenton oxidation

4. Conclusions - It is not expected to reduce COD to discharge standards with single stage adsorption process. Also, PAC adsorption following Fenton oxidation was insufficient to obtain the discharge standards. As a result, etodolac removal is fixed close to 100%. PAC adsorption could be recommended as a pre-treatment method in the case of PhAC toxicity on the biological system or as a post treatment method for PhAC removal.

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The performance comparison of an anaerobic sequencing batch reactor and an anaerobic membrane reactor treating chemical synthesis-based pharmaceutical wastewater

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1. Introduction – Wastewaters from pharmaceutical industry generally originate from the chemical synthesis and formulation of drugs. The chemical synthesis-based pharmaceutical wastewater containing various organics and inorganics, diluents, additives, reactants have high chemical oxygen demand (COD), total suspended solids (TSS) and pH ranging from 1 to 11 [1, 2]. Although pharmaceutical wastewater has traditionally been treated using physico-chemical and aerobic biological processes, anaerobic treatment processes are preferred for the high COD concentration and low biodegradability [3]. In this study, the anaerobic treatability of etodolac chemical synthesis wastewater from pharmaceutical industry and removal of etodolac were aimed. In this context, Anaerobic Sequencing Batch Reactor (AnSBR) and (AnMBR) systems were selected and the appropriate treatment technology was recommended.

2. Experimental – The chemical synthesis pharmaceutical wastewater was obtained from etodolac manufacturing plant. The AnMBR reactor was operated at pH:7, temperature: 35°C, 4 L of reactor volume and infinite sludge retention time. AnMBR was operated in three experimental stages (with flat-sheet membrane, hollow-fiber membrane and pre-ozonated wastewater) for 725 days. Operating parameters of AnSBR were selected as pH: 5, T: 35°C, hydraulic retention time: 1.53 days and 4 L of reactor volume. AnSBR was also operated with real wastewater and pre-ozonated wastewater for 605 days. The ozonation experiments were conducted in a lab-scale venturi–injection system (5 L). The wastewater was ozonated during 60 minute in the 2 g/h ozone dosage.

3. Results and Discussion - The AnSBR operated as a pre-acidification reactor was achieved 40% of acidification ratio at 2.6 kgCOD/m^3.day of organic loading rate (OLR). However, the AnSBR was failed at high OLRs (OLR: 3.9 kgCOD/m^3.day) due to sulphite inhibition. Pre-ozonation was applied to overcome the sulphite inhibition but the desired acidification (insufficient volatile fatty acid production) efficiency could not be obtained also by the pre-ozonation. The AnMBR was provided high COD removal efficiency (90%). The AnMBR was successfully operated up to 15000 mg/L of COD, but sulphite inhibition occured at this loading. Pre-ozonation process was applied to raw wastewater. The pre-ozonation-AnMBR system was provided the efficient operation conditions. Pre-ozonation was also effective to obtain the high

etodolac removal efficiency up to 99%. The AnMBR reactor was operated with the flat-sheet membrane for longer period than the hollow-fiber membrane.

4. Conclusions - As a result, hybrid ozonation-AnMBR system was found more suitable technology than hybrid ozonation-AnSBR system to treat chemical synthesis-based pharmaceutical wastewater.

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Treatment of carwash effluent by hybrid electrocoagulation and submerged membrane processes

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1. Introduction- Membrane processes are widely used in various wastewater treatment applications due to easy operation, lower cost in some cases and high removal efficiency. However, membrane fouling is still a limiting factor for the utilization of membrane filtration at the pilot scale in industrial applications. Filtration performance and flux can be improved by addition of coagulant to membrane filtration system [1]. Electrocoagulation (EC) is the efficient method for the treatment of wastewaters containing colloids, surfactants, organic-inorganic pollutants such as carwash wastewaters. Electrogenerated flocks contain less bound water so that can be separated easily by filtration process. Although the hybrid EC and membrane processes have been reported in literature [2-4], no investigation about hybrid EC and submerged membrane microfiltration (MF) process in the treatment of carwash effluent has been published. The objective of this study is to evaluate the treatability of carwash wastewater by hybrid process. The effects of operating parameters such as initial pH value, current density and stirring speed on the hybrid system performance and steady state flux value were evaluated. The operating conditions that achieve higher removal of pollutants and higher fluxes were optimized using Taguchi design method [5].

2. Experimental- Hybrid EC and submerged MF system was constructed from plexiglass having a dimension of 11x11x10 cm. Iron (Fe) plates (5x5x0.2 cm) were used as sacrificial electrodes in monopolar (MP) configuration. A Polypropylene (PP) MF membrane with an effective membrane area of 50 cm^2 was used. The membrane module was located to the system as equal distance from anode and cathode. The wastewater was pumped into the reactor with a peristaltic pump, whereas permeate was drawn through the membrane with a vacuum pump. The permeate flow rate was measured using an electronic balance and recorded by a computer. The system was operated for 6 hour at 25^0C. The wastewater volume was kept at 680 mL using level sensor. DC power supply (0–30 Volt, 0–6 A) was used to supply an electrical current. An L_9 (3^4) orthogonal array was applied for the examination of the effects of three factors with three levels based on Taguchi experimental design method.

3. Results and Discussion- The optimum conditions for hybrid system were determined as pH=3, current density= 45A/m^2 and stirring speed=250 rpm for removal of pollutants and pH=6, current density= 45A/m^2 and stirring speed=250 rpm for steady state flux value. Based on the analysis of variance (ANOVA), the results indicated that current density has significant effect on hybrid system performance except for surfactant removal and flux value. Higher rejections were observed for chemical oxygen demand (COD) (83%), surfactant (98%), oil-grease (93%), suspended solids (96%), but not for chloride (20%), under the optimized conditions.

4. Conclusions- The hybrid EC and submerged MF process is a feasible technology for higher COD, surfactant, suspended solids and oil-grease removal from carwash wastewater.

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The Use of Brahea Edulis for the decontamination of Yellow Bemacid textile dye from aqueous solution by adsorption

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Abstract

Environmental contamination is a major problem being faced by the society today. Industrial, agricultural and domestic wastes, due to the rapid development in the technology, are discharged in the several receivers. Generally, this discharge is directed to the nearest water sources such as rivers, lakes and seas. While the rates of development and waste production are not likely to diminish, efforts to control and dispose of wastes are appropriately rising. Wastewaters from textile industries represent a serious problem all over the world. They contain different types of synthetic dyes which are known to be a major source of environmental pollution in terms of both the volume of dye discharged and the effluent composition [1].

The focus of the present study was to assess the potentiality of Brahea Edulis for removal of synthetic dyes from aqueous solutions. We chose in this study Yellow Bemacid as a model compound because of its strong adsorption study on solids and its use in characterizing adsorptive materials.

Biosorption studies were carried out under various parameters such as mass adsorbent particle, pH, contact time, initial dye concentration and temperature. The biosorption kinetic data of the biomass was tested by the pseudo first- order and the pseudo-second-order kinetic models. The equilibrium data were analyzed using Langmuir, Freundlich, Elovich and Temkin isotherm models.The experimental results show that the percentage of biosorption increases with an increase in the biosorbent mass (0.25g: 12mg/g; 1.25g: 24mg/g). The maximum biosorption occurred at around pH value of 2 for the Yellow bemacid. The equilibrium uptake was increased with an increase in the initial dye concentration in solution (C_o = 120mg/l; q = 3.97 mg/g). Biosorption kinetic data were properly fitted with the pseudo-second-order kinetic model. The experimental isotherms data were analyzed using Langmuir, Freundlich, Elovich and Temkin isotherm equations. The best fit was obtained by the Langmuir model with high correlation coefficients (R^2 > 0.998) and a maximum monolayer adsorption capacity of 163.93 mg/g for Yellow bemacid. The Freundlich model also yielded a good fit to experimental data (R^2 = 0.997).

Figure 1. Sheet Brahea Edulis Edulis

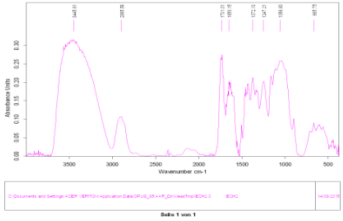

Figure 2. Infrared spectrum applied to Brahea Edulis

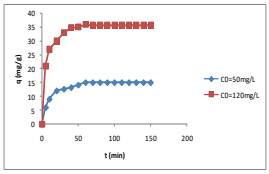

Figure 3. Yellow Bemacid kinetic adsorption on Brahea

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Member of the Department of Process Engineering Laboratory Environment -Water and in particular the research group: Treatment of agro-industrial aqueous effluents and industrial through solvent.

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Research topics

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Publications: 10

Education

My teaching is mainly carried out at the Department of Process Engineering at the University of Chlef of Algeria. It concerns:

- ✓ Heterogeneous chemical reactors
- ✓ Surface phenomena and heterogeneous catalysis

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Management of energy sources for hydropower energy: a case study GAP in Turkey

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1. Introduction – In the Energy Efficiency 2011 Evaluation, governments reported on efforts to ensure that voluntary and mandatory energy efficiency policies are adequately monitored, enforced and evaluated. For example, Australia's Energy Efficiency Opportunities Act (EEO Act) established measures for compliance and verification. Consultation with large energy-using companies in the EEO programme is underway to establish better monitoring and evaluation procedures for the EEO programme's second cycle, which runs from July 2011 to June 2016.

On the other hand, in Turkey, Southern Anatolia Project (GAP) originally planned by the State Hydraulic Works (DSI) is a combination of 12 major projects primarily for irrigation and hydroelectric generation. The project includes the construction of 22 dams and 19 hydroelectric power plants on the Euphrates and the Tigris rivers and their tributaries. It is planned that upon completion, over 1.8 million hectare of land will be irrigated and 27 billion kWh hydroelectric energy will be generated annually [1, 2, 3].

2. Management of Energy Sources in Turkey– Turkey should continue to take advantage of proved practices in other countries to improve energy efficiency. The transport sector is an area where urgent attention is needed. Turkey should set ambitious fuel-economy standards for vehicles and regulate non-motor components that affect vehicle energy efficiency (e.g. tire rolling resistance and tire pressure). Taxation should be used to favor the purchase of more efficient vehicles [1, 4].

Table I. The status of economically feasible hydropower potential in Turkey [15].

Project	Number of Project	Total installed capacity (MW)	Annual average energy (TWh/yr)	Ratio (%)
In Operation	172	13,700	48	35
Under Construction	148	8,600	20	14
In Program	1418	22,700	72	51
Total	*1738*	*45,000*	*140*	*100*

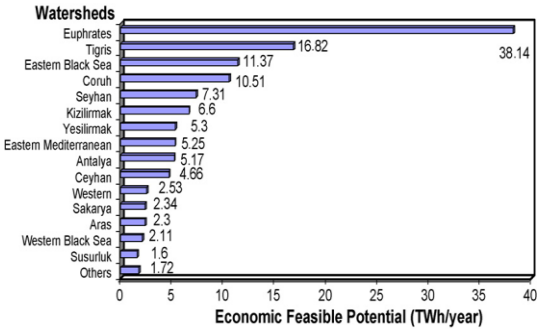

Figure 1. Distribution of Turkey's hydropower potential on basin level [13].

3. GAP Factor on Energy Management and Hydropower Energy in Turkey– Water and hydropower potential in Turkey are distributed into 26 basins and the total flow rate of water sources for energy production is 186 km^3/years.

4. Energy Policy on Energy Sources for Hydropower Energy in Turkey– Turkey total hydropower capacity is estimated at 440 TWh per year. Some of this potential can be achieved with small hydroelectric plants (SHEPs) having individual capacities of 10MW or less.

5. Conclusions–At firstly, because the 26 drainage basins are the main sources of the renewable and sustainable energy, especially for hydropower energy. Turkey should use the full capacity of these drainage basins for hydropower energy.

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Water management for hydropower energy in Turkey

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1. Introduction – Water management has recently become a major concern for many countries. During the last century, consumption of water and energy has been increased in the world. This trend is anticipated to continue in the decades to come. One of the greatest reasons is the unplanned industrial activities deteriorating environment in the name of rising standard of life. What is needed is the avoidance of environmental pollution and maintenance of natural balance, in the context of sustainable development.
As Turkey is a developing country, the water resources must be developed in an efficient way, which optimizes water's benefits -more crop per drop-, while minimizing negative environmental impacts. The availability of water per capita per year in Turkey is only about one fifth of that of the water rich countries. It is therefore imperative that Turkey should improve per capita water availability in order to enhance the quality of life of her people. Therefore, in recent decades, Turkey has made great success in water resources development for domestic use, irrigation, power generation, flood control, and other purposes [1, 2].
Comprehensive water planning activities have been carried out in Turkey since the 1950s. These have led to the construction of structures on rivers to regulate the flow and to meet the energy and food requirements of a growing population while achieving socio-economic development goals. Turkey's water management policies are directed towards satisfying the increasing demand for domestic water supply, achieving food security, generation of energy, and conserving the environment in accordance with international standards [1, 2].

2. Water potential and consumption in Turkey – There is a large variation in annual precipitation, evaporation and surface run-off parameters, in Turkey. Precipitation is not evenly distributed in time and space throughout the country.

3. Water utilization and hydropower energy in Turkey – Hydropower is a renewable form of energy since it uses the power of flowing water, without weasted or depleting it in the generation of energy. Because they are clean energy generation plants hydropower can contribute to reducing air pollution and slowing down global warming.

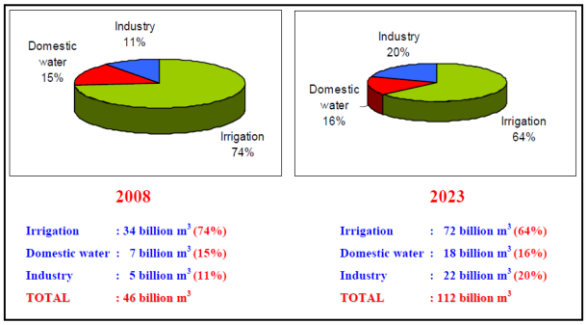

Figure 2. Water consumption projection in Turkey [2].

Table I. Development of irrigation, hydropower and water supply in Turkey [1, 11, 14].

	In Operation (2005)	Ultimate Goals (2030)	Development Rates (%)
Irrigation	4.9 million ha	8.5 million ha	58
Hydroelectric Energy	45.3 billion kWh	127.3 billion kWh	36
Water Supply	10.5 billion m^3	38.5 billion m^3	27

4. Conclusions - The development of water resources constitutes an important element in Turkey's economic development programme. There are several outstanding challenges, which constitute the basis for future action. All of these need to be overcome by developing this precious resource in an equitable, reasonable and optimal way. Therefore, it is of considerable importance for Turkey that the development, management, use and protection of water resources should be planned in an integrated manner taking into account all the economic and social needs of its people.

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Synthesis of mesoporous carbon material from waste "Date seeds" and its application for "tertiary butylation" of phenol

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1. Introduction – In last decades, an increased interest in biomass-derived carbon supported catalysts has been widely reported. Activated carbon due to high density, mechanical strength and porous nature with porous transport channels can be used as adsorbent and catalyst support for acid catalyzed reactions. Activated carbon functionalized with sulfuric acid exhibits high acidity and it appears to be high stable catalyst for liquid phase acid-catalyzed reactions with noncorrosive and easily separable property. The usability of recyclable solid materials as replacement to homogeneous acid catalysts is usually limited due to the low density and strength of the acid sites on the solid surface [1]. The method of immobilization of homogeneous catalyst on to solid supports has come up to solve the problem of acid density, but the procedure is time consuming and involves several preparation steps [2]. However, upto our knowledge there is no reported literature on utilizing waste Date pits for the preparation of sulphonated carbon catalysts by in-situ carbonization and sulphonation as well as its catalytic application for tertiary butylation of phenol.

2. Experimental - Waste Date pits were supplied from a local farm in Oman while other chemicals supplied by Merck chemicals (Germany). Powdered Date pits were dried at 100°C for 8h to remove the complete moisture. After that the sample was washed with warm de-ionized water to remove the impurities and dried under vacuum at 100°C for 3h, and then it was used for sulphonation. In order to synthesize the sulphonated carbon material, the synthesis procedure follows carbon material exchange with sulphuric acid (0.05M) at 100°C for 4h. Further the carbonization of the resultant mixture was carried out in nitrogen atmosphere at 300ºC for 4h to facilitate the decomposition and transformation of the date pit carbon to hydrophobic carbon residue bearing sulphonyl groups. Solvent free liquid phase alkylation reaction was studied and carried out in Parr reactor.

3. Results and Discussion - The findings of the present studies demonstrated a novel approach for the synthesis of potential sulphonated carbon catalyst (SUL-C) was prepared by comprehensive technique of in-situ carbonization and sulphonation from date pits biomass. The method is cheaper and produces thermally stable material suitable for catalytic applications involving bulky organic transformations. The synthesized sulphonated carbon material was mesoporous in nature and total acidic capacity was 4.7 mmol/g which attributed its novel characteristics. It was thermally stable up to 430°C and FTIR analysis confirmed the presence of acidic groups such -SO_3H, -OH and -COOH. The present studies shows maximum phenol conversion 79.27wt% with 68.01% selectivity towards 4TBP+2,4TBP which used as intermediate in various antioxidants. Moreover, the active material does not does not undergoes the deactivation and can be efficiently reused in consecutive five catalytic cycles. Further, the highly

mesoporous material obtained in the present study is expected to be an excellent catalyst for various other bulky-molecule involved reactions of industrial importance.

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Efficient use of water in Saguling HEPP using *HERTiMonS* applications on the operating mode Load Frequency Control

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1. Introduction –Saguling hydropower, Indonesia, always trying to conserve water through conservation of water resources and in terms of water consumption itself. This paper will explain about the water savings from energy use through the creation of an application that can measure the efficiency of the machine in real time and integrate with applications Load Frequency Control to influence the load set point value on the engine so that the generator output is obtained with the highest efficiency values. This application is called HERTiMonS, which is also an acronym Hydro Efficiency Real Time Monitoring System.

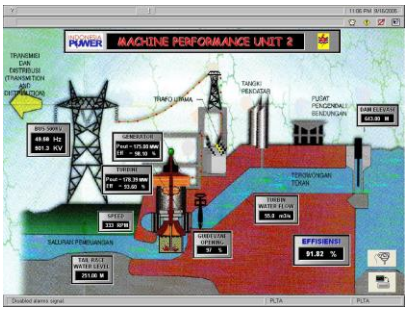

Image 1. HERTiMonS Application

2. Experimental – The efficiency of hydropower value can be calculated by finding the magnitude of Head Loss on the flow of water from the dam to the turbine side. By using some active variables such as: Dam Water Level, Output Generator, Water Discharge, Tailrace water level, as well as the constants in table losses due to friction. The measurement results are then compared with the data efficiency of the engine when commissioning. By knowing the actual efficiency values, then HERTiMonS will perform the intervention in changing the set point load on Load Frequency Control (LFC) mode so that the engine is forced to work in a range of high efficiency values.

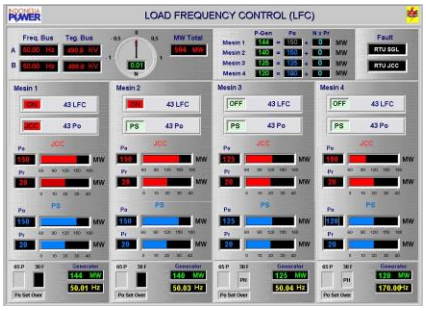

Image 2. Load Frequency Control Application

3. Results and Discussion - With HERTiMonS applications, engine efficiency during operation can be controlled to always operate at the highest efficiency values. Water savings generated by using HERTiMonS much as 1,238,544 m3 / year is available on the DAM. This will ensure the availability and continuity of electrical energy during the dry season. With the availability of plenty of water, then Saguling to operate longer so that it can help supply energy to the Java-Bali system. In other words, the benefits of integration between HERTiMonS and LFC when converted into fuel operating cost savings of thermal power plants will be obtained: Rp.78.436.252.700/year or about $ 5.7 million / year.

4. Conclusions - HERTiMonS is an application used to monitor the efficiency of hydropower machines that are operated in realtime while providing setpoint on Load Frequency Control system so that the engine is operating at maximum efficiency value. The savings from these applications is increasing water reserves in the DAM amounted to 1,238,544 m^3/years or equivalent to US $ 5.7 Million/years if the Diesel power plant operated.

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Scientific Curiculum Vitae

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Utilization of granulated oil shale ashes for neutralizing of acidic soils

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1. Introduction. The power and heat production in Estonia is based over 90% on the combustion of a local solid fossil fuel – Estonian oil shale (OS). The annual amount of ashes formed at that is on the level of 7-8 million tons. During combustion the inorganic part of OS undergoes a number of transformations including decomposition of carbonates with the formation of calcium and magnesium oxides. Partially, these oxides remain in the form of free oxides causing the alkalinity of this waste. One promising possibility for large-scale utilization of alkali ashes is the liming of acidic soils. In Estonia there is 350 000 ha of agricultural land that needs permanent annual liming. Hence, the aim of the current work was to study the possibilities of granulation of oil shale ashes for obtaining granulated product suitable for use in neutralizing of acidic soils.

2. Experimental. The ash samples studied were cyclone ash (CA) formed at pulverized firing of OS and electrostatically precipitated ash from the first field (ESPA) formed at circulated fluidized bed combustion of OS at Estonian Power Plant (PP). Samples were analyzed using chemical, grain-size, quantitative XRD, SEM and BET methods. The ashes studied differed in their chemical and mineralogical composition as well as in grain-size and specific surface area.

Granulation of ashes was carried out on a plate-type granulator using ash transportation water from Estonian PP or 2.5% solution of carbonylmethylcellulose Na-salt as binding agents. Clay from AS Kunda Nordic Cement (Estonia) was used as a solid binding additive to improve the properties of granulated ashes. After granulation, the moisture content of green granules was determined and the size distribution analysis of the dried granules was performed. For improving the compressive strength of granules, different drying regimes were tested: immediate drying of granules at 105°C, storing/drying in open air at room temperature and storing in atmosphere of CO_2 with following drying. Granules were also tested for mechanical hardness using compression testing equipment. For determination of leachability of ash components the granulated products as well as the origin ashes were tested using for that laboratory minilysimetries.

3. Results and Discussion. In our experiments it was possible to produce granules of which 85% had a diameter of 1-5 mm, and 70-75% a diameter of 1-3 mm. Granules with a diameter smaller than 1 mm can be used again as seed granules and granules with a diameter over 5 mm can be crushed and re-cycled to reduce production losses. The results of the compressive strength test indicated that ESPA granules have higher strength than CA granules obtained at the same drying regime and it was possible to get these with shorter storing/drying duration. Due to additional binding of carbon dioxide, drying of granules at room temperature produced stronger granules than drying at 105°C

For accelerating the carbonization process of granulated products, series of experiments were carried out by storing green granules in the atmosphere containing 15 vol.% of carbon dioxide (similar to the concentration of it e.g. in flue gases). The granules based on CA needed 8h of storing to have compression strength more than 5 N. For ESPA granules, to reach the same level of compression strength, the needed duration of storage in the atmosphere containing carbon dioxide was only 2-4h.

Considering the content of leached ions in filtrates granulation of ashes was resulted with the decrease in the content of leached cations: Ca^{2+}, Mg^{2+} and K^{+} and also SO_4^{2-}, depending on ash and leached ions, in the range of 5-69%, being at that more significant for Ca^{2+} and SO_4^{2-}. The results of soil analysis indicate that the use of ashes - as initial as well as granulated ones - improved the pH level of soil also significantly. The decrease in the content of leached ions in filtrate solutions and not mobile ions in soil mean that the soil neutralizing ability of granulated products is prolonged (extended) allowing to lime acidic soils more seldom being at that more effective comparing with fine ashes and the loss of ions with probable contamination of subsoil water and water-bodies is also diminished.

4. Conclusions. The results obtained revealed that using the optimum amounts of solid binding additives and liquid binders and optimum drying regime enables to obtain granules of which 80-90% have a diameter of 1-5 mm and are resistant to pressure strength up to 10 N per granule. The granules obtained have good leachability characteristics in soil media and good neutralizing ability of acidic soil.

A low-carbon water reclamation system that considers local conditions for recycling domestic wastewater

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The ongoing processes of climate change and natural resource exhaustion have an especially large impact on small islands. Kinmen is a small archipelago of several islands of approximately 150 km2 in area located off the southeast coast of mainland China. Kinmen lacks natural resources, and therefore its development is restricted by the ecological environment and reflected in cultural fragility. After the end of military administration in 1992, Kinmen transformed into a famous tourist attraction. The rapid development of tourism has attracted a large number of tourists, but also worsens the long-standing scarcity of fresh water resources. As Kinmen is currently aiming to move towards becoming a low-carbon demonstration island, installation of a water reclamation system with a low carbon consumption would be the best choice for the islands. A wastewater recycling system that considers local conditions and uses local materials to reduce the carbon footprint was therefore proposed. The system uses local agriculture by-products, including sorghum rods and oyster shells, as filter media to construct a water purification system that can purify domestic wastewater by reclamation. The results of this study demonstrated that the reductions in suspended solids (SS), biochemical oxygen demand (BOD) and NH4-N using this system reached 95.3%, 97.0% and 99.3%, respectively, achieving the standard required for tertiary wastewater treatment. In addition, oyster shells after burning absorbed around 50% of the phosphorus in wastewater. The findings of this study demonstrated that this low-carbon water reclamation system can achieve waste reduction, recycling wastewater to a quality suitable for irrigation.

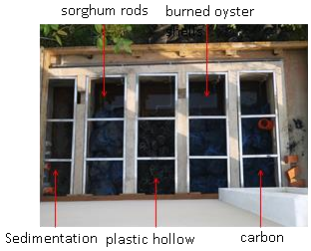

Table. Comparison of water quality after wastewater treated with different in a pilot-scale study.

Methods	Quality parameters	Water quality		
		Before	After	% of reduction
(1) Tank without aeration, carbon filters, coir, and oyster shells	SS (ppm)	23.7	2.2	90.7%
	BOD (ppm)	56.3	8.8	84.4%
	NH_4-N (ppm)	7.22	6.56	9.15%
	TP (ppm)	0.779	0.700	1.16%
(2) Tank with aeration, carbon filters, coir, and burned oyster shells	SS (ppm)	25.4	1.20	95.3%
	BOD (ppm)	29.2	0.90	97.0%
	NH_4-N (ppm)	5.77	0.04	99.3%
	TP (ppm)	0.514	0.332	45.0%
(3) Tank similar to (2), except uses carbon filters prepared from sorghum rods	SS (ppm)	20.4	1.3	93.3%
	BOD (ppm)	28.1	1.3	95.4%
	NH_4-N (ppm)	10.40	0.17	98.4%
	TP (ppm)	0.947	0.453	52.2%

Suspended solids (SS), biochemical oxygen demand (BOD), and total phosphorus (TP)

Burned oyster shells as phosphorus absorption material.

Biography

Hua-Yueh Liu is an Associate Professor at National Quemoy University. He graduated from Chung Yuan Christian University with a B.S. In 1995 he graduated from German Stuttgart University with a Ph. D. in Architecture. In 2002 he was invited to Germany as a visiting scholar through DAAD German Academic Exchange Service.

Mr. Liu has participated in the National Science Council projects, is an important member of government reviews of engineering plans, and continues to be actively involved in Kinmen island's advance planning for low-carbon emissions.

In addition to teaching, he is actively promoting and researching building energy efficiency and the application of renewable energy in construction projects.

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Biological activated carbon: effective technology to remove persistent micropollutants from wastewater

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1. Introduction. The biological activated carbon (BAC) is unique technology, where adsorption, desorption and biodegradation occur simultaneously; however, application to remove micropollutants is not well developed [1]. In this research we present results from experiments with specially acclimated biomass from industrial bioreactor. Attention was paid for metoprolol (MET) biodegradation and adsorption-desorption. Therefore, experiment results were combined with reactor runs in the laboratory.

2. Experimental. Adsorption, desorption experiments were done with Norit GAC 830 Plus activated carbon (AC). 0.4 g/L of carbon were weighted in triplicates to serum bottles and equilibrated with MET concentrations: 4, 16, 64, 256 mg/L. Biodegradation tests were performed with special biomass from industrial BAC reactor (Nieuw Amsterdam, the Netherlands), using the same concentrations as in adsorption-desorption experiments. Reactor runs were performed under conditions which are listed in a *Table I*.

Table I. Experimental conditions

Parameter	Value
Temperature, °C	20
Dissolved oxygen, mg/L	4
Total dissolved salts, g/L	<1
MET conc., mg/L	1÷200

3. Results and Discussion. The best fit of adsorption-desorption data was observed using Freundlich adsorption model. The maximum carbon adsorption capacity (K_f) of MET was 62 mg_{MET}/g_{AC}, showing high affinity (*Image I, A*); therefore, after desorption K_f value was 92 mg_{MET}/g_{AC}, indicating that there is hysteresis between isotherms. Hysteresis is an important factor for AC bioregeneration.

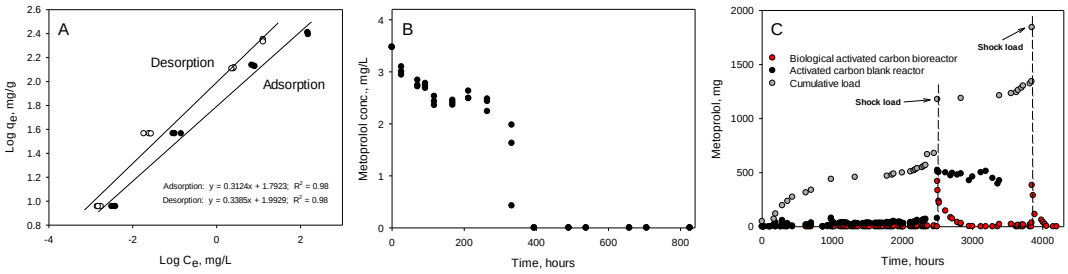

Image I. Metoprolol adsorption-desorption on virgin carbon (A), biodegradation (B) and removal in BAC reactor (C)

The biodegradation experiments showed that MET is biodegradable; biodegradation rate was 18.3 □g per 1 hour (*Image I, B*). Bioreactor experiments showed that after carbon saturation in a blank reactor, the BAC performance was still good – over 97% metoprolol was removed (*Image I, C*). The phenomenon that can explain great BAC performance over activated carbon reactor is bioregeneration [2]. Biomass is able to regenerate activated carbon and can prolong the lifetime of the adsorbent. Moreover, BAC system can eliminate toxic compounds and absorb shock loads.

4. Conclusions. The adsorption, desorption and biodegradation processes are the main driving forces in BAC reactor. Because of biomass present, MET loaded AC can be bioregenerated, therefore the lifetime of carbon increases. In this work max carbon capacity was 62 mg_{MET}/g_{AC}, while biodegradation rate was 18.3 □g per 1 hour. Bioregeneration of carbon occurred in a BAC reactor – the blank reactor showed complete saturation while BAC still removed MET.

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Valorization and characterization of three types of marble waste a view to use them in of manufacture of ceramic tiles

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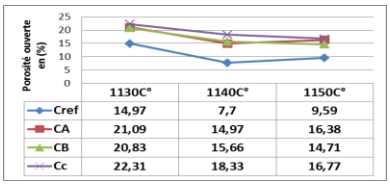
1. Introduction – The universal need to protect the environment , require to adapt new concepts [1]. . Recycling of the waste has two beneficial ecological effects: reducing, of their volume and the conservation of natural resources [2]. Given the depletion of natural resources and supply difficulties, the algerians manufacturers, must consider this, as well as aspects of health, ecology, and choice, renewable raw materials, because the recycling and recovery of waste is considered a future solution . They enable to respond to the deficit, between production - consumption and environmental protection [3].The purpose of work is to demonstrate the opportunity to use the waste of marbles in adding them in mixtures of manufacturing of ceramic tiles for obtain a new formulation and Improve their properties. Giving at these waste, a second life because they, are considered, materials, fully fledged [4].Marble is a metamorphic rock derived from limestone having, several colors and at least 75% of calcite ($CaCO_3$).

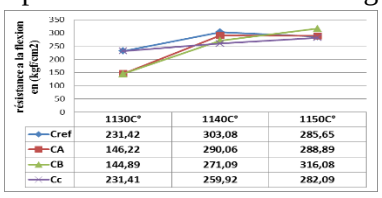
2. Experimental - The materials used are: Clay (G), of local origin , kaolin, feldspar, clay (R), of foreign origin. Chemical analysis, mineralogical, granulometric , were carried out, . The equipments used are, respectively: -Sequential spectrometer Siemens , -X-Ray diffractometer Siemens ,- **G**ranulometer Laser The mixtures was carried in jar grinder .The pressing of the ceramic tiles was carried out in a hydraulic . Cooking in a roller kiln. The mechanical resistance is determined in a bending apparatus

3. Results and Discussion - - 09 mixtures were studied with 03 marbles waste, named :(M_A, M_B, M_C). the substitution of clay R, by the waste, is carried out as following : M_A is introduced into variants (V_1, V_2, V_3), M_B in variants (V_4, V_5, V_6), M_C in variants (V_7, V_8, V_9). Their proportions of are (2 - 4 and 6%). This work consists on the one hand the study of the rheological properties. It was completed by a study of the characteristics, physical and mechanical, of the products of each mixture , cooked at temperatures from (1130 -1140 and 1150 ° C). The results obtained are compared with those the industrial mixture. The three types of waste, are complies with the requirements of manufacturing of ceramic tiles. The results of few physic mechanical characteristics are presented in the following figures



	1130C°	1140C°	1150C°
Cref	14,97	7,7	9,59
CA	21,09	14,97	16,38
CB	20,83	15,66	14,71
Cc	22,31	18,33	16,77

(a)



	1130C°	1140C°	1150C°
Cref	231,42	303,08	285,65
CA	146,22	290,06	288,89
CB	144,89	271,09	316,08
Cc	231,41	259,92	282,09

(b)

Image 1: *Variation in physic mechanical characteristics depending on the marble rate and the cooking temperature: (a) open porosity (b) flexure resistance*

4. Conclusions - The three waste, are complies with the requirements of manufacturing of ceramic tiles. By comparing products obtained with the different mixtures, one noted than those obtained with the M_B waste, having a content of 6% and cooked at 1150 ° C provide, a flexural strength of 313.13

kg / cm^2 considerably higher than that of the ceramic tiles, manufactured in industry, who is of the order of:

285, 65 kg / cm^2.

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International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

Valorization and characterization of three types of marble waste a view to use them in of manufacture of ceramic tiles

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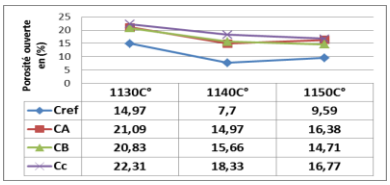
1. Introduction – The universal need to protect the environment , require to adapt new concepts [1]. . Recycling of the waste has two beneficial ecological effects: reducing, of their volume and the conservation of natural resources [2]. Given the depletion of natural resources and supply difficulties, the algerians manufacturers, must consider this, as well as aspects of health, ecology, and choice, renewable raw materials, because the recycling and recovery of waste is considered a future solution . They enable to respond to the deficit, between production - consumption and environmental protection [3].The purpose of work is to demonstrate the opportunity to use the waste of marbles in adding them in mixtures of manufacturing of ceramic tiles for obtain a new formulation and Improve their properties. Giving at these waste, a second life because they, are considered, materials, fully fledged [4].Marble is a metamorphic rock derived from limestone having, several colors and at least 75% of calcite ($CaCO_3$).

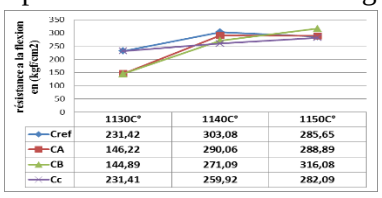
2. Experimental - The materials used are: Clay (G), of local origin , kaolin, feldspar, clay (R), of foreign origin. Chemical analysis, mineralogical, granulometric , were carried out, . The equipments used are, respectively: -Sequential spectrometer Siemens , -X-Ray diffractometer Siemens ,- **G**ranulometer Laser The mixtures was carried in jar grinder .The pressing of the ceramic tiles was carried out in a hydraulic . Cooking in a roller kiln. The mechanical resistance is determined in a bending apparatus

3. Results and Discussion - - 09 mixtures were studied with 03 marbles waste, named :(M_A, M_B, M_C). the substitution of clay R, by the waste, is carried out as following : M_A is introduced into variants (V_1, V_2, V_3), M_B in variants (V_4, V_5, V_6), M_C in variants (V_7, V_8, V_9). Their proportions of are (2 - 4 and 6%). This work consists on the one hand the study of the rheological properties. It was completed by a study of the characteristics, physical and mechanical, of the products of each mixture , cooked at temperatures from (1130 -1140 and 1150 ° C). The results obtained are compared with those the industrial mixture. The three types of waste, are complies with the requirements of manufacturing of ceramic tiles. The results of few physic mechanical characteristics are presented in the following figures



	1130C°	1140C°	1150C°
Cref	14,97	7,7	9,59
CA	21,09	14,97	16,38
CB	20,83	15,66	14,71
Cc	22,31	18,33	16,77

(a)



	1130C°	1140C°	1150C°
Cref	231,42	303,08	285,65
CA	146,22	290,06	288,89
CB	144,89	271,09	316,08
Cc	231,41	259,92	282,09

(b)

Image 1: *Variation in physic mechanical characteristics depending on the marble rate and the cooking temperature: (a) open porosity (b) flexure resistance*

4. Conclusions - The three waste, are complies with the requirements of manufacturing of ceramic tiles. By comparing products obtained with the different mixtures, one noted than those obtained with the M_B waste, having a content of 6% and cooked at 1150 ° C provide, a flexural strength of 313.13

kg / cm^2 considerably higher than that of the ceramic tiles, manufactured in industry, who is of the order of:

285, 65 kg / cm^2.

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[3] H.Hebhoub, M.Belachia, *Revue Nature et Technologie*. **4** (1) (2011) p. 41-46.

[4] Recycling and valorization of materials, in second life N°**19** , 2007

Background and Experience: Prof Halima CHEMANI for ewwm2016 ITALY-ROME

I am Professor and I am classed first at the national level in my field of specialty

I got my abilitation in 2010

I'm a doctor since 2007, specialty "structural materials". The latter was prepared in France at the National School of Limoges ceramic

I got my magister in 1996. It was prepared in France at the National School of Limoges ceramic

I'm an engineer since 1979

I teach at the university since November 1979

I am, president of the Algerian group clays since 2002

I'm the president, in the technical committee of ceramics and certification at the Algerian Institute of Standardization since 2006

The main modules, that I taught are quite diverse.

organic chemistry, colloidal chemistry, physical chemistry, chemistry of fats, and since 1986 I teach also all the material on modules (ceramic technology, and glass, vitro ceramic the thermomechanical ceramics, biomaterials etc.

I did, a lot of publications, and communications in the field of ceramics, all kinds of materials: in the environment, recycling of liquid solid waste etc.

The past five years

(2010 -2015)

I made : 15 international communications and 2 National communications

more : 10 international publications

International Congress on Water, Waste and Energy Management
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Performance tests on filling with mortar the cementing containers of radioactive concrete waste

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1. Introduction – Low level radioactive concrete waste resulted after removal of the nuclear facilities are, generally, immobilized by cementing in the steel drums which are then stored in safe places. Due to large amounts of low level radioactivity concrete (LLW) results, it is important that they handle at the storage as small volume. In this paper is presented an technology, adapted to the requirements of dismantled structures of VVR-S nuclear research reactor from Magurele, in which radioactive concrete is crushed and the mortar made from recycled radioactive sand, cement, water and superplasticizer agent is poured in container with radioactive rubble (that is pre-placed in container) for cimentation, Image 1. Is achieved a radioactive waste package in which the degree of filling of radioactive waste increases substantially, compared to where it uses mortar with natural aggregate. Are analyzed a series of characteristics of the fluid mortars (grouts) with recycled aggregate, in fresh and hardened state, such as: density, fluidity, compressive strength, mortar fill ratio etc.

Image 1. The storage containers with concrete block and rubble 16/50 sort

2. Experimental - Performance tests were carried out on mortar filling obtained with recycled fine aggregate having a particle size < 2.5mm, < 5 mm respectively, obtained from C25/30 original concrete [1]. It was aimed compositional optimization of the mortars in terms to obtain fluid and homogeneous mortars and implementations required specifications [2]. The rubble fill ratio was determined as a percentage volume of container capacity, by replacing the volume of empty space in the container with water. The recycled aggregate was, previously, saturated with water [3]. To confirm the results obtained on a small scale, it made an attempt to fill the mortar in three containers type that simulates the final storage packages. Were used: a) three drums with a capacity of 100 liters (filled with rubble 16-50mm sort and an parallelepiped concrete block); b) three drums with a capacity of 100 liters (filled with rubble 16-50mm sort); c) an rectangular container sector with a=530mm and h=685mm dimensions (filled with rubble 16-50mm sort and six parallelepiped concrete blocks). In area of gravel was poured mortar at a rate of about 25 l / min.

3. Results and Discussion - For all types of mortar made, the correlation time of the mortar flow through the cone with W/C ratio, indicate that mortars become more fluid when the water content increase (for the same amount of cement). The dependences were quantified by relationships such as those defined by the Power Low rheological model, with very good correlation coefficients. It reveals, in general,

decrease of the density and mechanical strength with increasing W/C ratio, for mortars with the S/C ratios = 1.3, 1.7, 2.1. For all tests the degree of filling with mortar was between 99.3-99.6%.

4. Conclusions - This paper presents a series of compositions for filling mortars, made with recycled aggregate, used in cementing the low level reactivity of concrete waste (LLW), resulting from the decommissioning of nuclear facilities. In this way it follows a marked increase in degree of filling with radioactive concrete of the storage containers.

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Modeling and Experimental Study of Investigation of Mineral Scale Deposition in Produced Water Re Injection (PWRI) of Water Management: Case Study

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1. Introduction –Produced Water Re Injection (PWRI) is one of the common methods used in IOR usually applied in offshore oil fields to do the water management as well as maintain the reservoir pressure and improve secondary recovery.

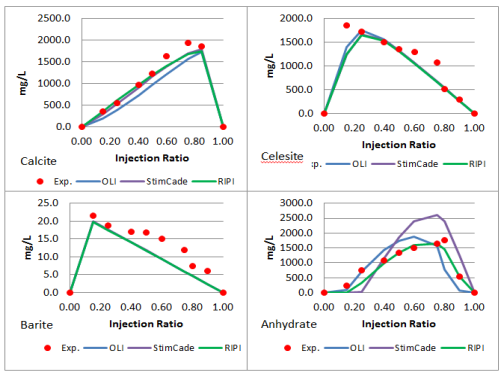
Mineral scale deposition in near wellbore regions of injection wells is one of the main challengeable issues during the water injection process which magnify the importance of robust model in predicting the amount of mineral scale deposition due to super-saturation of salts.

The objective of this study is to develop a model that can accurately predict the formation and amount of mineral scales in multicomponent aqueous systems by three major tools; utilization the best temperature and pressure dependent thermodynamic interactive ion coefficients (MSE Model: Pitzer), developing our fine-tuned iterative mathematical solver and verification the results of model by large number of accurate experimental data.

2. Experimental and Methodology - Static jar tests in different individual solids and multicomponent mixtures are carried out. Our model was runed for some case study. The results are verified by several experimental data bank ranging from infinite dilution to the fused salt limit. This Model is based on an iterative procedure for scale precipitation calculation in mixed-solvent electrolyte solutions.

3. Results and Discussion - The results showed that at the optimum value of precipitant (10%) in scale deposition reactions and by defining the best temperature and pressure dependent coefficients, we can attain the best accuracy in prediction of mineral scale deposited amount (less than 3 percentages as relative error compared to commercial software by more than 18 percentages underestimation). Therefore we can recognize critical points for scaling in process and facilities of water production and injection.

A



B

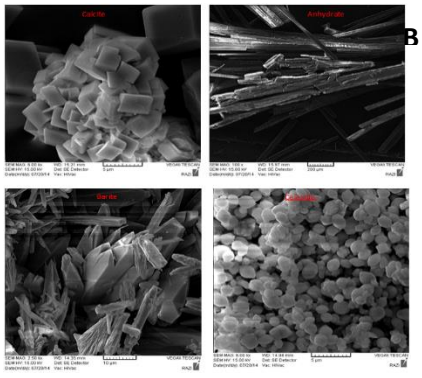


Image 2. A. Comparison of mineral scale precipitation in developed model (RIPI) and different common software as well as laboratory tests (at T=25 C, P=1 bar), **B**. SEM of scales

4. Conclusions – In this research scaling potential is predicted in different conditions such as surface facility and reservoir states for water management with lower risk in oil fields.

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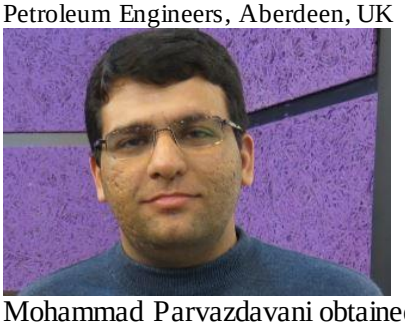

Mohammad Parvazdavani obtained his B.S. degree in Mining Engineering from Isfahan University of Technology, Iran (IUT) in 2009 and his M.S. degree in Petroleum Engineering from Sharif University of Technology (SUT) in 2011. Currently, he is Ph.D. candidate of Petroleum University of Technology in common with Sharif University of Technology. He works in Research Institute of Petroleum Industry related to NIOC (National Iranian Oil Company) and his interested field is wáter injection as EOR/IOR study.

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An integrated MRIO - CGE model for studying water and production reallocations in Spain

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ABSTRACT: Over the last years, two tools have sparked a growing interest with regard to their potential usefulness in solving environmental and economic problems. This paper proposes to combine multiregional input-output (MRIO) and Computable General Equilibrium (CGE) tools in order to take advantage of the opportunities offered by both models for analyzing reallocation criteria in the Spanish economy. The main objective is to assess the economic and environmental impacts of alternative scenarios of production distributions according to different reallocation criteria. We specifically focus on the Spanish agricultural and agri-food sectors and their impact on water resources through their full supply chains, which show important asymmetries within different regions as a consequence of important resources imbalances. From the methodological point of view, we design a CGE-MRIO model for Spain (considering the 17 Spanish regions, the European Union and the Rest of the world) which is environmentally extended to compute water flows. We then formulate different scenarios of alternative geographical production reallocations based on stimulating production of water intensive products in regions with greater water resources availability through the development of shorter food supply chains (SFSCs) between agriculture and agri-food industry. We evaluate the impact on income and water variations to provide some guidelines for decision-makers. Our results reveal the possible efficiency of a support scheme through fiscal measures to shorten food supply chains between agriculture and agri-food industry among Spanish regions from both an environmental and economic point of view. More interestingly, the combination of payment criteria allows proposing a shared responsibility between consumers and producers to stimulate production of water intensive products in regions with greater water resources availability and save water even with improvements in the total production.

KEY WORDS: MRIO, CGE models, reallocation criteria, short food supply chain.

JEL classification: C68, D57, L66, P16, Q10, Q25.

About the authors

We are members of the research group "Growth, Demand and Natural Resources" and we are involved in several projects funded by the Ministry of Education and Science of Spain and the Government of Aragon. Our research focuses on regional, national and environmental accounts, and the use of input-output models and computable general equilibrium models. We have contributed to several articles in international journals such as Ecological Economics, Economic Systems Research, Energy Policy, Water Resources research, Water, Environmental Science and Technology, Journal of Industrial Ecology, Journal of Cleaner Production, Applied Economics, Sustainability, Water, Spanish Journal of Agricultural Research, among others. Specifically, **Cristina Sarasa** is an assistant professor, **Rosa Duarte** is an associate professor, **Julio Sánchez** is a professor, all in the Department of Economic Analysis, Faculty of Economics and Business Studies, University of Zaragoza, Zaragoza, Spain. **Ignacio Cazcarro** is a postdoctoral researcher at the BC3–Basque Centre for Climate Change, Bilbao, Spain.

DISCRETE MULTI-CRITERIA METHODS for ELECTION of LANDS USE ALTERNATIVES in the TORO RIVER HYDRO-BASIN (Province of Salta, Argentina)

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1.- Introduction - The study area is the part of Toro river hydro-basin, situated in the Lerma Valley. The Lerma Valley is a natural area located in the Province of Salta, along the Andes Mountains, in the Argentine Northwest. It has 2.400 km^2, with a population of 670.000 inhabitants. It is a fertile zone with loess soils and a temperate climate. At present, the main activity is the tobacco production, but due to the regressive commerce and its low price, it is necessary to study a compressive plan to reorganize the land use and the "modus Vivendi" of the population.

Several actions must be implemented. The most important should be the hydraulic management action improving the irrigation systems. Cultivated gently since one hundred sixty years ago, a coordinated action planning has become necessary to conserve lands while keeping good agro-production. The authors have collected data on soils and on hydrology for the study area. They have analyzed the alternatives to crop tobacco, taking into account the agronomic, economic and sociologic characteristics.

2.- Experimental – Authors have applied Decision Support Systems (DSS) with Mathematic tools, using Discrete Multi-criteria Methods (MCDM). For that, they used ELECTRE, weighted or original PROMETHEE and AHP methods with a system of criteria grouped as environmental, economic and social, to obtain a better view on the general aspects for the middle or long term planning.

3.- Results and Discussion - The paper concentrates on these discrete MCDM, and the results on the alternatives selected could be taken into account to elaborate recommendations for farmers and to guide policies, combining public and private actions, for the use and conservation of these areas.

4.- Conclusions.- The alternative selected would be: Maintaining the current production system but increasing production and tobacco area due to higher flow irrigation, by means of a system of pressurized gravitational collective irrigation to the demand (**ITA**).

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CURRICULUM VITAE

Juan Bta. Grau was born in Valencia (Spain). In 1969 he was graduated in Agricultural Engineering at the Polytechnic University of Valencia (UPV) with the qualification of Remarkable and in 1973 Doctor in Agricultural Engineering at the same University with a rating of Outstanding "Cum Laude". He is also an Industrial Psychologist from the Complutense University of Madrid, since 1977, with the rating of Remarkable. He also has a great lot of diplomas.

He has been lecturing and researching for more than 40 years in various Universities in the area of Applied Mathematics. He teaches courses on applications of Decision Theory and Fractals in Latin American Universities. He has the appointment of "Distinguished Visitor" from the Catholic University of Cordoba (Argentina).

He is an expert in Multi-criteria Decision Making (MCDM), mainly, in the areas of environment, management and land use planning, erosion control, climate change adaptation and integral water resources management.

He belongs to **the GASC Research Group of the UPM,** making a large number of national and international **projects**

He is the author of numerous **articles** in scientific journals with high rate of JCR and is speaker at prestigious **International Congresses** and member of the **Scientific Committees.**

He also belongs to **the Educational Innovation Group RIESGOMAT**

He has participated on Doctoral Courts and as Director of several PhD`s.

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Predictors of students' intentions to use bioenergy – a Finnish case study

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1. Introduction – Bioenergy is the mainstay of Finland's renewable energy (RE) program and it will remain as a significant contributor to Finland's transition towards a low carbon society by 2050. It is believed that young students' intentions to adopt RE technologies would be a key driver towards that transition as they are the future users of different RE options such as bioenergy. However, there is a significant gap in understanding the predictors of students' intentions to use bioenergy. In this regard, a recent study explored Finnish and Indian students' intentions to use bioenergy from a cross-cultural perspective [1] using the Theory of Planned Behavior (TPB) [2] model. TPB is one of the most widely cited and applied theories in explaining human behaviors in environmental matters. In the TPB model, intention to act is primarily determined by three psychological constructs or predictors: Attitude towards the behavior, Subjective Norm (SN) and Perceived Behavioral Control (PBC). However, it is also believed that individuals' pro-environmental values and environmental concerns could also be the predictors of their pro-environmental intentions. There has been no study, which included these factors to predict students' intentions to use bioenergy. Therefore, this study attempted to predict Finnish school students' intentions to use bioenergy based on their pro-environmental values and perceived risks regarding bioenergy, and compared that with the results from the TPB model for a better country-specific understanding of students' intentions to use bioenergy. The Finnish data came from 402 school students (mean age=15.35 years, SD=0.52) studying in 9th grade in six high schools in eastern Finland. A Structural Equation Modelling (SEM) using the maximum likelihood method in AMOS 21 software was applied to predict students' intentions to use bioenergy.

2. Results and Discussion – It appeared that the students' pro-environmental values and their perceived risks concerning bioenergy were able to explain only about 9% (R^2=.09) and 3% (R^2=.03) of the variance in the Finnish students' intentions to use bioenergy, respectively. However, the TPB model was able to predict 63% of the variance (R^2=.63) in the students' intentions to use bioenergy. Among the TPB predictors, Attitude showed the strongest positive effect on Intention, whereas both SN and PBC showed smaller positive effects though all were statistically significant. An extended TPB model including the pro-environmental values and perceived risks regarding bioenergy as predictors explained 62% (R^2=.62) of the variance in students' intentions to use bioenergy. The effects of the additional two predictors were negligible. The results implied that the Finnish students' intentions to use bioenergy would be primarily determined by the personal factors (i.e. their attitudes to bioenergy).

3. Conclusions - Despite some limitations related to sample representativeness, the study was able to explain young students' intentions to use bioenergy using the standard TPB model. The results could be useful for the future energy and environmental psychology related studies.

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Biosurfactants from kerosene degraders for efficient bioremediation

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1. Introduction – Kerosene, obtained from fractional distillation of petroleum, is used as jet fuel, heat oil and as pesticides [1]. Being as one of the most commonly spilled petroleum products, kerosene causes great pollution problems in the environment [2]. Kerosene pollution can be overcome by bioremediation through the use of kerosene degrading bacteria. One of the most important characteristics of kerosene-degrading-bacteria is to emulsify kerosene by biosurfactants. Biosurfactants promote bioavailability of kerosene for biodegradation [3]. Therefore, this study aimed at characterizing biosurfactants produced by kerosene degraders isolated from contaminated surface waters.

2. Experimental - Water samples collected from hydrocarbon contaminated river waters were used to isolate kerosene degrading bacteria. For selective isolation, sterile mineral salt medium containing kerosene as a sole source of carbon was used. Biosurfactant production and kerosene degradation abilities of the isolates were determined by using following methods drop-collapse test [4], oil displacement test [5], emulsification index measurement [6], microbial adhesion to hydrocarbon [7] and gas chromatographic determination of kerosene degradation.

3. Results and Discussion – Out of 290, 22 bacteria were isolated as kerosene degraders. Among them, six kerosene degraders were found to be potential biosurfactant producer and identified as *Pseudomonas koreensis* Cu12, *Acinetobacter calcoaceaticus* Fe10, *Acinetobacter haemolyticus* Mn12, *Acinetobacter johnsonii* Sb01, *Micrococus luteus* Sr02, and *Staphylococcus aureus* Al11.

4. Conclusions - Interest in biosurfactants has been steadily increasing in recent years, as biosurfactants have numerous advantages over chemically synthesized surfactants, including lower toxicity, higher biodegradability, better production using renewable feed stocks, and greater stability towards wide range of pH, high temperature, and salinity. Due to the increasing demand of microbial biosurfactants, there is a need to characterize the biosurfactants having potential for kerosene remediation.

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Scientific CV

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Municipal Solid Waste in Waste-to-Energy Operations – Questions of Classification and Consistency

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1. Introduction - Following the entry into force of Directive 2008/98/EC (the 'Waste Framework Directive')[1] and increases both in the amount of waste produced and in the need for energy, production of energy from waste has increased. This paper examines the situations in which municipal solid waste based fuels cease to be waste in and whether waste to energy procedures should be classified either as methods of recovery or of disposal according to the EU waste legislation. If the fuel is classified as waste, the plant in which it is incinerated is classified as a waste incineration plant regulated under Chapter IV of Directive 2010/75/EU (the 'Industrial Emissions Directive')[2]. The Industrial Emissions Directive requires the incineration to happen at predetermined high temperatures. This requirement may have severe consequences in relation to the operation of the power plant and make such operation less appealing in a technical and commercial sense, especially in periods of lower heat and less demand for power (such as during the summer).[3] Thus, it would be extremely beneficial for waste to energy installations that their fuels would not be considered waste in a legal sense.

2. Results and Discussion – In EU waste legislation all objects and substances are either considered waste or non-waste and all operations are considered either recovery or disposal operations. Article 5 of the WFD lays down criteria under which a substance or object may be regarded as a by-product, and Article 6 contains the end-of-waste criteria. If an object or substance fulfils either of these sets of criteria it ceases to be classifiable as waste. However, the precondition to a material ceasing to be waste is that, it is in a recovery operation.

The Court of Justice of European Union held that incineration was to be classified as a recovery operation when it fulfilled the criteria set out in paragraph R1 of Annex II of the WFD: (1) the amount of energy produced must be larger than the amount of energy consumed in the operation; (2) the surplus energy produced should be used in producing heat or electricity; and (3) the waste should be mainly used as a fuel or other means of producing energy.[4] However, by-product status is unavailable because municipal solid waste-based fuel cannot fulfil all the criteria as a consequence to waste fuel production not being an integral part of the energy production process. The end-of-waste criteria might help the municipal solid waste based fuel to cease to be waste, if their quality and emissions can be controlled in a sufficient way.

3. Conclusions – Municipal solid waste based fuels can only cease to be waste through the end-of-waste criteria of Article 6 of the Waste Framework Directive. However, to fulfil the criteria the quality of the

waste and the emissions of burning it, would have to be strictly controllable. Thus, it is vitally important to create quality standards for waste based fuels, if they are to be used in efficient energy production.

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Pre-Concenration of Precious Metals from Waste Printed Circuit Boards (PCBs)

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1. Introduction

Over the past several years, the electrical and electronics industry has been one of the fastest growing industries. This rapid development has caused an increase in waste electrical and electronic equipment (WEEE). Physical beneficiation processes are essential for effective liberation and separation of metallic parts from non-metallic component before recovery of metals by hydrometallurgical technique without affecting environment. The aim is to develop an improved environmentally friendly recycling technology involving physical beneficiation with a combination of hydrometallurgy. The main purpose of this study is to investigate the possibility of effective application of gravity based concentration methods prior to hydrometallurgical processes.

2. Experimental

This research also focused on the separation and concentration of minor metals using physical methods such as the wet shaking table. After disassembling and comminution processes, the ground PCB particles which were separated into three size fractions (+1 mm; -1+0.3 mm, and -0.3 mm) were fed to shaking table concentrator. The laboratory Wilfley table used in this work is a typical one, commonly used in mineral processing studies to concentrate ore. The separation and concentration efficiencies of metals were calculated through a chemical analysis.

3. Results and Discussion

After shaking table concentration test, 20.6% of the total feed was obtained as a concentrate and 66.7% was as tailings. 72.3% of the copper was collected in concentrate with 42.61% Cu content. Au and Ag contents are increased in the concentrate by 3 times comparing those of the feed. Iron was concentrated in the small size fraction and 91.5% recovery was successfully attained after gravity separation. Since aluminium is very soft metal and gives plate like shape after crushing and grinding, high Al contents are accumulated at coarser size ranges.

4. Conclusions

The existing processes of recycling printed circuit boards are pyrometallurgical or hydrometallurgical methods, which generate atmospheric pollution. Pre-concentration of these metals by using simple and cheaper mechanical methods prior to chemical and metallurgical processes will end up an economic benefit and diminish environmental problems. In order to recover metals in PCBs, a gravity separation process was proposed in this study. The results indicated that shaking table concentration is very useful and effective for enrichment of metallic values. Unlike mineral ores, PCBs do not have a particular size fraction for liberation and thus different types of elements are liberated at different size fractions. Aluminium is found to be liberated in much coarser fractions while iron, gold and silver are liberated in finer fractions. Further processing will help to recover these metals with greater contents and recoveries. Centrifugal and flotation methods may also be adapted to recover finely ground particles for additional separation.

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The Factorial Design Application Of Hause Valuation : Case Study Samsun - Turkey

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1. Introduction – The real estates create a large part of social wealth and everyone wants to know the value of owned real estates. The value is changeable according to the shape, location, and the properties of real estate. Also the value of real estate can be differently from person to person. But, the based objective value must be determined valid [1]. The factors affecting the real value had been investigating for many years. Until recently, the real estate value was determined according to personality experience. The reason of the widespread in valuation process, it is necessary to the objective, sensitive, scientific, quantitative of the real estate valuation [2]. Today, the comparison, income and cost methods are generally used in the valuation process. The of real estate values are formed from the environmental factors, the social factors and the personal factors. [3].

The valuation process data can be obtained from experiment and observation. The experiment; is realized to validate previous results, examine the details about some feature of the process, and obtain new results. Also the experiments can help to the decision maker for to take the decision makers to take the decision about continue or replace a scientific process. The experimental design is a process about the input factors of belonging the process are subjected to the aimed changes and then the changes are determine on the output variables. The experimental design is used in all performed production areas.

The full factorial design is experimental designs methods about the effects of factors having the number of levels more than one are investigate on the response variables. In the factorial design it is provided that each factors and their all levels are matched the other factors and their levels in experiment Thus, all possible level combinations of the factors can be examined [4]. 2^k factorial design is a special form of full factorial design of experiments and allows to study the impact of two - level factors [5-6] .

2. Experimental -This study involves the 48 real estates (the apartment or private house) placed in different district of Samsun city. The marketing values of these had been given in internet sides. While, the marketing value was selected as response variable, the district, area, rooms number and state were selected as factor. The experiments carried out three times.

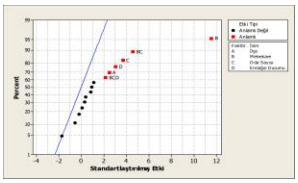

Image 1. Normal Probability Chart of Effects

3. Results and Discussion – It is seen that The main effects of the district, area, room number, the state and the interactive effects of the area* room number, the area* room number*the state had got a significant effect on the marketing value (Image 1).Also, the regression equation can be obtained from the statistical result of the experimental data.

$$Value = 132{,}844 + 4{,}531 * A + 20{,}906 * B + 6{,}719 * C + 5{,}552 * D + 8.281 * B * C + 3{,}906 * B * C * D$$

4. Conclusions – It was seen that all the selected factors are effective as statistical values on marketing value. The area (B) is the factor that has the largest main effect. The high levels of factors had increasing effect on the value.

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Bio-lubricants production using biodiesel from *Cynara cardunculus* L. oil as a starting material

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1. Introduction – In the last few years, the biobased lubricants have received a great attention as substitutes of the mineral oil based lubricants. In this sense, the bio-lubricants show faster biodegradability, lower toxicity, good behavior as lubricant and a minimal impact on environment and health. The bio-lubricants can be produced by means of transesterification of methyl esters (ME) obtained from vegetable oils (biodiesel) with an alcohol superior as 2-ethyl-1-hexanol (EH) [1]. In this work the synthesis of lubricants from methyl esters of Cynara cardunculus L oil is analyzed. This oil is a non-edible crop, which can be grown on nutrient-deficient land and does not compete with existing agricultural resources [2].

2. Experimental – In order to prepare the ME, 500 mL of Cynara cardunculus L oil and 5g of sodium methoxide were dissolved in 81 g of methanol and placed in a 1000 mL glass reactor with magnetic stirrer and a condensation system. The reactor temperature was maintained at 60 ºC and the reaction was carried out for 60 min. The reaction mixture was cooled to room temperature and the resulting two layers were separated. The upper layer (methyl esters) was washed with water, to eliminate the rests of catalyst; next it was dried at 110 ºC. Then, the methyl esters were transesterified with 2-ethyl-1-hexanol. For this process, 150 mL of ME were placed into a spherical glass reactor of 500 mL with the necessary amounts of alcohol and catalyst. A Dean-Stark receiver was used to carry out the distillation of methanol. The reaction was carried out at high temperature (from 120 to 170 ºC) and p-toluenesulfonic acid, titanium (IV) isopropoxide and potassium methoxide were tested as catalysts. The progress of the reaction was determined by chromatographic analysis and also the removed methanol was used to measure the conversion of the reaction. In addition, the main properties of the bio-lubricant were analyzed.

3. Results and Discussion – The variables of operation such as temperature (120-170 C), HE:ME molar ratio (1:1, 2:1 and 3:1), type of catalyst and catalyst concentration (0.1, 0.25, 0.50 and 1.0 wt%) were studied. In all cases the biodiesel used as starting material had a ME content of 95 %. Temperature had positive effect on the equilibrium conversion of ME to esters of HE and on the necessary time to achieve this equilibrium. Total conversion was reached at 170 ºC in 30 min of reaction. Also HE:ME molar ratio exercised positive effect. When a molar ratio of 1:1 was used, the equilibrium conversion was 80 %; nevertheless, when the amount of alcohol was increased up to 3:1 molar ratio of HE:ME, total conversion (100 %) was achieved. The tested catalysts showed similar behavior, although titanium (IV) isopropoxide led to the best results. The influence of the concentration of this catalyst was also tested, and the best results were obtained with a 0.5 wt%, even though the achieved results with 1.0 wt% were very similar. The synthesized bio-lubricants were characterized by determination of density, viscosity, pour flash and ignition points, acid number and hydroxyl index.

4. Conclusions – Bio-lubricant was obtained from Cynara cardunculus L. oil by two successive transesterification reactions. Temperature, HE:ME molar ratio and catalyst concentration showed positive effect on the conversion. According to the product characterization, they could be used as commercial lubricants, considering their thermal stability, their small cloud point and their high biodegradability.

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Selection of BTEX degraders from petroleum hdyrocarbon contaminated surface waters

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1. Introduction – Benzene, toluene, ethylbenzene and xylene (BTEX) are frequently caused surface water contamination [1]. BTEX compounds are highly toxic to humans and are suspected carcinogens; thus the United States EPA classifies them as environmental priority pollutants [2]. Detection and identification of BTEX degrading bacteria are of greatest help for bioremediation efforts. Therefore this study aimed at selecting BTEX degrading bacteria and evaluating their catabolic genes involved in BTEX degradation.

2. Experimental – Water samples were collected from petroleum hydrocarbon contaminated surface waters and hydrocarbon degrading bacteria were isolated using selective enrichment culture methods [3]. These bacterial isolates were identified by 16S rRNA sequencing and their phylogenetic tree was constructed by using NCBI database [4]. Then each strain was grown in Bushnell Haas medium containing benzene, toluene, ethylbenzene and xylene as a sole source of carbon to determine the ability of isolated microorganisms to degrade BTEX [5]. After that BTEX degraders were investigated in terms of their corresponding catabolic genes.

3. Results and Discussion – All BTEX degrading isolates were identified and annotated according to their phylogenetic relationship. Each strain was incubated in BH medium and well-grown isolates were recorded. There are five different BTEX degradation pathways catalyzed by monooxygenases and dioxygenases encoded by different catabolic genes. Hereafter the study will be focusing on detection of the genes that play role in BTEX degradation.

4. Conclusions - Biodegradation of BTEX compounds is a significant phenomenon due to their toxic effects to human and natural environment. The bacterial strains isolated from petroleum hydrocarbon contaminated surface waters can enhance BTEX degradation and serve as potential biotechnological application for management of oil spills.

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Production of biolubricant by transesterification of biodiesel from castor oil

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1. Introduction – Industry and automobile sectors extensively use lubricants. The petroleum-based lubricants are widely used, generating a significant amount of wastes which increases the concern for pollution. In addition, the concern about the depletion of petroleum reserves has also led to the search of new resources to obtain lubricants. These new resources could be vegetable oils. The esters obtained by modification of vegetable oils could be considered biolubricants. They are highly biodegradable, produced from renewable sources, they show lower or no toxicity and good properties as lubricant [1].Therefore, the aim of this work was to obtain biolubricant from a non-edible vegetable oil, such as castor oil.

2. Experimental - Firstly, methyl esters (biodiesel) were obtained by reaction of castor oil with methanol in presence of potassium methoxide as catalyst. At the end of the reaction, the catalyst was neutralized and the reaction mixture was washed with distillated water. The phase of biodiesel was heated up to 110 ºC to remove the remaining washing water. Then, the biodiesel was transesterified with an alcohol, which is larger than methanol. Several alcohols were tested for this process. In addition, the reaction had to be carried out in presence of a catalyst. Acid and basic homogeneous catalysts were used to check their activity in the transesterification with the superior alcohol. The reaction was carried out at high temperature (from 120 to 160 ºC) to promote the reaction and to remove the methanol formed as a product by evaporation. The methanol was collected by a Dean-Stark receiver. Finally, the surplus of superior alcohol was separated by vacuum distillation of the product. The progress of the reaction was determined by chromatographic analysis and the main properties of the biolubricant were analyzed.

3. Results and Discussion – In this work biolubricant was obtained from castor biodiesel, 95.9% methyl ester. The biodiesel was subjected to reaction with a superior alcohol to obtain a substance with a particular chemical structure which supports the lubricant properties. The influence of the type of alcohol was studied by the use of three alcohols with different length of carbon chain and branches: 2-ethyl-1-hexanol, 1-heptanol and 4-methyl-2-pentanol. The highest conversion was achieved with 2-ethyl-1-hexanol (~90% in less than 20 min). The type of catalyst was also studied. Three homogeneous catalysts were tested: p-toluenesulfonic acid, titanium (IV) isopropoxide and potassium methoxide. All of them led to high lubricant conversion in 120 min of reaction, but the highest reaction rate was reached with titanium (IV) isopropoxide. Catalyst concentration was also studied, from 0.5 to 1.5 wt %. When catalyst concentration was increased up to 1.0 wt %, the reaction rate increased too. The reaction temperature affected positively, and the best results were reached at 160 ºC. Finally, alcohol:biodiesel molar ratio was varied (2:1, 2.5:1, 3:1 and 5:1), using 2-ethyl-1-hexanol as alcohol, and the highest conversion was obtained with the ratios 3 and 5:1. The product obtained under these conditions was characterized as a lubricant.

4. Conclusions – Biolubricant was obtained from castor oil by two successive transesterification reactions. The best results were achieved with 2-ethyl-1-hexanol as alcohol and titanium (IV) isopropoxide as catalyst. High temperature was necessary to reach high conversions in few minutes and the product properties were suitable to be used as commercial grease.

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Application of electrocoagulation method in TOC removal from Arak Oil Refinery wastewater

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Abstract

Oil Refineries are among major consumer sites of water resources in the industrial sector which almost they have been built near or inside of cities in Iran. Generated wastewater of oil refineries contains varying amounts of pollutants and chemical compounds. Because of high pollution load caused by wastewater of Oil Refineries, pre-treatment are usually done, then are refined by other processes. In this research, the ability of electrical coagulation process is used to eliminate a wide range of chemical compounds in order to treat Arak Oil Refinery wastewater. In every step of testing, 2 liters of Oil Refinery wastewater are placed in a pilot made of Plexiglas with dimensions of (13cm * 14cm * 15cm). Then 6 Aluminum electrode with dimensions of (10cm*12cm) and 2 mm of thickness was located into the reactor in a bipolar arrangement with 2cm distance from each other. Moreover, we tried to obtained optimal values of important parameters like time, pH and voltage. According to the results, time equal to 90 minutes, pH equals to 6 and voltage equals to 30 volt are optimal values for removal of TOC. The amount of TOC reduced from 480 (mg / L) to 85 (mg / L). These results indicate that the electrocoagulation process can be effectively used in Oil Refinery wastewater treatment.

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Organic and Nitrogen Loading Rate Effects on Nutrient Removal Efficiency and Stability of Aerobic Granules

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1. Introduction – Biogranules, either aerobic or anaerobic, are dense and compact aggregates composed of different microorganisms. Aerobic granules are advantageous compared to conventional activated sludge flocs due to their high biomass retention, toxicity resistance, ability to tolerate high loadings, high settleability thus easy separation from effluent [1]. Nutrient removal ability of aerobic granules and short start-up periods make them more attractive compared to anaerobic counterpart [2]. However, for having high growth rate, stability problem still remains to be resolved and the factors affecting stability and in turn treatment efficiency are widely researched. The influent loading rates and carbon to nitrogen (COD/N) ratio are two major operational parameters in aerobic granular reactors. This study was, therefore, conducted to determine the maximum influent organic and nitrogen loading rates providing both high nitrogen and COD removal efficiencies while maintaining the structural stability of the aerobic granular sludge.

2. Experimental – A sequencing batch reactor (SBR) with 8 cm inner diameter, 60 cm depth, 2.45 L working volume and 50% volumetric exchange ratio was used and seeded with aerobic granules. COD/N ratio was kept constant at 7.5 [3], while organic loading rate (OLR) and nitrogen loading rate (NLR) were gradually increased from 0.75 to 12 g COD/L.day and from 0.1 to 1.6 g TAN/L.day, respectively. This was achieved by increasing influent COD (chemical oxygen demand) and total ammonia nitrogen (TAN) concentrations gradually from 375 to 6000 mg/L COD and from 50 to 800 mg/L TAN.

3. Results and Discussion - High COD treatment efficiency (85-96%) was obtained at OLRs of 0.75-6 g COD/L.day and NLRs of 0.1-0.8 g TAN/Lday. When OLR was further increased to 12 g COD/L.day, and NLR to 1.6 g TAN/L.day, COD removal efficiency decreased to 81% and high amounts of filamentous growth was detected. The increasing NLR (from 0.1 to 1.6 g TAN/L.day), and the corresponding OLRs from 0.75 to 12 g COD/Lday resulted in decreased TAN removal efficiency trend (from 87 to 45-51%). Decreasing TAN removal efficiency was especially noted above 0.4 g TAN/L.day NLR and 3 g COD/L.day OLR. The optimum OLR and NLR values were determined to be 1.5 g COD/Lday and 0.2 g TAN/L.day, respectively, regarding the provision of the highest COD (85%), TAN (87%) and TN (55%) removal efficiencies as well as the formation of granules with high stability. Both high COD and TAN removal efficiencies were attributed to the formation of efficient granule sizes with suitable anoxic and aerobic volumes at the optimum loading rates. Thus appropriate amounts of aerobic/anoxic heterotrophic and nitrification bacteria were provided to obtain high removal efficiencies.

4. Conclusions – This study revealed that OLR and NLR values of the influent wastewater affected the relative abundancy of the microbial populations contributing to the aerobic granular structure, as also indicated for COD/TAN ratio [3]. Thus it can be concluded that the influent COD/TAN ratio, OLR and NLR determined the COD and TN removal efficiencies. In order to obtain high TN removal efficiency, the influent wastewater should have appropriate COD/TAN ratio, OLR and NLR values which will promote both nitrifying and denitrifying species.

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Cost-effective disposal of milk whey II: recovery and purification of lactose and pure water from the diafiltration permeate stream

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1. Introduction – Times ago, a number of technologies were tested, at pilot plant scale, for application in milk whey disposal processes with recovery of valuable products [1-3]. Nowadays, a consolidated approach for cost-effective disposal of milk whey is based on fractionating the whole stream in two or more valuable streams, plus a small retentate waste stream resulting from microfiltration of raw material which contains the whole amount of residual fat and bacteria that, along with other suspended dairy biomass wastes, is definitely purified, preferably using hydrothermal carbonization [4-6]. The purpose of this contribution is to describe with some interesting and not yet discussed details, the procedure and the technologies required for producing a desalted and concentrated aqueous solution of lactose, along with an aqueous recirculating stream for washing the rich protein retentate in the dialysing section and a stream of very pure water. To this purpose, literature results were used to develop a nanofiltration based section for the separation of the salts from the lactose; than the activity and the partial molar volume of the water in aqueous solution of lactose were quantified as function of temperature and concentration in order to calculate the osmotic pressure and to find optimal T, P, and concentration values to be used in the reverse osmosis (RO) section. For this, it was necessary to properly account for the strong influence of the temperature on the solubility of lactose which is 5 times lower of that of sucrose at ambient temperature, while is almost comparable at 363 K; consequently, a number of experimental vapour pressure lowering and density data were required along with a proper model capable to describe quantitatively the thermodynamic properties of aqueous solutions of lactose in wide ranges of temperature and concentration.

2. Results and Discussion – It was found that concentrated aqueous solutions of lactose deviate significantly from the ideal behaviour and, consequently, calculation of osmotic pressure must accounts for the partial molar volume of the solvent along with its activity behaviour. As preliminary results an optimal set of the RO operating parameters is around to: T=353 K, P=6 MPa, and lactose concentration in the retentate=30%.

3. Conclusions – Very pure, uncontaminated and concentrated solutions of lactose can be obtained by properly processing milk whey using membrane separation technology under optimal set of operating parameters identified with a rigorous analysis of the physic-chemical and thermodynamic properties of the solutions.

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An optimal water resources allocation model based on the coevolution theory

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Abstract - Rationality and objectivity in allocating the water resources are critical to high-efficient and sustainable water use. In response to both cooperative and competitive relationship among different sectors in the arid region, a novel water resources allocation model, based on the coevolution theory in biology, was established in this study in an effort to achieve sustainability and balance in water use among different sectors. The model then was applied for Tibet region based on the region's water consumption data from 2006 to 2011, and gray identification method was used to estimate the model parameters. As a result, an optimal water allocation scheme for the region was obtained, and according to the scheme, 1.72, 1.95 and 26.36 billion m3, i.e. 5.73, 6.49 and 87.78% of the total amount should be allocated for domestic, industrial and agricultural -water use respectively. The optimized allocation results were in good agreement with the trend of actual water use in the region, indicating the current water allocation in the region is sustainable. The new approach would be a useful tool for assessing the rationality of water resources allocation in other regions.

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Agronomic valorization of anaerobic digestate via production of heterotrophic algal biomass.

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1. Introduction – Microalgae are a highly diverse and specialized group of microorganisms. The flexibility to switch their nutritional mode based on substrate availability and light condition is one of their multiple advantages. This paper analyze the current state of a specific niche of microalgae growth: heterotrophic cultivation, specifically supported by anaerobic digestate as carbon and nutrients source, replacing in this way the traditional support of light energy (Figure 1). When compared to autotrophic cultivation, heterotrophic systems are more suitable for producing high cell densities of microalgae which can be converted into valuable products. Apart from that, heterotrophic cultivation is far simpler to construct facilities, cheaper to operate and easier to maintain on a large scale than autotrophic cultivation. This capacity allows large volume applications, as organic waste streams treatment combined, or separated, with production of slow release fertilizers and biostimulants. Recycling the nutrients from anaerobic digestion an assimilating them into algal biomass can result in high quality fertilizers without incurring the environmental and monetary costs of using chemical fertilizers while simultaneously remediating the waste effluent from this process. Manure digestate is an especially attractive feedstock to grow microalgae for biofertilizers production, as it is less contaminated than untreated effluents and rich in nitrogen and phosphorus. The application of biofertilizers has been shown to decrease soil erosion, pest infestation, and water requirements, and improve soil tilth. The use of algae as biofertilizers of biostimulants is particularly appealing. In this paper the challenges faced during heterotrophic microalgae large scale production and limiting factors which hinder the microalgae growth are enumerated. A general perspective of the field is presented, describing the best-known examples from the literature and analyzing the prospect of heterotrophic cultures to produce sustainable fertilizers and biostimulants.

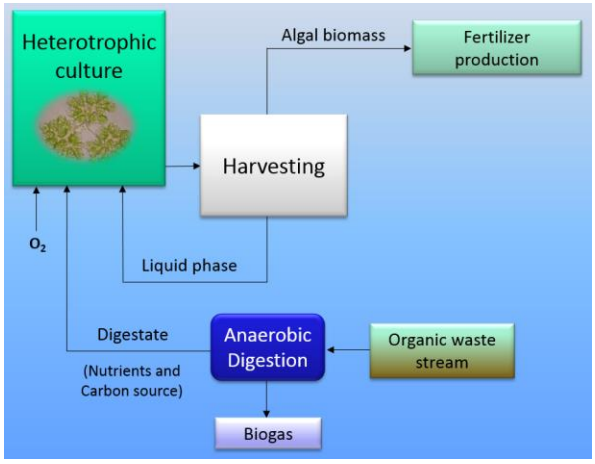

Figure 1. Heterotrophic microalgae cultivation using anaerobic digestate as carbon and nutrients source

2. Results and Discussion - Microalgal cultivation for fertilizers production is economically viable only if wastewater is used as source of water and nutrients. For this reason, coupling microalgae culture for

fertilizers production and manure digestate treatment is nowadays seen as an appropriate and economic solution.

3. Conclusions - Heterotrophic microalgae cultivation could be implemented in the short term as a solution to convert nutrient rich streams from different processes to slow-release fertilizers with less adverse effects on the environment than the direct application of these streams on soils or conventional fertilizers.

Scientific CV

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Pumice Supported nZVI for the Treatment of Contaminated Groundwater with Heavy Metals

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1. Introduction - This study was conducted to investigate the adsorption of Ni (II) using synthesized pumice supported nano zero-valent iron (P-nZVI). nZVI is a strong reducing agent with high reactivity due to its large surface area and very small particle size. However, nZVI tends to agglomerate and oxidize easily to iron oxide due to its high surface energy [1]. Pumice with a porous structure can be found profusely in Turkey. Therefore, pumice was modified by nZVI to increase its surface area and thereby increase removal efficiency.

2. Experimental - nZVI was prepared by reduction of (Fe^{+3}) by sodium borohydride ($NaBH_4$), which produced black particles and then supported on the pumice [2-3]. Bottle adsorption experiments was performed to investigate the removal efficiencies of P-nZVI. The effect of contact time, adsorbent dose, pH of solution, initial nickel concentration on the Ni (II) removals was studied.

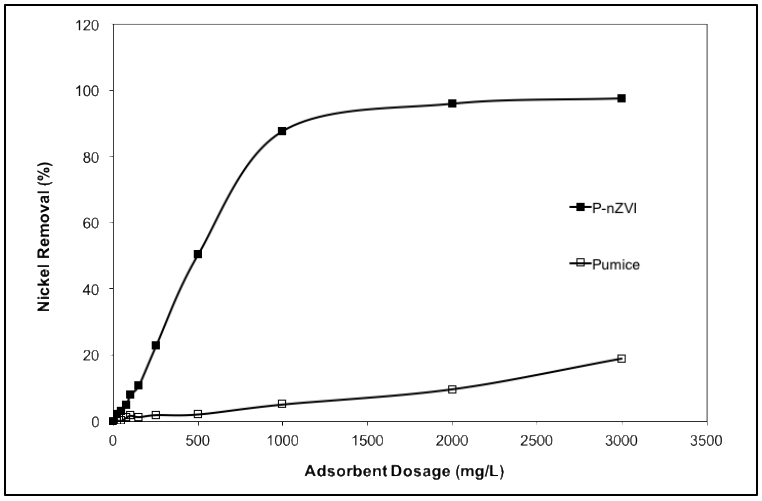

Fig. 1. Effect of adsorbent dosage on the sorption of Ni(II).

3. Results and discussion - Fig. 1. shows the removal efficiency of both raw and modified pumice at various adsorbent dosage. The results indicate that pumice modification with nZVI enhanced the nickel removals. The observed removals of raw and P-nZVI were reached to around 19% and 98%, respectively.

4. Conclusions – Overall the results indicated that the removal efficiency of modified pumice with nZVI increased effectively by increasing its surface area. Also the pumice is an excellent material for supporting nZVI to prevent

its agglomeration and oxidation. P-nZVI can become promising technology for the treatment of groundwater polluted with nickel.

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Simulation heat carrier fluids efficiency and molten salts in collector-receiver tube in concentrating solar power

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1. Introduction - Concentrating solar power (CSP) represent 90 % of the market in contrast to others technologies. Spain and the USA have the highest number of build plants. The total electrical output of CPS plants until February 2016 was 4,74 GW and is projected to reach 10 GW by 2018. The energy production costs associated with CSP have to decrease in order to insure the competitiveness of photovoltaic systems, it is, therefore, necessary to investigate and develop new components that promote these installations' efficiency [1]. Image 1.

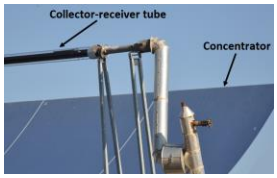

Image 1. Concentrator and collector-receiver tube. [Image:

2. Experimental - This article simulates the states of different heat carrier fluids and molten salts, so as to define their efficiency inside collector-receiver tube in CSP. SolidWorks Education Edition Software® and the tool FlowSimulation® were used to simulate the flow path with real function conditions and the heat losses of HFT (Heat Transfer Fluid) going through a section of the collector-receiver tube[2]. Image 2.

3. Results and Discussion - Simulation results show that synthetic oils Therminol VP-1 and Dowtherm A are more efficient in solar plants due to their high temperature working levels, low heat losses, low viscosity and reasonable cost. If we consider the whole plant's efficiency levels, the best results are obtained using Hitec XL salt because it works at temperatures that are 100°C higher than oils.

Table I. Related estimated errors [Source: Own elaboration].

Result	Out temperature	In temperature	Temperature increase	Thermal losses
	°C	°C	°C	W
Theoretical	291,0056	290,0000	1,0056	365,2511
Simulation	290,9965	290,0000	0,9965	365,4701
Relative error [%]			0,9071	0,0599

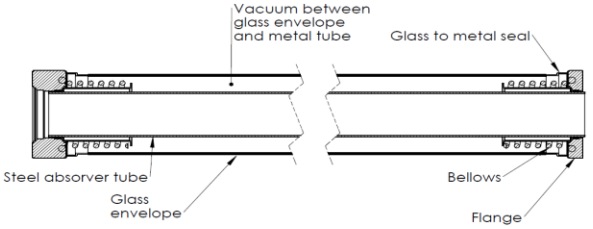

Image 2. Collector-receiver tube in CSP. [Source and image: Own elaboration].

4. Conclusions - Molten salts are also an option to use in HTF because they facilitate a decrease in plant costs, therefore, increasing the competitiveness. Fluids made with silicone such Syltherm 800 o malted salts are less environmentally damaging than organic oils. Related estimated errors, compared to the simulation done by Burkholder y Kutscher [3] are lower than 1%. Table 1.

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Reduction and modification of biofilms in seawater tubular heat exchanger subjected to EMF treatment

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1. Introduction – Seawater is an aqueous solution having large concentrations of ions and a high biological activity. The formation of organic and inorganic deposits that depend on biotic and abiotic factors inherent to the system is unavoidable when seawater is used in industrial heat exchange processes [3]. The formation of these deposits on surfaces used for heat exchange has well-known consequences on heat transfer efficiency [1]. This study evaluated the antifouling (AF) action of a continuous physical treatment process with electromagnetic fields (EMFs) applied to the seawater used as the refrigerant fluid in a heat exchanger-condenser. The aim was to minimise the biofilm adhesion on the internal tube surface and study the effect of EMF in composition and structures of the biofilms produced.

2. Experimental – The pilot plant used a tubular heat exchanger-condenser in a simple-step counter-flow configuration and tubular bundle comprised four independent tubes made of AISI 316Ti grade stainless steel. The cooling seawater flow rate of heat exchanger was fixed at 1 m s^{-1} within the tubes, having an average thermal increase of 5.1 ºC. The quantitative evolution of biofouling adhered to the internal surface of tubes walls in the heat exchanger was followed using direct measurements (thickness and composition of the biofouling film), which depended on the solid matter deposited on the internal surface tubes. The biofouling thickness was calculated as Trueba et al. 2016.

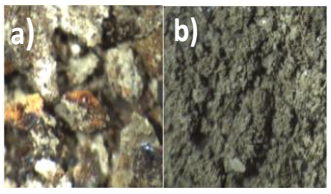

Figure 1. Samples of Microscope images of dried biofilms prepared for observation: a) untreated and b) treated samples.

3. Results and Discussion - According with in previous experiments [2], these results demonstrated that the hydraulic-thermal conditions in the untreated heat exchanger favour the formation of biofilm on the internal surface of the tubes. The application of the EMFs treatment demonstrated a 40% reduction of the biofilm thickness compared to the untreated control tubes. The presence of inorganic mater was reduced up to 87% due to the capacity of EMFs to precipitate mineral ions dissolved in water as mineral salt crystals, which avoid adherence to the tube surfaces [1]. In this sense, the capacity of the EMFs to precipitate ions dissolved in seawater was evidenced by the decrease of 4% in the water conductivity of effluent seawater treatment. Furthermore, the concentration of Ca^{2+} and Mg^{2+} in the seawater sample during the experimental period was decreased a 6% at the treated tubes compared to the untreated control tubes. This reduction of the ions dissolved caused a 60% reduction of $CaCO_3$ in the composition of the biofilm that it showed more loosely packed and non-compact structures that untreated samples (Figure 1).

4. Conclusions - The EMFs increases the mobility of ions dissolved in the seawater and increased the probability of collisions among them, thereby favouring their nucleation and precipitation as mineral salt crystals which are carried away by water flow. Consequently, the biofilm adhering to the internal surface of the treated tubes was thinner, lower concentration of $CaCO_3$ and less compact structure.

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Batch tests to access the efficiency of beetroot and orange molasses as sources of nutrients to sustain bioremediation processes for acid mine drainage

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1. Introduction - Water pollution is a threat and global concern. One activity that has left the water environment heavily polluted with wide impact is mining, which can result in the production of a sulphate and metals bearing acidic wastewater known as acid mine drainage (AMD). The search for efficient and economically viable methods for the treatment of AMD has been receiving attention from researchers over the last decades. A group of bacteria with the ability of reducing sulphate to sulphide, known as Sulphate Reducing Bacteria (SRB), has long been explored for microbiological mitigation of these sulphate and metals containing wastewaters. The objective of this work was to test molasses coming from beetroot sugar and orange juice processing industries as sources of nutrients to feed sulphate reducing bacteria (SRB) in the bioremediation of acid mine drainage (AMD) from São Domingos Mine in Portugal, aiming the achievement of water that accomplish the standard limits for irrigation stipulated in the Portuguese law.

2. Experimental - Batch experiments were carried out in triplicates at room temperature, in anaerobic conditions using 120mL glass bottles. Mixtures of AMD with pH previously adjusted to 7 plus molasses (beetroot or orange) and calcite tailings as buffering agent were inoculated with SRB. Cultures were protected from oxygenation by adding liquid paraffin and sealing the batch bottles with butyl rubber stoppers and aluminum crimp seals. The redox potential and the sulphide and sulphate ion concentrations were measured to evaluate the sulphate reduction activity. The pH was measured to monitor the effectiveness of the buffering agent in maintaining optimal conditions for SRB. Concentrations of metals (Cu and Zn) which remained above the limits for irrigation water after neutralizing the pH of tested AMD were monitored to evaluate removal efficiencies.

3. Results and Discussion - When each molasses (from beetroot or from orange) was added to AMD from Mina de São Domingos and inoculated with SRB, the pH remained neutral (6.4 or 6.8), the redox potential evolved from positive (263 or 267 mV) to negative values (-256 or -303 mV) and high percentages of sulphate reduction to sulphide (65 or 67 %) were observed throughout the experiment, suggesting growth and activity of these microorganisms. The concentrations of sulphate achieved values under the maximum recommended value (MRV) for irrigation waters (575 mg/L) after 3 weeks, while the monitored metals were removed to concentrations below their respective maximum MRVs (Cu: 0.2 mg/L; Zn: 2.0 mg/L) just in 1 week.

4. Conclusions – The two alternative low-cost by-products from food industries tested (molasses from beetroot and from orange) were confirmed in batch tests to be suitable sources of nutrients to feed SRB bioreactors aiming to convert AMD from Mina de São Domingos to water in legal compliance for irrigation, opening the way for further experiments with continuous flow systems.

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Occurrence of selected bacterial and protozoan species in treated wastewater used for irrigation of public parks in Dubai

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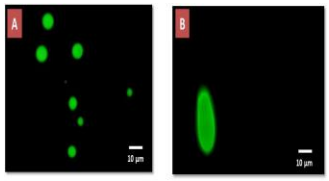
1. Introduction –

The supply of fresh water to satisfy the country's domestic, agricultural and industrial needs became one of the greatest challenges that face the UAE. Recycled water generated after wastewater treatment process plays an important role as a substitute for fresh water, saving the production of potable water, and contributing to the reduction of carbon footprint generated from the desalination process. In general, there are several categories of very well maintained public parks in Dubai, which are expanding due to extensive development and urbanization. These public parks use recycled wastewater for irrigation. Therefore, there is a risk of contamination of irrigated soil by various types of microbial pathogens. Therefore, investigating the microbial quality of irrigation water used in public parks is important to know whether the wastewater treatment methods used by the concerned municipalities are adequate to reduce the occurrence of microbial pathogens. This study aimed at investigating the microbial quality of the recycled wastewater used for irrigation of public parks in the emirate of Dubai, UAE. In particular, the presence of selected protozoan parasites such as Cryptosporidium, Giardia and bacterial species including Legionella, Pseudomonas and traditional fecal pollution indicator microorganisms such as total fecal coliform, total coliform, and heterotrophic bacteria were studied.



ure 1. Immunofluorescence image/s of yptosporidium oocysts labeled by fluorescent tibodies (A) bright apple green color viewed under e fluorescein filter, (B) Giardia cysts labeled by orescent antibodies.

2. Experimental - A total 96 samples of treated wastewater (TWW) and irrigated soils from four public parks were collected and tested for Legionella, Salmonella, traditional bacterial indicators using membrane filtration method. Immunofluorescence assay was used to detect Cryptosporidium oocyst and Giardia cysts.

3. Results and Discussion - The majority of the irrigated water samples were found contaminated with Legionella, Pseudomonas, and traditional bacterial indicators. Both Cryptosporidium oocysts and Giardia cysts were detected in these samples with a higher occurrence of Cryptosporidium oocysts (96%) than Giardia cysts (35%) (Figure1). The fecal coliform bacteria were detected in 60.8% of water samples and 58% of soil samples. Total coliform bacteria were detected in most of the water and soil samples with a higher occurrence than the fecal coliform bacteria.

4. Conclusions - The results of this study indicate that microorganisms are surviving, and further multiplying in the public parks irrigation network system. Therefore, monitoring the treated wastewater for bacterial pathogens, protozoan parasites and controlling their growth at the point of end use are vital to reducing the risk of environmental contamination with microbial pathogens.

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Scientific CV (optional)

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Usefulness of stevensite as adsorbent of antibiotics (tretracyclines)

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1. Introduction – Tetracyclines (TCs) are one of the most widely used classes of veterinary and human antibiotics. The conventional treatment of wastewater based on activated sludge is not completely efficient to remove antibiotics and their residues are still biologically active even at low concentrations. Therefore the implementation of advanced treatments to prevent the dispersion of antibiotics is necessary. The objective of this work was to evaluate the efficiency of stevensite to adsorb three tetracyclines from water.

2. Experimental – Adsorption isotherms of oxitetracycline (OxTC), tetracycline (TC) and chlortetracycline (ClTC) were performed at 25 ºC in darkness with N_2 atmosphere. To each 50 mL centrifuge tube, 0.1000 g of stevensite and 20 mL of TCs solutions were mixed on an orbital shaker at 150 rpm for 24h. The initial concentrations of the TCs were 50, 100, 200, 300, 400, 500, 600, 800 and 1000 mg L^{-1} in $NaNO_3$ 0.01 M pH 2.0. After equilibrium, the samples were centrifuged at 5000g for 10 min and the supernatant analysed by HPLC. Then, desorption experiments with $NaNO_3$ 0.01 M solution at pH 2 and 7.5 were performed sequentially under the same conditions describes above. The data obtained were fitted to Langmuir and Freundlich models.

An assay of TCs adsorption on continuous system was performed in pressurized glass columns (n=3) with 10g of stevensite mixed with 90 g of milled glass. The composition of the effluent was OxTC, TC and ClTC at 50 mg l^{-1} in $NaNO_3$ 0.05M pH 7.

3. Results and Discussion –Freundlich and Langmuir models (Table I) showed good and similar fit (R^2 > 0.97). Stevensite showed high TCs adsorption capacity. ClTC presented the highest affinity to stevensite with Q_{max} 140 mg g^{-1} followed by TC and OxTC (Q_{max} 126 and 127 mg g^{-1} respectively). The desorption was lower than 10% of adsorbed TCs for 72, 103 and 111 mg g^{-1} of OxTC, TC and ClTC, respectively, at pH 2. The percentages of TCs desorbed at pH 7 were below 9% for the three TCs at all concentrations tested. The desorption rate of TCs when the stevensite was close to saturation was higher than at low saturation rate. At low concentration the desorption process was low or negligible because re-adsorption phenomena. After the two desorption procedures the percentage of TCs that remain adsorbed

Table I. The fitting parameters of the Freundlich and Langmuir isotherms for OxTC, TC and ClTC adsorbed on stevensite.

	Freundlinch			Langmuir		
	K_F	n	R^2	K_L	Q_{max} (mg g^{-1})	R^2
OxTC	28.1	3.78	0.992	0.052	126	0.988
TC	40.2	4.65	0.987	0.112	127	0.986
ClTC	54.0	5.06	0.980	0.181	140	0.978

in stevensite were between 96-70, 99-74, 100-80% for OxTC, TC and ClTC respectively of initial adsorbed amount. The adsorption of TCs on continuous system reached 188, 319 and 505 mg of OxTC, TC and ClTC respectively. Total TCs adsorption was 101 mg g^{-1}. Therefore the removal rates of OxTC, TC and ClTC were 36, 43 and 55% of total amount of each antibiotic. The data confirm that ClTC was the compound which presented more affinity to stevensite followed by TC and finally OxTC.

4. Conclusions –. The results shows clearly the high capacity of **s**tevensite to adsorb TCs. The most retained compound is ClTC. This material is useful to remove high amount of TCs antibiotic from water.

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Removal of tretracyclines from water: degradation with laccase enzyme or adsorption on stevensite?

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1. Introduction – Tetracyclines (TCs) are one of the most widely used classes of veterinary and human antibiotics. There are multiple strategies to remove TCs from water such as microbial degradation, chemical oxidation or adsorption on clays, activated carbon or metal oxides. The use of ligninolytic enzymes to degrade organic pollutants is growing. However the use of free enzymes presents some problems such as the lack of stability and the requirement of enormous quantity of enzyme. The immobilization of ligninolytic enzymes solves these problems. Spent mushroom substrate is a good source of ligninolytic enzymes. The objective of this work was to assess the ability of free and immobilized laccase on stevensite to degrade three tetracyclines from water and to compare the results with the tetracycline adsorption on stevensite.

2. Experimental – Degradation of oxitetracycline (OxTC), tetracycline (TC) and chlortetracycline (ClTC) by commercial laccase from *Trametes versicolor* were determined during 7 days in solution (pH 4.5). The initial concentration of each compound was 25 mg L^{-1} and the activity of the enzyme was 800 U L^{-1}. Remaining TCs were analysed by HPLC and laccase activity by oxidation of ABTS.

Laccase extracted for spent *Pleurotus ostreatus* substrate and commercial laccase from *T. versicolor* was immobilized on stevensite as follows: 1g of stevensite was mixed with 25 mL of laccase solution (Na-acetate/acetic acid 50 mM pH 4.5) and shaken at 200 rpm for 2h in ice. Then was centrifuged and the pellet washed with above buffer. Adsorption and degradation of TCs were assessed on stevensite (S), stevensite with laccase immobilized (S+L) and S+L denaturalized by temperature (S+L+T). The results obtained were compared with TCs solution (Control). To each 50 mL centrifuge tube, 0.1000 g of stevensite (or S+L) and 20 mL of TCs solution were mixed on an orbital shaker at 150 rpm and 25 ^{o}C for 24h. The initial concentration of each TC was 500 mg L^{-1} in $NaNO_3$ 0.010 M. After interaction, the samples were centrifuged at 5000g for 10 min and the supernatant analysed by HPLC.

3. Results and Discussion –Free laccase was able to degrade OxTC, TC and ClTC. At 24h of interaction the degradation rates were 30, 44 and 82% respectively. These rates were incremented to 88, 93 and 100% for OxTC, TC and ClTC respectively, after 7 days of incubation. Therefore free laccase was able to degrade the three antibiotics tested. Stevensite was able to immobilize laccase and the enzyme remained active according to ABTS analysis. The thermic treatment denaturalized the laccase enzyme.

The adsorption of TCs on stevensite reached 46, 60 and 75% of total amount of OxTC, TC and ClTC, respectively. The removal of TCs on S+L was 17, 32 and 42% of OxTC, TC and ClTC, respectively for immobilized commercial laccase from *T. versicolor*. The denaturalization of the enzyme did not modify the removal rate of TCs (21, 36 and 46%). The same trend was found for the immobilized laccase from

spent *P. ostreatus* substrate. Therefore the removal of TCs by T+L treatments was only adsorption and not degradation was detected. The immobilization of laccase on stevensite probably produced steric impediment which impeded the oxidation of TCs by laccase. The adsorption of TCs on stevensite was more efficient than adsorption on S+L because the removal rate of S was higher than S+L.

4. Conclusions –. The ligninolytic enzyme laccase is able to degrade tetracyclines in solution. However the immobilization on stevensite by electrostatic bonds inhibits the ability of the enzyme to oxidize TCs. Therefore the strategy of simultaneous adsorption and degradation by laccase immobilized on stevensite is not effective. Stevensite demonstrates high potential to adsorb tetracyclines form water.

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Copper Removal by Modified Ceramic Membranes: Surface Modification, Characterization and Performance

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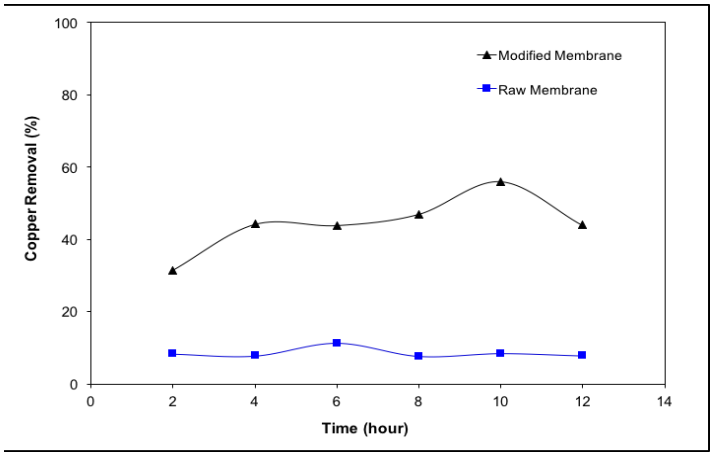
1. Introduction – Investigation of modified ceramic membranes for the copper removal was the main goal of the study. Ceramic membranes may be advantageous over polymeric ones due to their higher mechanical strength and resistance to harsh chemicals and extreme values of pH and temperature. However, relatively larger pore sizes of these membranes due to their synthesizing conditions and material may limit the sieving mechanism. Thus, molecular sieving mechanism has very little effect in removing some specific pollutants. It is well known that copper ions can easily pass through the membrane pores due to their smaller hydrated ionic radii. In this context ceramic membranes were modified for enhanced copper removal.

2. Experimental – A lab-scale, cross-flow ceramic membrane test unit was used in all experiments. Monochannel tubular ceramic membrane module was tested with molecular weight cut-off (MWCO) value of 10 kDa (Filtanium™, TAMI Industries, France). Simply, ceramic membrane module was modified with silica and then coated with amino groups. The tested membrane operating pressures were 1, 2 and 3 bar. Three different copper concentrations were tested: 6.5, 64 and 128 mg/L. The tested feed water pH values were 4.0 and 7.0. Modified membranes were characterized by SEM-EDX, membrane surface charge, XRD, FTIR, and contact angle measurement.

Figure 1. Copper removals of raw and modified membranes (membrane pressure: 1 bar, feed conc.: 6.5 mg/L Cu).



3. Results and Discussion - Figure 1 shows the copper removals obtained by modified and raw ceramic membrane. Enhanced removals were observed with modified membrane. While maximum 10% copper removal was achieved with the raw membrane, 48% copper removal in average was obtained with modified ceramic membrane at the same operating conditions. In addition to pore size exclusion effect, the main mechanism of copper removal was the adsorption of copper ions on modified membrane surface.

4. Conclusions – These results indicated that the membrane modification achieved enhanced copper removals as expected. Silica coating of the membrane might reduce the pore sizes on ceramic membranes, which may contribute the copper removal by size exclusion mechanism. Besides, second coating layer (amino groups) on silica layers may enhance the copper removal via adsorption. These modified membranes can be used effectively in reducing the copper pollution of waters. Also, used

membranes can easily be regenerated with various chemicals without any membrane degradation. Long-term membrane tests should be conducted in terms of membrane flux and removal trends.

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Isolation of wild strains of Clostridium sp. for biobutanol production with fruit processing wastes as low-cost substrates

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1. Introduction – Nowadays, the high dependency of fossil fuels is an important issue and biofuels production would be an alternative to overcome this non-sustainable situation. On the other hand, by-products generation from food industry represents an interesting source of biomass for biofuel production. Every year, thousands of tons of solid waste are generated by agro-industries situated in Maule region of central Chile.–Current challenges for the research going to towards biotechnology development in order to produce biofuels from agro-industrial residues. Biobutanol has properties similar to gasoline; with several advantages: less miscible in water, less corrosive and, poses a higher energetic content than bioethanol. These characteristics allow enhancing the mixture with gasoline in relation to that made with ethanol [1].

Biofuels such as biobutanol are produced naturally by the Clostridium bacterial gender. Biobutanol can be obtained through ABE fermentation (Acetone, Butanol and Ethanol) [2]. This fermentation process is one of the main biochemical processes having found an industrial application [3-4]. The abovementioned process has caused an interest in enhancing biobutanol production at industrial scale as well as in developing new technologies that allow an increase in yield. In order to achieve this challenge it is necessary to use fermentable substrates, that do not compete with those used for human feeding [5], along with the search for new wild type Clostridium strains, allowing a higher biobutanol production.

2. Methodology – In this study, five different bacterial strains corresponding to Clostridium sp. were isolated from natural samples and livestock manure. These samples were dried at 37°C for 1 week and then sieved at 300 µm. An aliquot of each sample was seeded with a selective medium for Clostridium in petri dishes. These assays were made with both synthetic medium P2 and liquid cherry waste from an agro-industrial facility. For both mediums pH was adjusted to 6.0 and batch reactors were incubated for 7 days under anoxic conditions. Aliquots were collected at 0, 1, 2, 3, 4, 5, 6 and 7 days. The total DNA extracted from Clostridium samples was used for PCR analysis with the following primers; 8F 5'-AGA GTT TGA TCC TGG CTC AG-3 '(Forward) and 519R 5' TTA CCG CGG CKG -GWA CTG- 3 '(Reverse), as these primers are specific to bacteria, a 529bp fragment was obtained and thus to molecularly identify the biobutanol-producer bacteria. Samples from incubated batch reactors were analysed by GC-FID to determine the butanol content and intermediates.

3. Results and Discussion – All isolated Clostridium strains were able to produce biobutanol with different yield. The experimental biobutanol production was higher when synthetic medium was utilized reaching around 60 mg/L after 96 hours. Biobutanol concentration with cherry waste as substrate reached around 30 mg/L after 168 hours. Theoretical biobutanol production were compared and the higher biobutanol production was obtained using cherry waste (3200 mg/L after 168 hours), being almost fivefold the value obtained with synthetic medium (700 mg/L after 168 hours).

4. Conclusions – Aforementioned results lead to obtain new wild type strains able to produce biobutanol with agro-industrial waste as substrate and more research is necessary in order to improve the obtained yield from ABE fermentation products.

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Brief Scientific CV

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- Master in Microbiology, Universidad de Talca, Talca, chile. Diversidad Genética de bacterias del Orden Actinomycetales con potencial para la producción de biodisel: primeros pasos hacia el uso de fuentes bioenergéticas más saludables.

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- Fortalecimiento del capital social en PYMES agroindustriales para fomentar la recuperación y producción de compuestos de alto valor a partir de residuos hortofrutícolas 2015.
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Industrial wastewater treatment by radical-based advanced oxidation technologies: Fenton treatment versus ferrous ion-activated persulfate process

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1. Introduction – The application of advanced oxidation technologies (AOTs), chemical treatment methods involving the generation of hydroxyl radicals ($HO^{\bullet}$), proved a viable solution for the decomposition of nearly all persistent organic pollutants presented in different aqueous matrices. Among different $HO^{\bullet}$-based AOTs, the Fenton treatment (H_2O_2/Fe^{2+}) is widely studied and used technique for effective organic load and micropollutants destruction in real industrial effluents. Recently, the innovative sulfate radical ($SO_4^{\bullet-}$) based treatment technology has been studied as an alternative to conventional $HO^{\bullet}$-based AOTs both for water and wastewater treatment. The $SO_4^{\bullet-}$ are usually generated from persulfate ($S_2O_8^{2-}$) by heat, UVC irradiation or ultrasound activation, transition metal activation, alkaline activation, and peroxide activation. Among different transition metals used in $S_2O_8^{2-}$ activation, Fe^{2+} is the most frequently applied metal. Therefore, the main objective of this study was to evaluate and compare the potential of the Fenton treatment and $S_2O_8^{2-}/Fe^{2+}$ process in organic load and selected target compounds removal from three different high-strength industrial wastewater samples.

2. Experimental – The studied wastewater samples were comprised of: i) effluent 1 (E1) – a paint manufacturing wastewater obtained from a plant manufacturing multicolor water-based paints, ii) effluent 2 (E2) – a phenolic wastewater obtained from an oil shale thermal treatment plant, and iii) effluent 3 (E3) – a mature municipal landfill leachate. The coagulation with ferric sulfate was done in a jar test apparatus. All of the H_2O_2/Fe^{2+} and $S_2O_8^{2-}/Fe^{2+}$ oxidation trials were performed in batch mode and in non-buffered solutions at ambient room temperature (21±1 °C).

3. Results and Discussion – The ferric coagulation proved a practical technique to pre-treat E1, and as a result to reduce considerably the amount of oxidant required in the subsequent oxidation step. The optimized Fenton treatment was the most effective E1 post-treatment technique and resulted in substantial COD and DOC removal as well as in considerable the BOD_7/COD ratio increase. Accordingly, the residual COD and DOC after the application of combined pre-coagulation and Fenton treatment was 0.5% and 3.5%, respectively. In contrast, the residual COD and DOC after the combined pre-coagulation and $S_2O_8^{2-}/Fe^{2+}$ treatment of E1 was 2% and 11%, respectively. In the case of E2 and E3, the Fenton process also demonstrated a higher treatment efficacy than the Fe^{2+}-activated persulfate system. Conversely, the Fenton process was characterized by a temperature increase and excessive foam formation. Notably, the removal of phenolic micropollutants was near to 90% and more in all Fe^{2+}-activated persulfate and hydrogen peroxide trials. As a result, the persulfate proved to be a feasible

alternative oxidant due to the reasonable treatment conditions and sustainable treatment of the studied industrial effluents.

4. Conclusions – This study demonstrates that both the H_2O_2/Fe^{2+} and $S_2O_8^{2-}/Fe^{2+}$ are promising treatment techniques for the reduction of organic load and destruction of persistent organic pollutants in highly contaminated industrial effluents and provides valuable information for the potential practical full-scale application of these technologies.

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Synthesis and Characterization of two different Poly aspartate-montmorillonite nanocopmosites and their efficiency toward the adsorption methyl blue from aqueous solution: A Comparative Study

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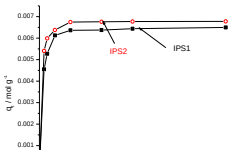
1. Introduction – With increasing global population, the gap between fresh water supplies and demands is widening to the extent that wastewater and other secondary water resources should be utilized, especially in Arabic countries. Wastewater is widely contaminated by recalcitrant organic chemicals such as pesticides, herbicides, dyes, phenols, and hormones. In recent years, adsorption technique has gained favor due to proven efficiency in the removal of pollutants from effluents to stable forms for the above conventional treatment methods. In this work surface modification of Na-montmorillonite (Na^+-Mt) cheap mineral clay using hydrophilic biodegradable polymers non-biodegradablepolymers such as poly(acrylic acid) was deve



The influence of contact time on the adsorption of MB onto IPS1 and IPS2. $[MB]_0 = 3 \times 10^{-3}$, $[IPS1]_0$and $[IPS2]_0 = 2$ g/L at 25ºC and pH = 2.5.

2. Experimental - For this aim, polyelectrolyte containing quaternary nitrogen in the main chain (termed as polyionenes) was prepared. The well characterized ionene polymers were reacted in two fold excess with sodium montmorillonite (Na^+-Mt). The produced ionene-clay nanocomposites were further modified by reaction with negatively charged polyelectrolyte: sodium poly (succinimide-*co*-aspartate). The two modified clay-polymer nanocomposites are named ***IPS1 and IPS2***. The chemical structures of the native and modified Na^+-Mt were characterized by X-ray diffraction, FT-IR, SEM, TGA, and The Brunauere Emmette Teller (BET) surface analyzer. The adsorption behaviors of methyl blue (MB) on Na^+-Mt, and the two polyaspartate-conjugated montmorillonite were compared.

3. Results and Discussion - The results demonstrated that the modified Na^+-Mt (IPS2) nanocomposite showed the highest adsorption capacity toward MB, the adsorption process on both IPS1and IPS2 was spontaneous, and the adsorption capacity of MB was increased with temperature increasing. The equilibrium time of 20 min toward MB adsorption and the adsorption process followed the pseudo-second-order model. Furthermore, the adsorption

isotherm of MB on the IPS1 and IPS2 has been investigated at 25, 30 and 35 °C and the data were in good agreement with the Langmuir isotherm model. The thermodynamic parameters show that, Gibbs free energy ΔG_{ads} has negative values at different temperatures indicate the spontaneous nature of the adsorption process. The calculated enthalpy ΔH_{ads} has positive values for both surfaces, which indicates the adsorption process is endothermic. The positive value of entropy, ΔS_{ads} refers to the increasing randomness at the solid/solution interface through the adsorption process.

4. Conclusions - The surface modification of Na^+-Mt with polyaspartate will markedly improve the removal of methyl blue (anionic dye) from aqueous solution which is not adsorbed on native Na^+-Mt.

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Spent drilling fluids utilization in soil fertility enrichment composition

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1. Introduction - The main objective of the work was development a technology for manufacturing the composition - soil fertility enrichment agent - based on waste streams produced within shale gas exploitation technology. The main waste stream is drilling fluid, which is treated as mining waste. According to [1] it can be subjected to a recovery or disposal. The increasing demand for gas and the depletion of conventional gas has increased the interest in unconventional gas deposits. In case of significant influence shale gas exploitation technology on environmental condition and scale of investment there is a need for comprehensive approach to the problem, taking into account all components of environment, specially soil and groundwater.

2. Experimental - Wastes from many branches were used as the components to manufacture an agent to enrich soil fertility. There spent drilling fluids, sewage sludge, biomass' ash were used. Phys-chem. properties of wastes were evaluated, to calculate fertile ability, as well as to fulfil UE legal requirements in environment protection aspects. Developed technology consists of few steps as follow; importation and storage of wastes and additional sources, pretreatment of spent drilling fluids to accelerate sedimentation process, mixing fluids with sulfuric acid, to lower the pH to approx. 5, ferrous sulfate and a coagulant to coagulate the particles and sedimentation, dehydration on filter press, dosing and mixing the raw materials in the mixer, intensive mixing of the components fed in appropriate proportions (sludge from a biological sewage treatment plant, cuttings, dehydrated drilling fluid and lime, ash and biomass) and final granulation.

3. Results and Discussion - Unit operations used in proposed technology were adjusted to actual conditions in order to obtain aconomic and ecological adventages. The filtration process allows to obtain a sludge stream containing approx. 30-35% water. The clear filtrate may be used to prepare sealing-fluid used in drilling technology (water circulation).
The resulting product of the projected composition meets the requirements of measures for improving soil properties. An exemplary composition of the resulting composite is shown in Table I.

Table I. Characteristic of soil fertility enrichement agent

compound	**%, m/m**
CaO	12,0
P_2O_5	1,2
K_2O	7,0
N	> 1,0
pH	8

4. Conclusions - Preparation, production and evaluation of the quality of the final product allow to conclude that described technology has the potential to launch on the market agents whose exhibit properties such as soil conditioners. What is more mining wastes are recovered as valuable streams and can be used in soil remediation techniques. The results of the leaching tests indicates that the tested waste streams pose no threat to the environment in terms of susceptibility to leaching ingredients such as chlorides, sulfates, sodium, potassium, heavy metals etc., that are limited by acts. They can therefore be discharged into the soil-water environment. The research was co-financed by The National Centre for Research and Development of Poland

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Removal of anionic dye eosin Y from aqueous solution using *Saccharomyces cerevisiae* biomasse

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Abstract

The potential use of *Saccharomyces cerevisiae* biomasse for removal of eosin from aqueous solution was investigated in a batch system. The eosin binding capacity of biosorbent was shown as a function of initial eosin concentration in the range of 50–100 mg l^{-1} and temperature of 20, 30 and 40°C. UV/Visible spectrophotometer is used as a method of analysis of eosin. Maximum sorption was observed at the initial pH value of 7.5 and at 30^{o}C, and the equilibrium uptake increased with increasing initial eosin concentration for the biosorbent. The percentage removal of eosin was determined as 85% for *Saccharomyces cerevisiae* biomasse at these conditions. The results showed that eosin uptake processes followed the second-order rate expression for *Saccharomyces cerevisiae* biomasse.

Key-words: Biosorption, Eosine, *Saccharomyces cerevisiae*, Static adsorption

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Sustaianble Management of Water Softening Plant Residuals

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1. Introduction: The effective management and disposal of water treatment plant residuals is receiving increasing scrutiny worldwide at present due to the more stringent regulations that have been enacted on the disposal of these waste materials (Roth et al, 2008; Walsh et al, 2008). The addition of chemicals to remove turbidity and TOC through coagulation, and filtration processes results in the production of sludges in the range of 120 to 539 pounds per million gallons (lbs/MG) of water treated. However, by far the largest amount of solids are produced during water softening operations (1,278 to 3,151 lbs/MG). A large number of water treatment plants throughout the world use lime-soda softening to bring calcium and magnesium to acceptable levels in community water supplies. These facilities produce substantial amounts of residuals containing calcium carbonate, magnesium hydroxide, unreacted lime, suspended solids and coagulant precipitates. The direct discharge of water treatment residuals to watercourses is prohibited at present. Storage in lagoons and land application are two options that are available to many of the smaller communities. For larger facilities, the option of mechanical dewatering and recalcination to calcium oxide is available. However, very few facilities utilize this option due to the complexity of the process, and the high energy costs involved in the operation of such systems. The cost of lagooning is increasing as land costs increase, and communities have to transport the residuals to sites located at considerable distances from the treatment plant. This paper will examine the potential use of water softening sludges in the production of deicing chemicals, calcium magnesium acetate (CMA) and propionate (CMP) for the control of snow and ice problems on roads, highways, and airport runways in winter. CMA is currently produced by reacting synthetic acetic acid with limestone and has a 3:7 Ca:Mg molar ratio. The use of water treatment plant waste materials in the production of a value-added product will provide a cost-effective and sustainable method for the management of water plant residuals.

2. Experimental: Experimental studies were conducted on the determination of freezing point depression and ice melting rates using CMA and CMP deicers produced using water softening plant sludges. The sludge after vacuum filtration to 40% solids contained 0.3 equivalent (eq) of OH^- per kg of sludge, and 7.9 eq of CO_3^{2-} per kg of sludge. CMA and CMP were prepared by reacting 200 g of filter cake to 96 g of acetic acid and 118 g of propionic acid. Freezing point depression studies were also conducted using CMA and CMP produced with Ca:Mg molar ratio of 3:7, and the results were compared with that of sludge-CMA (S-CMA) and S-CMP. Ice melting and ice penetration depth data were also developed.

3. Results and Conclusions: A theoretical model was used to predict the freezing point depression values for various concentrations of CMA and CMP deicers. The model equations involving osmotic coefficients and activity coefficients of mono and di-valent ions will be presented. The theoretical model

predictions for salt weight fractions up to 0.4, and temperatures up to – 15° C closely match the experimental data. The performance of S-CMA and CMA were evaluated in terms of ice melting rates and ice penetration depths. Even though the CMA produced using water softening sludge contained mainly calcium and very little magnesium, the S-CMA performed very favourably compared to CMA, indicating that S-CMA can be applied in the field for ice and snow control.

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International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

Experimental Investigation of Different Formation Waters and Injection Water Incompatibility to Obtain the Optimum Water Mixing Ratio in Re-Injection Process

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1. Introduction – Water injection is a widely used method during improve oil recovery stage as it is more cost-sufficient and simple compared to other available enhanced oil recovery (EOR) methods, as well as to dispose of unwanted produced water from oil and gas wells in an environmentally responsible fashion. Water quality and compatibility plays an important role in determining the effectiveness of the water injection. Produced water can be the result of a mixture of the waters originally present at the petroleum reservoir and different layers, which can be classier as connate water (or formation water), saturation water in the reservoir fluid, aquifer water and injected water [1]. Typical injection water may contain one or more of these source constituents, blended together in a variety of possible ratios (blend mixtures) over the life of the water injection were effected [2].

The seawater as injection water is rich in sulphate and carbonate, while the formation water usually contains significant amounts of precipitating cation such as barium, strontium and calcium. Therefore, mixing them may cause to form scales in oil reservoir. Thermodynamic changes as pressure and temperature can be other reason for scale formation. Mixing of different water types may however cause precipitations in the reservoir or in production wells and equipment.

2. Experimental - Experimental methods namely; the AAS, XRD and SEM were used to identify the minerals and the composition of the water: For the AAS method, the samples were analyzed by aspirating through the nebulizer using the atomic absorption spectrophotometer. The numbers of water samples were four samples as the name of F, U, L and K (Karoon River).

3. Results and Discussion – In this research water samples analyse for investigation of composition and scaling potential. Waters Compositions of produced water of different reservoir layer and Karoon River was determinate and investigated. The scale filtered samples were examined by SEM and XRD to observe the particle size and morphology of the precipitates. The formations of CaSO4, SrSO4 and BaSO4 were detected during transition of waters to the surface were observed by SEM micrographs. Morphology of BaSO4, CaSO4 and SrSO4 formed in the filtered paper was compared by XRD. XRD analysis of the membranes showed barium sulfate scale for U sample and L water samples while F sample is not detected because of amorphous structure. Since XRD detects crystalline structures.EDX is performed on scales seen by SEM pictures to determine the types of scales present on the filters. SEM and EDX results are given below. Figure 2 show the SEM and EDX image of typical scaling crystals in filtered precipitated from produced water. Change in Ca, Sr and Ba contents with time can be observed in some of mixing. The common types of scale found of mixing different value are classified into two types-carbonate scale and sulfate.

4. Conclusions - The obtained results indicated that water incompatibility is between formation water and Karoon river water. The SEM and XRD analysis confirmed presence of scales based on sulphate and carbonate at different ratio mixing. The optimum mixing ratio in this regard can be used for further study and even in field application to experience less severe scale precipitation problem as well as taking preventative measures knowing the type of scales. Regarding the results procedure one can assure the type of scale and maintain the optimum mixing ratio for the water mixing where needed.

Table 1: XRD analysis of scales (suspended solids) existing within initial water samples

Samples	Method	Result
F	XRD	Identified compounds: Amorphous samples
L		$BaSO_4$ Barite
U		$BaSO_4$ Barite

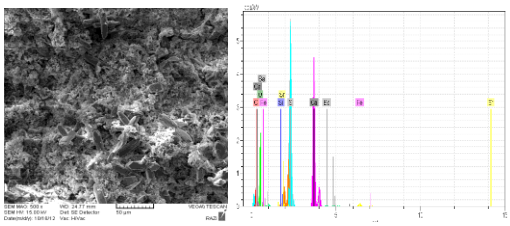

Figure 2: (a) SEM of F produced water filtrate (b) Spectrum of elemental analysis of precipitated F produced water

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Saeed Abbasi obtained his B.S. degree in Chemical Engineering from Iranian University of Technology, Iran (IUT) in 2000 and his M.S. degree in Petroleum Engineering from Petroleum University of Technology (PUT) in 2003. Currently, he is project manager at EOR studies center of Research Institute of Petroleum Industry related to NIOC (National Iranian Oil Company) and his interested fields are EOR research, Water Management in Oil fields, Smart Water, Gas Injection, Water alternative Gas injection, formation damage especially by water injection process. Also Saeed Abbasi was employed by OIEC Group in OEID branch as an engineer in reservoir engineering section and reservoir studies. He has investigated on different problems and phenomena in Water Management in oil fields as formation damage or permeability reduction in water and gas injection in reservoirs.

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Elimination of whey proteins by electrocoagulation: Investigation of some key operational parameters and modeling

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1. Introduction – the disposal of whey produced during cheese production has always been a major problem because of organic material in the dairy industry [1]. Dairy wastewaters are generally treated using biological methods, such as activated sludge process, aerated lagoons, aerobic bioreactor, trickling filters, sequencing batch reactor (SBR), upflow anaerobic sludge blanket (UASB) reactor, upflow anaerobic filters and biocoagulation. In this study, the objective is to investigate the elimination of whey proteins (components of organic matter in dairy wastewater) from water by electrocoagulation (EC) in the batch mode using aluminum electrodes.

2. Experimental – EC using planar aluminium electrodes was carried out in a 4-L cylindrical tank, and agitation was performed using a Rushton turbine at a constant speed of 240 rpm. EC was conducted in the galvanostatic mode using a 30 V-10 A power supply (ELC, France), while the cell voltage (U) was recorded in order to derive the electric power input. During EC, samples were taken out at different time intervals and filtered by 0.45 µm filters (Macherey-Nagel GmbH, Germany); the filtrates were then used for subsequent chemical analysis.

3. Results and Discussion – Results showed that the best (100%) and fastest removal of whey proteins was observed at pHi 4, current 4.5 A, and electrolyte concentration of 6.25 g/L. The mechanism responsible for whey proteins elimination was found to be adsorption onto the flocs. This was enhanced on flocs formed during EC than on preformed flocs. Adsorption behavior of whey proteins in our case seems to be best fitted by Langmuir adsorption model (Figure 1). Experiments also showed that EC cost increased with increasing pHi, current and electrolyte concentration. A robust predictive model based on mass balance equations, Faraday's law and Langmuir isotherm was also established to describe protein removal using EC; this is not only able to fit experimental data, but it is also promising for other applications involving EC process.

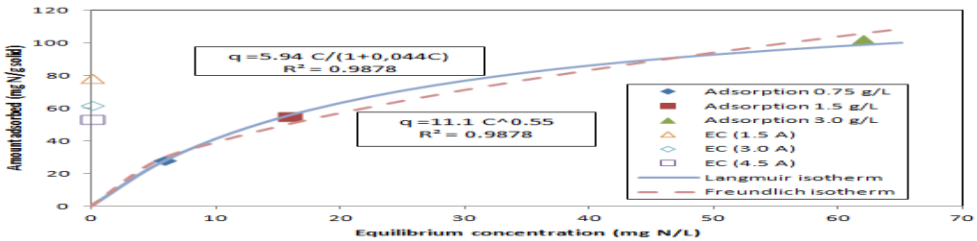

Figure 1: Isotherms of whey proteins adsorption on preformed flocs at different initial concentrations without EC (filled symbols) and on flocs being formed during EC using a volume of water V=1 L to standardize with adsorption experiments at different current (empty symbols). q is the amount of proteins adsorbed by the adsorbent (solid phase).

4. Conclusions – Our experiments demonstrate that EC is a promising technology for the elimination of whey proteins from dairy effluents.

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Separation of volatile fatty acids and simultaneous treatment of digestate wastewater by electrocoagulation

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1. Introduction – Acidogenic fermentation and anaerobic digestion of organic wastes are promising alternative technologies for volatile fatty acids (VFA) production. However, one of the major challenges is the development of sustainable downstream technologies for VFA recovery. The aim of this study was to investigate - for the first time the use of electrocoagulation (EC) in batch mode with aluminium or iron electrodes - the possibility of treating the wastewater (digestate) issued from the anaerobic fermentation of glucose, while at the same time separating the VFA from the other components of the digestate. The respective influences of electrode material, charge loading, stirring speed, initial pH (pH_i) and inter-electrode distance on the efficiency of the process were investigated.

2. Experimental - Electrocoagulation using planar aluminium or iron electrodes (4×6.5 cm) was carried out in a 500 mL cylindrical tank. EC was conducted in the galvanostatic mode using a 30 V-10 A power supply (ELC, France), while the cell voltage (U) was recorded in order to derive the electric power input. Samples were taken every ten minutes for further analyses.

3. Results and Discussion - Results showed that VFA were 100% found in the liquid phase at the end of EC. Figure 1 shows this behavior under the influence of charge loading. Our results also showed that EC was efficient in removing the pollution parameters (TSS, Turbidity) and nutrient parameters (TN, TP), but was less efficient in removing COD (as EC did not remove VFA). The highest efficiency of removal involved the use of aluminium electrodes with charge loading of 90 C (Figure 1), at pH_i 4 and inter-electrode distance of 1 cm. Stirring speed did not have any influence on removal efficiency.

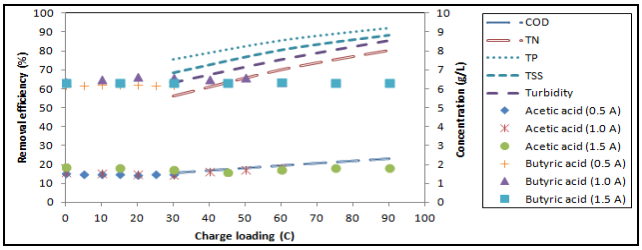

Figure 2: Influence of charge loading on the concentration (g/L) of the main VFA (Acetic and Butyric acid) and on the removal efficiency (%) of COD, TN, TP, TSS and Turbidity during EC.

4. Conclusions - EC seems to be an efficient method for the separation of VFA from digestate wastewater while simultaneously treating this wastewater.

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Pyrite dissolution through galvanic oxidation: Effect of HRT on galvanic cell performance

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1. Introduction – Mining waste (i.e., mine tailing) containing various heavy metals such as As, Cu, Pb, Zn, and Cd can generate acid mine drainage when left untreated [1]. Galvanic cells can be used to treat mining waste as metal sulphide like pyrite can be dissolved via galvanic oxidation. During pyrite dissolution in the galvanic cell, electricity can be generated at the same time. However, the build-up of dissolved ions in the galvanic cell operated in a batch mode can prevent continuous operation of the cells, and this can be overcome by using a continuous-flow mode. Therefore, this study investigates the effect of different hydraulic retention times (HRT) on the electrical performance of the galvanic cells.

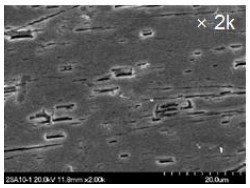

Image 1. Pyrite surface observed using SEM on the 30th day

2. Experimental – Galvanic cell consisted of an anode for pyrite (150-250 μm) oxidation, a cathode for air reduction, and a proton exchange membrane dividing the anode and cathode compartments. Galvanic cells with three different HRT (1, 7, and 30 d) were operated for 30 d. The current density vs. voltage curve and the current density vs. power density curve were plotted every week to check the electrical performance of the galvanic cell. Total dissolved Fe and SO_4^{2-} ions were measured to determine pyrite dissolution.

3. Results and Discussion – Linear cracks were observed after pyrite dissolution (Image 1). At 30 d HRT, the current density vs. voltage and current density vs. power density curves showed that the electrical performance of the galvanic cell decreased with time (Image 2). The initial maximum power density of the cell (0.0003 mW/cm^2) decreased to 0.0002 mW/cm^2 after 9 d and to 0.0001 mW/cm^2 after 16 d. The electrical performance of the galvanic cells at 1 d or 7 d HRT

is expected to be maintained at the initial high level as the dissolved ion concentrations will remain low.

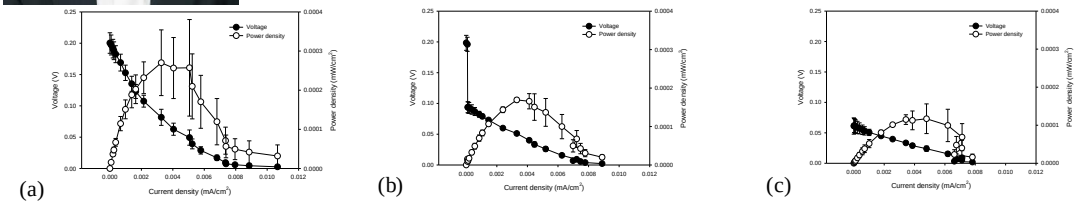

Image 2. Decrease in the galvanic cell performance operated in a batch mode (HRT of 30 d): Current density-Voltage, Current density-Power density curves plotted on the (a) Day 0, (b) Day 9, and (c) Day 16.

4. Conclusions – The study shows that when pyrite containing mining wastes are treated using galvanic cells, the electrical performance of the galvanic cells can be optimized by operating the cells in a continuous-flow mode.

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Scientific CV (optional)

Eun Hea Jho is an assistant professor in the Department of Environmental Science of Hankuk University of Foreign Studies in South Korea. She obtained her Ph.D. in Civil Engineering at the University of Auckland. Her research interests are on development of beneficial reuses of environmental wastes, toxicity and risk assessment of contaminants and contaminated environmental media, and developing remedial techniques for contaminated environmental media.

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Sensorless water flow control of DFIM-solar photovoltaic pumping system

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Abstract: The paper deals with the problem of autonomous photovoltaic water pumping installation in a rural area. Solar water pumping is based on photovoltaic (PV) technology that converts solar energy into electrical energy to run a doubly fed induction motor (DFIM) based water pump. Solar energy is an uncertain fluctuating resource which requires a tight control management. So, it is still an exigent task for the control design engineers. A sensorless control for a DFIM based solar energy conversion system is presented. The nonlinear behaviour of the PV array characteristic raises interest towards the power control in order to maximise the extracted power from the PV array system. The control objective is twofold: (a) seek the maximum power point (MPPT) using perturb and observe algorithm; (b) regulate the pumped water flow by performing a rotor speed controller (proportional-integral technique). To reach the second objective, a high gain state observer (soft sensor) is developed to estimate the rotor speed and load torque. The performances of the proposed observer are analysed using lyapunov stability approach. Despite the rapid change in the measured climatic parameters (solar radiation and ambient temperature), the proposed controller strategy shows a good dynamic performance. Hence, it is simulated and successfully tested on a detailed model of the installation.

Keywords: Solar energy; Photovoltaic; Solar water pumping; Irrigation; State observer; MPPT; Lyapunov approach; DFIM.

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Electrochemical water remediation using electro-Fenton method

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1. Introduction – Pesticides have become a pervasive problem for the environment owing to their widespread utilization. Sources of pesticide pollution are mainly wastewaters from agricultural industries and pesticide formulating or manufacturing plants. Recently, advanced oxidation processes (AOPs) based on in situ production of a strong oxidant, mostly the hydroxyl radical (•OH), are considered as promising powerful methods for removal of persistent organic pollutants (POPs) from water [1]. The electro-Fenton process is belonging to AOPs and consist of electrochemical assisted Fenton's reagent in which H_2O_2 electrogenerated quickly from the two-electron reduction of dissolved oxygen gas at carbon-felt cathode reacts with electrochemically regenerated Fe^{2+} ions in the medium leading to the formation of hydroxyl radicals (•OH) from Fenton's reaction:

$$Fe^{2+} + H_2O_2 \rightarrow Fe^{3+} + OH^- + {}^{\bullet}OH$$

The •OHs thus generated react with POPs leading to their oxidative degradation and total mineralization [2].

We have described here the degradation of carbaryl, the second most frequently found insecticide in water, in aqueous medium, by electro-Fenton process using Pt or boron-doped diamond (BDD) anodes coupled with a carbon-felt cathode. According to the EPA-US, carbaryl is the second most frequently found insecticide in water [3]. Therefore, removal of carbaryl from environmental waters is of great importance.

2. Experimental – Carbon felt was used as the cathode material and platinum (Pt) and boron-doped diamond (BDD) electrodes were compared as the anode material. Kinetics of degradation and mineralization were followed by high performance liquid chromatography (HPLC) analyses and total organic carbon (TOC) measurements during treatment of carbaryl solutions. The formed intermediates were detected by HPLC, GC–MS and ion chromatography methods.

3. Results and Discussion – Kinetic studies revealed that the reaction between carbaryl and •OH followed a pseudo-first order kinetics with an absolute rate constant of 4.60×10^9 M^{-1} s^{-1}. Mineralization of the pesticide solutions were monitored using total organic carbon (TOC) analysis. Under optimum conditions, almost mineralization (over 90% TOC removal) of the

solution was obtained at 2 h treatment when BDD electrode was used as anode. Degradation products such as aromatic intermediates were identified using GC-MS, short chain carboxylic acids and inorganic ions were recognized and quantified using chromatography techniques. Based on these data, a plausible mineralization pathway was proposed.

4. Conclusions – Electro-Fenton process was successfully applied for the removal of carbaryl in aqueous medium. Along with the use of carbon felt as the cathode material, use of Pt and BDD anodes were compared for the effective degradation and mineralization of carbaryl and the evolved oxidation by-products. It was concluded that mineralization of the carbaryl solutions was achieved more effectively on BDD anode with respect to Pt one.

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Eliminiation of Enivronmental Impact of the Old Copper Lefke-Gemikonagi Copper Plant Tailings Using Copper Cementation Process

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1. Introduction

The environmental problems encountered in the Gemikonagi region of Lefke, Northern Cyprus were resulted from the tailings dam of an old copper flotation plant. In order to eliminate the negative effects of these tailings in terms of economic aspects, copper cementation process following water leaching was investigated in this study.

In between the metal gaining processes, cementation is one of the most effective and economic method applied successfully. Relative simplicity, ease of control, and low energy consumption can be counted as the advantages of this technique [1,2,3,4]. This process is based on the chemical reduction of metal ions in a solution by galvanic interaction between noble metal ions and a more active metal [1,4].

2. Experimental

The chemical analyses of the sample were carried out using Inductively Coupled Plasma (ICP). According to the analyses, copper content of the sample was determined as 0.38%. In addition to this, 22.25% Fe, 500 g/t Zn, 283 g/t Co, 96 g/t Pb, 26 g/t Ni, and 0.59 g/t Au existed in the sample.

Cementation process was carried out using the "stair system". This system was thought to be applicable in an industrial operation. While the scrap iron was kept immobile, the PLS was recycled using an acid resistant pump at the desired flow rate

3. Results and Discussion

The leaching conditions were optimized as 30% solids ratio and 30 min duration using water. In the tests with the stair system, above 85% Cu content could be achieved for the pH ranges 2.00-2.15 and 2.30-2.45. However, nearly 5% higher cementation was obtained with 2.30-2.45 pH range. The role of lower pH value than 2.5 can be explained as to prevent iron precipitation and

provide iron to remain in the PLS, as well. On the other side, the pH should not be too acidic either, since it hindered the cementation process.

4. Conclusions

The tailings of the old copper plant have remained idle in many years and caused environmental pollution, which affected both the Mediterranean Sea and the island. By means of this study, producing economic value from these tailings in the case of emptying the dams was presented.

In conclusion, 87.35% Cu content with 98.7% cementation was achieved at 1.67 L/min flow rate and pH range 2.30-2.45 for 180 min using the stair system.

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From organic waste to organic fertilizer

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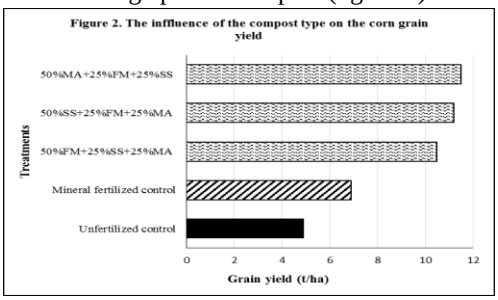
1. Introduction. Different kinds of composts prepared from wastes could be very useful for soil fertilization. In this context, a compost consists of three wastes: farmyard manure, sewage sludge from a wastewater treatment plant and marine algae has been achieved. Besides farmyard manure, for the other two wastes wasn`t found a proper way to recycle, although they contain a wide range of nutrients necessary for the plant nutrition.

2. Experimental. Three types of compost, were carried out into Könemann type cubes, with side by 1.20 m, consisting in different ratios of the three wastes, namely: (1) 50% farmyard manure (FM) + 25% sewage sludge (SS) 25% marine algae (MA); (2) 50% SS + 25% FM + 25% MA (3) 50% MA + 25% FM + 25% SS. Composting lasted two months, both under reducing and oxidative conditions. The fertilizing properties of three compost types, applied in different doses of each compost formula, namely 25; 50 and 100 t/ha were been tested in a field experiment on the corn plants. In addition to biometric measurements of corn plants, nutrient content of the leaves collected during the vegetation has been analyzed. Assessing the results obtained in variants fertilized with compost was made by comparison with those recorded in two control variants: one without fertilization and other conventionally fertilized with mineral fertilizers.

3. Results and discussion. Chemical analyses performed in the final stage of composting recorded a significant decrease in the organic carbon content, nearly seven times lower than in intermediate phase, and a slight increase in total nitrogen content. These changes have led up to 14.6 C/N value, close to a normal soil. Taking into account the neutral-weak alkaline reaction, high nutrient levels, and that of all of the organic carbon mostly comes from humines (80-90%), we come to the conclusion that it was obtained through the composting a very good material for soil fertilization in organic farming systems, which an enough pleasant aspect (figure 1).


Figure 1. Compost pellets

The best results of the corn yield have been recorded in the variant fertilized with compost made up of 50% MA, 25% SS, 25% FM applied at a dose of 100 t / ha, for which was revealed an increase of 2.5 times as compared to the unfertilized and 1.8 times to the mineral fertilized control variants (figure 2).



4. Conclusions. The compost prevalent in marine algae applied at doze of 100 t/ha generated the highest grain production (11.7 t\/ha), 135%, respectively 67% higher as compared to unfertilized or mineral fertilized controls.

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Comparative study of the use of different biomass bottom ash in the manufacture of ceramic bricks

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1. Introduction – Biomass is the most important renewable energy source in the world for their production, consumption and capacity development. Andalusia with 18 generators of electricity from waste biomass, is the autonomous community that records higher consumption of biomass in Spain and one that has higher production potential. The combustion employed process for energy recovery from biomass generates large quantities of fly and bottom ash, whose majority final destination, is its abandonment in landfills, which leads to possible environmental impacts, to the occupation of a territory that it stops being productive and in addition this solution neither presents any socioeconomic advantage. Therefore, it is essential to develop and optimize alternative and low-cost technologies, enabling the reuse and recovery from these ashes, in order to avoid their accumulation and indiscriminate dumping and promote recycling, viably and economically profitable. In this context, the general objective of the present study was to investigate the potential presenting different bottom ash produced in the combustion of residual biomass in Andalusia (essentially waste the agroindustry of olive groves, as well as residual forest biomass and wood waste) for use as raw material in the manufacture of ceramic clay bricks.

2. Experimental - Raw materials, clay and different bottom ash (wood board bottom ash; olive stone bottom ash, pine-olive pruning bottom ash, and olive pomace bottom ash), were analysed by X-ray diffraction, fluorescence and thermal analysis. The 20 wt % of biomass bottom ash was added to the clay. Samples were compressed and sintered in air inside an electric furnace (1000 ºC, for 4 h) and evaluated by a series of technological properties such as, bulk density, absorption and suction of water, compressive strength and thermal conductivity

3. Results and Discussion - The results indicated the bulk density of the sintered products decreased with the addition of biomass bottom ash due to the increased number of pores created by combustion of the organic matter of waste, as indicated in the chemical elemental analysis and TGA-DTA curve. The type of porosity (mainly open) was determined by the type of biomass bottom ash and influenced the mechanical and thermal properties of the bricks.

4. Conclusions - The incorporation of wood board bottom ash < pomace bottom ash < olive stone bottom ash < pine-olive pruning bottom ash in the body clay increased, in this sense, the amount of open pores, as indicated by the water absorption data and SEM micrographs, thus decreasing the compressive strength and increasing the thermal insulation properties of the bricks. All biomass bottom ash bricks met the UNE standards RP3404 and RP 3406-REV 7.

Acknowledgments

This work has been funded by the Project "Valorización de distintos tipos de cenizas para la obtención de nuevos materiales cerámicos sostenibles" (UJA2014/06/13), Own Plan University of Jaen, sponsored by Caja Rural of Jaen.

Scientific CV

Dolores Eliche Quesada is Associate Professor of Materials Science and Metallurgical Engineering of the University of Jaen, Chemical Engineer by the University of Granada and PhD in Sciences by the University of Malaga. Her research is mainly focused in the science and technology of materials, and in particular in the study and development of eco-efficient products through the valorization of industrial wastes for building sector (ceramic bricks). She is author and co-author of more than 35 papers in an international peer-reviewed journals. She has presented her research activity in a large number of national and international congresses. She acts as a Reviewer for several peer reviewed journals like Construction and Building of Materials, Ceramic International, Applied Clay Science and Waste Management. She is Associate Editor of Journal of Minerals and Materials Characterization and Engineering.

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The use of pine-olive pruning fly ash waste in manufacturing of light clay brick

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1. Introduction - Renewable energy technologies should play a key role in the generation of electrical energy around the world representing one increasingly larger share of generation in the coming years, to represent a weight of 57% in 2050 according to forecasts made in studies of the International Energy Agency. Among these resources, biomass could exercise an important role, as it is considered a source of CO_2 neutral and renewable energy. Biomass burning generates waste as bottom and fly ash. Common disposal of biomass ash is landfilling next to power plants, but this alternative is the least attractive in an environmental management. This research work tries to deepen the characterization and possible use of pine-olive pruning fly ash, focusing on determining, by means of laboratory scale tests, the technological properties of raw materials in the preparation of clay bricks

2. Experimental - Fly biomass ash and clay were previously characterized in terms of chemical and mineralogical composition and thermal behavior. Ceramic bricks were produced with different quantities of fly biomass ash (0-30 wt %) as raw material, with conformed bricks being fired at 900 or 1000 ºC. In order to determine optimal mixing, physical, mechanical, thermal and chemical properties of bricks were assessed in accordance with standards.

3. Results and Discussion - The fly biomass ash waste contains large amount of silica (48.1 wt %), calcium oxide (17.7 wt %) and alumina (9.3 wt%) and lower amount of Fe_2O_3 (3.2 wt %), as well as low amount of fluxes such as alkaline oxides, MgO and K_2O, similar composition to the clay used as raw material. Fly biomass ash have large amounts of organic carbon indicating incomplete combustion of pine-olive pruning, which suggests inefficient fuel use. The technological properties of fly biomass ash-clay showed that adding increasing amounts of fly biomass ash waste produced both positive effects (weight loss, bulk density and thermal conductivity decreased and porosity increase) and negative ones (increase of water absorption and mechanical strength decrease).

4. Conclusions - This study has demonstrated a feasible way for using pruning pine-olive fly ash (up to 20 wt%) as a clay substitute to produce good quality bricks, becoming an effective measure for saving raw materials and decreasing pollution. OPBA is the main residue from olive pomace incineration plants. The optimum amount of pine-olive pruning fly ash was 20 wt% fired at 1000 ºC, confirming a good balance between the effect provided by the melting capacity of waste and the role of pine-olive pruning fly ash as pore forming agent. Waste-clay bricks presented optimal technological properties that meet more than the brick quality standards.

Acknowledgments

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LCA of different energy sources for a water purification plant in Burkina Fasso

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1. Introduction – This article presents the reality of many African villages where access to drinking water and electricity is unthinkable. Previous studies showed the results of valuation of the residue generated by a Moringa oleifera seed oil extraction plant. The residual cake produced during the process of Moringa oleifera oil extraction maintains the positively charged protein of the seed which enables the suspended particles in the water to be captured. Such coagulant flocculant properties give rise to the elimination of turbidity in the process of water purification [1].

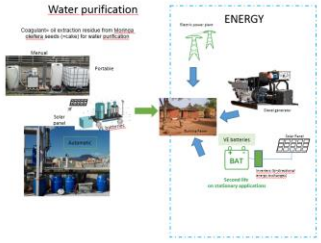

Image 1. Analysis system inserted on the text

In this article we will discuss the possibility of self-sufficiency in water purification and electricity in a village of Burkina Faso. We used three scenarios: the first one bringing the energy used in the water purification plant from "Energy Power plant"(+technical losses [2]), the second one using a "diesel generator" and the last one using "second life electric vehicle (EV) batteries with solar panels" (Image 1).

2. Experimental - For the development of the LCAs, data on energy consumption and CO_2 emissions were obtained comparing the three scenarios. Bibliographic references and database ecoinvent [3] were used to compile a comprehensive and comparative inventory. SimaPro was the LCA software used in this analysis.

3. Results and Discussion - As a case study, a rural settlement in Burkina Faso (Western Africa) has been selected. At this location, the construction of a water purification plant incorporating the above-mentioned natural cake coagulants. This plant is supposed automated and working 16 hours a day to produce 10,000 of water for 500 inhabitants.

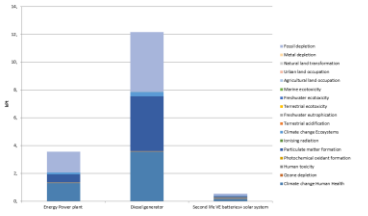

Image 2. Results for the three scenarios proposed

The energy necessary to produce the purified water of one day is 11,178Wh (16 working hours). Image 2 shows the LCA results for the three scenarios proposed. As we can see the best option for this case in Burkina Fasso is "second life EV batteries with solar system", as this system entails a significant reduction of the environmental impact, mainly in the categories of climate change and fossil depletion. In fact, human toxicity, caused by silicon of solar panels, is the only category with a higher value respect to the other two scenarios. Nevertheless, this category has a very small relative impact.

4. Conclusions - Considering the fragile nature of the subject of potable water supply to a settlement in a country such as Burkina Faso, it is clear that the use of local energy production for the purification water plant is of paramount importance. "Second life EV batteries with solar system" at a local level is more environmentally friendly.

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Scientific CV

Beatriz Amante García was born in Alicante (Spain). She has a PhD in Telecommunications by the "École Nationale Supérieure des Telecommunications" of Paris in 2002. She is nowadays working at the "Universitat Politècnica de Catalunya" in the Department of Project and Construction Engineering. She started her teaching career focusing on the fields of electronics, radio systems and Engineering projects. During these last years she started the study of battery ageing, water purification systems and LCA.

Víctor López Grimau was born in Barcelona in 1976. He presented his PhD thesis in 2007 focused on the electrochemical treatment and reuse of industrial waste water. He is Associate Professor of the Department of Projects and Construction Engineering of the "Universitat Politècnica de Catalunya-Barcelona Tech". Their research expertise is related to the development of sustainable water purification methods.

Lluc Canals Casals was born in Barcelona. He finished his master degree in industrial engineering in 2005 at the Universitat Politècnica de Catalunya and, after some years working in the automotive industry, in 2013 he became a PhD student on electric vehicle battery ageing.

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Medical waste management

Case Study: CHL - St. André Hospital - Leiria

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1. Introduction – Current hospitals are complex structures that promote the recovery of patients' health by resorting to a wide range of resources such as human, financial, technological, energetic and material.

This has led to a growth in health care costs and consequent hospital waste production (HW) [1].

The great amounts of waste resulting from health care services is a major environmental and public health concern and requires increasing attention in order to prevent its negative effects on populations. (Decree 242/96, of August 13th). In view of this, it is of utmost importance for us to be eco-efficient, i.e. to be able to create more products and services with a lesser use of resources while diminishing the production of pollutants and waste. Medical waste also has economic aspects such as its storage, transportation and treatment which constitute a major source of expense to health institutions.

2. Experimental - The aim of this work is to analyse, by means of a survey questionnaire, the awareness, the existing practices and the perceptions among the health care professionals and the second- and fourth-year students of the Nursing degree programme, offered at St. André Hospital, Leiria, by means of a survey questionnaire. This study was carried out in the medical units of Surgery I and II, Medicine I and II and Orthopaedics I and II.

3. Results and Discussion - The results obtained are similar in both groups and allowed us to conclude that there are problems in managing hospital waste as a result of a lack of training.

4. Conclusions - Among health care professionals, nurses show greater awareness of the separation of waste by classes or categories and doctors show less awareness, with 75% and 61% of correct answers respectively. As for sorting waste, the gravest doubts have to do with hazardous Group IV waste such as, separating medicines, cytostatic medicines and recognisable body parts, which translates into a higher percentage of these wastes being directed to inappropriate treatment and final disposal. As for work accidents relating HW, nurses are the professional cohort

experiencing more accidents involving medical sharps, but the results suggest that most accidents are not reported.

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Reverse supermarket, an advanced solid waste collection system: The case of Attiki, Greece

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1. Introduction – A new method for the collection of urban solid waste is the reverse supermarket [1]. According to this, people can deliver their recyclables in isolated collection centres in order to either obtain a waste fee reduction or shopping vouchers. In this work is proposed that wastes should include a separate code (Qrcode) in solid waste packages, in which will be recorded specific elements of the product packaging material. This can further promote the transfer of wastes in cash desks at supermarkets and their separation in different bins according to the material as described in the tag by scanning the code. This way, proper separation into recyclable materials can be achieved and the identification of the composition, transportation and management of wastes will be improved. Moreover, if organic wastes were also collected in supermarkets on a separate bin, pedestrian bins could be removed, making collection at supermarkets compulsory and thus diminish the high cost of street collection. The proposed system was applied in case of the region of Attiki in Greece, with 2.2 million tons of waste annually and participation of 774 supermarkets. The bins that were selected had compression mechanism with volume between 10-20 m^3 for 10 different kinds of materials including organics.

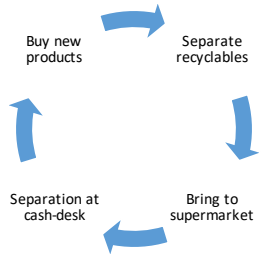

Image 3. Scematic description of the advanced reverse supermarket.

Table I. Economic results

Times bins filled per supermarket annually	183
Old cost per tone (€/tn)	35
New cost per tone (€/tn)	9.91
Percentage savings (%)	71
Possible earnings from recyclables products (€)	65,610,808

2. Results and Discussion - The economic results of the new applied system are presented in Table I.

3. Conclusions - This system aims to raise the performance of the whole recycling system by providing an economic incentive, while creating a new materials market. Circular economy that is a European target can be fulfilled, waste will not lose its value by being landfilled and economic viability of recycling procedures can be offset.

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5. Acknowledgments

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Evaluation of biogas potential of lignocellulosic residue: date's pedicels

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1. Introduction – Enormous quantities of agro-based industrial waste materials are generated throughout the world from the processing of raw agriculture materials. Dates' pedicels present in large amounts in Algeria such as food industry waste.The recycling of dates' pedicels for biogas production as renewable energy allow a better management of organic waste. Anaerobic digestion is a biological process carried out by a consortium of microbes that produce biogas with methane percentage between 50% and 80%. The process begins with hydrolysis, where bacteria reduce complex polymers (carbohydrates, proteins and fats) to simple molecules (amino acids, fatty acids and sugars); follows fermentation where simples molecules are converted into short chain volatile fatty acids, acetogenesis, where the last products are converted mainly into acetate, and metanogenesis for the final methane conversion [1]. Operating conditions for dates' pedicels biogas production using anaerobic digestion must be optimized, taking into account reaction conditions (mesophilic or thermophilic), temperature, time, organic loading, solid retention time and pH. This study aimed to evaluate the feasibility of biomethane production from dates' pedicels in mesophilic batch operation and the impact of organic loading on the biomethane production.

2. Experimental - Experiment was setup by varied total solids of the dates' pedicels in the range of 0.5- 2.5 % w v^{-1}.The feedstock and microbial seed were mixed in 0.5 L batch reactors under mesophilic condition (35ºC), pH 7. The reactors were placed in the incubator equipped with stirrer plate. Liquid samples were collected every 48 hrs for pH, alkalinity, volatile fatty acids (VFA) and total volatile solid; (TVS) analyses. The volume of biogas was collected and measured by water displacement method in a 500 mL graded cylinder.

3. Results and Discussion - The dates' pedicels contained total sugars over 41.84%, which are the good carbon source and energy sources for microorganisms. The tests on the ground substrate load showed that the load of 1% substrate at the end of 28 days of biométhanisation, produced very important biogas volume, the maximum cumulative biogaz was 1400 mL. Results suggested that at low amount of dates' pedicels in the reactor, mixing is more efficient, and the bacteria readily access, utilize the substrate and generate the biogaz. The pH varied between 6.8 and 7.5 which nearly lied in the favorable pH range of 6.6–7.8 for methanogenic bacteria [2]. Total

volatile acid (acetic acid) ratio to total alkali (calsium carbonate) VFA/Alk is important indicator to check acid and base balancing or process stability of digester. VFA/Alk ratio shows ideal range on 0.1to 0.3.

4. Conclusions - Agricultural waste that contains high organic matter if not managed properly will cause detrimental damage to the environment. Anaerobic digestion of these waste will not only reduce its organic strength but also convert them into other products that may be useful such as biogas. These waste may also be converted into high nitrogen content fertilizers after naturally being processed in an anaerobic digester. The study successful demonstrated that fermentation process can be used to produce biogaz from dates' pedicels and reduce the organic waste in the peel at the same time. The optimum condition of the process was achieved.

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Use of a three-stage system comprised of dark fermentation, methanogenesis and photofermentation to improve energy production

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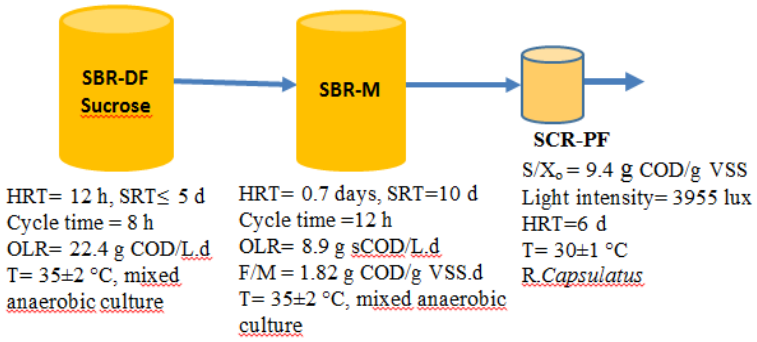
1. Introduction – This study was conducted to investigate a three-stage integrated hydrogen and methane production from sucrose. This study is the first to research and conduct a three-stage configuration, composed of dark fermentation, methanogenesis and photofermentation stages in series. It was aimed to determine total energy (i.e. total H_2 and CH_4) production from unit organic matter (sucrose).

2. Experimental – Dark-fermentation (DF) and methanogenesis (M) stages were performed in sequencing batch reactors (SBR), while photofermentation (PF) in semi-continuous reactor (SCR). The three-stage system in series and the operational conditions of each stage are shown in Figure 1. These operational conditions were previously optimized to achieve highest energy out of three-stage system. In order to calculate the energy production from each stage and that of total from three-stage system, H_2 production yields were converted to a common unit; the gross (or net) heat energy per gr of sCOD (soluble Chemical Oxygen Demand) added.



3. Results and Discussion - The results are presented in Table 1. As can be calculated from Table 1, total gross and net energy from three-stage system was 14.55 and 12.80 kJ/g $sCOD_{added}$ [1], which is equivalence of 9.9 mol H_2/mol hexose. This energy was 37% greater than the energy obtained (10.60 kJ/g $sCOD_{added}$ or 7.2 mol H_2/mol hexose) so far and 23.8% greater than the value defined as the economical threshold value (8 mol H_2/mol hexose or 11.78 kJ/g $sCOD_{added}$) in two-stage H_2 systems (DF-PF combinations) [2].

Table 1. H_2 or CH_4 production yield and the related energy (heat, calorific value) obtained from each stage

Stage	Yield of each stage	Yield ($g H_2$ or CH_4/g sCOD)	Heating Value (kJ/g $sCOD_{added}$)	
			Gross	Net
SBR-DF	1.66 mol H_2/mol hexose	0.017	2.41	2.03

4. Conclusions – Energy per unit organic matter was increased significantly in a 3-stage system compared to 2-stage H_2 systems. Methanogenesis had the most significant role in total energy produced.

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Contaminant Evaluations on Beach Showers from Metropolitan Region of Recife, Pernambuco - Brazil

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1. Introduction –The wastewater in Brazil has often been used to supply cities, irrigation, industries and tourism. One example is the wells at the sands of Boa Viagem (Recife) and Janga (Paulista) beaches, both on Recife Metropolitan Region in Pernambuco/Brazil. That supplies the showers installed by the local workers to attract tourists and prevent beach bathing due the risk of shark attacks, providing them comfort. The present work has analyzed and compared the concentrations of Ammoniacal Nitrogen, Nitrites, Nitrates, Phosphorus, Total Coliform and *E. coli* in the waters of showers from both beaches to assess if their concentrations are in accordance to the maximal limits that CONAMA's Resolution 357/2005 [1] and 274/00 [2] for brackish water from class I.

2. Experimental – Samples from beach shower water were collected in Boa Viagem, Recife/PE in December of 2014, and in Janga, Paulista/PE in December of 2015, for phys-chem and microbiological analysis. The analysis procedures followed the Standard Methods for the Examination of Water and Wastewater [3]. The results were reported and compared with standards recommended by Resolutions 357/05 and 274/00 from CONAMA.

3. Results and Discussion – All the samples from Boa Viagem's beach have exceeded the standards of Ammoniacal Nitrogen, NO_3 and NO_2, which are, respectively, 0.4, 0.4 and 0.07 $mg.L^{-1}$. At Janga's beach, 43% of the samples have exceeded the limits for Ammoniacal Nitrogen and 71% have exceeded the limits of NO_3. The high levels of Ammoniacal Nitrogen found have shown current contamination, which implies precarious well's construction. All samples of Phosphorus from Boa Viagem were out of standards, but on Janga, only 71% of the samples were not in accordance with the standard value, that's 0.124 $mg.L^{-1}$. All samples from Boa Viagem's beach exhibited high levels of Total Coliforms concentrations, and in Janga's beach, only 43% samples were not in accordance with the maximum limit from CONAMA 274/00, that is <1000 $CFU.100mL^{-1}$. At *E.coli* analysis, only 25% of the samples from Boa Viagem and 14% from Janga showed a concentration above the maximum established by the Resolution 274/00 that is

<800 CFU.100mL^{-1}. The high levels of *E.coli* indicate current contamination, which might be related to the increasing frequency of tourists on both beaches.

4. Conclusions – The beach showers water analyzed from Metropolitan Region of Recife proved that the water is not in concordance with the standards of Brazil's Law for brackish water form class I. Therefore, the completion of this project will increase interests on water's quality from the beach showers for the population welfare.

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Fe-TiO_2 assisted photocatalytic degradation of TNT in aqueous media, under UV-VIS irradiation

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1. Introduction – 2,4,6-Trinitrotoluene(TNT) is one of most common toxic pollutant identified in wastewater generated from ammunitions plants. Due to its potential carcinogenic characteristics, TNT presence in water bodies presents a risk for human health and aquatic life. Various treatment methods were investigated in order to remove toxic pollutants. Among them, TiO_2 photocatalysis was successfully applied. Fe-TiO_2 assisted photocatalytic degradation of TNT in aqueous media, under UV-VIS irradiation was studied. The effects of operating parameters such as catalyst loading and pollutant concentration were assessed. The kinetic and mechanism of pollutant degradation were also investigated.

2. Experimental - The photodegradation experiments were performed in a batch reactor equipped with cooling system and a medium pressure Hg lamp as UV-VIS light source (λ =320-550nm). Solutions with (0.27-2.72) $x10^{-4}$M TNT content were photo-oxidized in the following working conditions: pH=7; photocatalyst dose=50-500mg/L; irradiation time=30-240min. Prior to irradiation, the photocatalyst was added to samples, and resulted suspension was bubbled with air (50L/h). In order to evaluate the effect of the main active species involved in Fe-TiO_2 assisted photocatalytic degradation of TNT we suppressed the free •OH radicals mediated process by addition of $16x10^{-3}$M iso-propanol (i-PrOH) scavenger. Lock of $•OH_{ads}$ radicals production on the catalyst surface was assured by addition of $16x10^{-3}$M sodium iodide (NaI). The initial and irradiated samples were analysed for TNT, NO_3^-, NO_2^- and NH_4^+ concentrations by Gas Chromatography(GC), and Ion Chromatography respectively.

3. Results and Discussion – In the tested experimental conditions, at $2.72x10^{-4}$M pollutant concentration, the increase of Fe-TiO_2 load up to 200mg/L leads to the enhancement of initial TNT degradation rate up to $6.4x10^{-7}Ms^{-1}$. Since, ten times increase of initial TNT content has a negative effect on pollutant degradation rate constant, in similar experimental condition, prolonged irradiation time from 60 to 240 min was needed in order to assure pollutant advanced degradation efficiencies ($\geq$ 99.9%). The TNT degradation and its inorganic by-products formation obeyed a pseudo-first-order kinetics The experimental results of the reactive species quenching showed that •OH radicals was the predominant oxidant species participated in reaction, and the pollutant degradation occurred mainly on the surface of catalyst. Our findings are supported by the fact that presence of O_2 (electron scavenger) inhibited, reductive TNT degradation and pollutant direct photolysis occurs with much lower reaction rate than •OH radicals mediated process.

4. Conclusions – **In optimum working conditions (pH=7, photocatalyst dose = 200mg/L, t_{irr} = 240min) Fe-TiO_2 assisted photocatalysis assures advanced degradation of TNT ($2.72x10^{-4}$M) from aqueous media.**

Acknowledgments: **This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI UEFISCDI, project number PN-II-PT-PCCA-2011-3.1-0031.**

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Comparison of Oil Removal Efficiencies in the Vertical and Horizontal Electrokinetic Units depending on Operational Modes

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1. Introduction – Metal working fluids (MWFs) have wide industrial applications in machining processes such as cutting, rolling or drilling. Although the spent MWFs show eco-toxicological effects because of their components (surfactants, emulsifiers, etc.), there is no universal solution for their treatment [1]. Several techniques such as flotation, chemical and biological destabilization, membrane technologies, and adsorption have been applied to treat oily wastewaters [2]. Electrochemical techniques are another alternative method which has been already successfully applied for the treatment of oily wastewaters. It has a significant role in the treatment of oily wastewaters because of its various advantages, such as, simple equipment, easy operation, low capital and operating costs and less amount of sludge production [3].

2. Experimental – MFWs were used for the preparation of synthetic wastewaters. The electrokinetic experiments were performed under constant voltage by using the vertical and horizontal electrokinetic units. The volume of both units was 6 L and the studied voltages were 5, 10 and 15 V. The electrodes were aluminum plates (13.5x 8.5x 0.3 cm^3) and 8 electrodes were used in all experiments. The wastewater flow rate was 24 mL/min and the total operating time was 90 minutes. Turbidity, current and COD were measured during the experiments.

3. Results and Discussion – The results obtained from the batch and continuous electrokinetic experiments were shown in Table I when the applied voltage was 15 V. Since the currents were measured during the experiments, the specific energy consumptions were evaluated numerically using trapezoidal rule. For the vertical and horizontal electrokinetic units, the batch flow experiments resulted in a higher treatment performance and lower energy consumption.

Table I. The removal efficiencies and energy consumptions in the electrokinetic experiments.

		Batch Flow	Continuous Flow
The Vertical Electrokinetic Unit	Turbidity Removal (%)	76	55
	COD Removal (%)	88	83
	Energy Consumed (kW-hr/m^3)	0,17	0,92
The Horizontal Electrokinetic Unit	Turbidity Removal (%)	95	72
	COD Removal (%)	97	81
	Energy Consumed (kW-hr/m^3)	0,20	0,81

4. Conclusions – The turbidity and COD removals were improved at the horizontal and vertical units by increasing the applied voltage in both operating modes. The highest turbidity and COD removal efficiencies were attained in the horizontal unit and are equal to 95% and 97%, respectively.

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International Congress on Water, Waste and Energy Management
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Elimination of phosphorous and organic contamination from industrial wastewater

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1. Introduction Organic esters of phosphoric acid have many applications and their production scale in Europe reaches thousands tonnes per year. The basic applications are flame retardants, plasticisers and lubricants. The most produced materials are the organic-phosphoric flame retardants including chloro-phosphate compounds. [1]. These compounds are detected in the environment including surface waters. The main source of the emission are industrial processes including industrial wastewaters [1-4]. Water soluble esters of phosphoric acid are poorly dissociated in water. Therefore, the precipitation with inorganic substances must be preceded by hydrolysis of the organic compounds to orthophosphate(V) ions. The removal process of phosphorus using iron(III) compounds is based on ion-ion reactions. The precipitation of iron(III) phosphate is accompanied by formation of hydroxides. In fact, reactions of phosphorus removal with iron(III) salts are more complicated. To simplify, it can be assumed that in acidic conditions mainly $FePO_4 \cdot 2H_2O$ precipitates but at pH>3 besides clean iron phosphates, insoluble hydroxide compounds are formed. According to the [5,6], the optimal pH for iron removal by precipitation is 4-6 but many authors stress that the value is closer 4 or 6 depending on sewage composition.

The aim of the research was the removal of iron excess in the wastewater from the chloro-organophosphate flame retardants production process before wastewater treatment process.

2. Experimental - Industrial wastewaters contain 7000 mg/L of total phosphorus, water soluble organic compounds (COD ≈ 70 000 mg O_2/L) and other impurities (Na^+, Cl^-). 1 L of wastewater (starting pH approx. 12,2) and $FeCl_3$ with the Fe/P molar ratio 1,0-2,0 were introduced to the reactor with stirrer. pH of the solution was changed between 2,0-6,0. The precipitate was separated using Büchner funnel. The filtrate was tested for P content, COD and pH were also measured.

3. Results and Discussion - The chemical phosphorus removal process from wastewater is based on the precipitation of water-insoluble orthophosphates. The tested wastewater, besides from phosphate esters containing the majority of phosphorus, contains other organic water-soluble compounds. The latter compounds are partially reactive with Fe^{3+} ion (glycols, chlorohydrins, epoxies). They originate from unreacted substrates and their hydrolysis. Acidic conditions and high temperature favours the dissociation of phosphate esters. At pH<2 up to 65% recovery was

achieved; at pH>3,0 the recovery increased to 70%. The best results were obtained for pH~4,5 and Fe/P ratio up to 2,0. The phosphorus removal process is connected with decrease of COD value. The best results were obtained for Fe/P 1,5-1,7 and pH ~4.

4. Conclusions - From industrial wastewater, contaminated with organophosphate ester and the other water-soluble organic compounds, 60-90% of phosphorus can be eliminated using iron(III) chloride as a precipitating agent. The phosphorus removal process is accompanied by COD decrease in the residual wastewater.

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Photocatalytic degradation of nitroaromatic pollutants and their kinetic parameters in UV-VIS /TiO_2 system

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1. Introduction – Hazardous organic compounds like nitroaromatics are frequently found in effluents discharged by chemical and petroleum industries. In the past decades, semiconductor photocatalysis was frequently applied for the advanced degradation of toxic pollutants. In order to improve optical absorption and photocatalytic activity of TiO_2 many attempts have been made, one feasible approach consisting in doping oxide semiconductor with metals.

2. Experimental - The photodegradation experiments were carried out in a laboratory scale UV reactor - Heraeus system using a medium-pressure mercury lamp which emits in the range: 320-500 nm. The lamp equipped with a quartz water cooling jacket is immersed in the centre of the reactor containing the pollutant solution. The photon's flow of the emitted radiations was determined by ferrioxalate actinometry and a value $I_0 = 6x10^{-6}$ einstein s^{-1} was found. Concentrations of nitroaromatic compounds, dinitrobenzene (DNB), dinitrotoluene (DNT), nitrobenzene (NB) and nitrotoluene (NT), were monitored by gas chromatography coupled with flame ionization detector (GC-FID). Kinetic curves obtained for degradation of tested nitroaromatic compounds and organic nitrogen mineralization were linearized by a pseudo-first order kinetic.

3. Results and Discussion - Dopant type and pollutant structure influence on the degradation efficiency were assessed. The dopant type (0.5% Fe, 1%Co, 1%Ni) induces various modification on catalyst photoactivity and the rate constant obtained for tested pollutant decreases in order k_I (0.5 wt.%Fe) > k_I (1 wt.% Co) > k_I (wt.% Ni).

For similar number of nitro group, toluene nitroderivative is faster degraded than nitrobenzene derivative for the same irradiation time. Increased number of nitro groups leads to improved efficiency degradation for benzene and toluene nitrocompounds. Rate constants for degradation

of studied nitroaromatic compounds decrease in order DNT>DNB>NT>NB according to their equilibrium adsorption constants K_d. The energy per order of magnitude, E_{EO} expressed in kWh/m^3/order was calculated in order to assess the process efficiency with respect to the electrical energy consumption associated with nitroaromatics compound removal through photocatalysis process. For optimum operating conditions the best values were obtained for toluene nitroderivatives (7.02 – 11.03) kWh/m^3/order, which are acceptable value in terms of process costs.

4. Conclusions – The presented photocatalytic process qualifies as a promising method for the treatment of wastewater with nitroaromatic content.

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Study for Generation of Maximum Precipitation using physically based model : Case study of Typhoon Rusa

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1. Introduction – Designing large hydraulic structures, such as dams and flood protection structures requires an estimate of the extreme precipitation event. Under climate change, the extreme precipitation events are more frequent than expected. This makes it difficult for researchers to estimation of extreme precipitation. In general, the extreme precipitation is calculated based on historically observed data. Traditional approaches are fundamentally based on the assumption of stationarity of the observation data and can not account for nonstationarity like climate change. To overcome this logical weakness, this paper suggests the new approach to the estimation of MP (Maximum Precipitation) using physical based NWM (Numerical Weather Model) that can incorporate the effect of the nonstationarity of atmospheric process.

2. Experimental - As a case study, we reproduced typhoon, Rusa, which hit Korea in 2002, and then maximized.

3. Results and Discussion - First, multiple experiments are carried out by changing the physics option to reproduce in spatio-temporal distribution of rainfall and typhoon track. At this time, about 650 automatic weather stations (AWS) data and Real-time, global, sea-surface temperature (RTG_SST) analysis data were used for more realistic initial and boundary condition. Second, reproduced typhoon was maximized by adjusting the corresponding initial and boundary condition or humidity maximization. Finally, maximum precipitation is estimated using various maximization results(Image. 1).

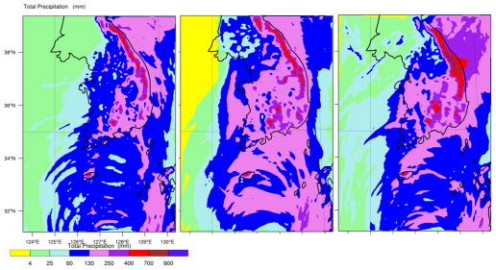

Image 1. Examples of maximum precipitation results

4. Conclusions - The suggested approach in this paper will provide useful information to the design of large hydraulic structures and hazard mitigation fields.

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Probabilistic Projection of IDF curves in Korea

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1. Introduction – Uncertainty contained future projections in IDF curves are influenced by global climate change and regional factors. Taking a look at Korean future precipitation expected from current climate models, the increased trend is predicted. However, the results from the observation data does not show a clear increase. In this study, a methodology for the probabilistic projection of future IDF curves is proposed to reflect the trend that can be extracted from observed data and its uncertainty.

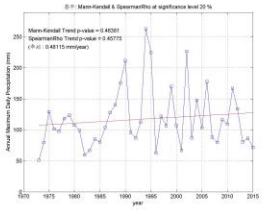

Image 1. Trend analysis of observed daily maximum precipitation series (Choongju)

2. Experimental - First, the scale-invariance relationship is established to estimate IDF curves for sub-daily durations from observed daily precipitation data. The reason for using daily precipitation data is that future climate information is usually given on a daily basis. Based on the trend analysis of observed daily maximum precipitation series, the trend of future daily maximum precipitation series incorporating the uncertainties of the trend is projected.

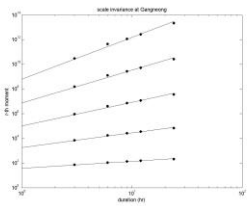

Image 2. Scale-invariance

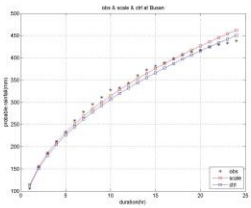

Image 3. Scale-invariance verification (Busan)

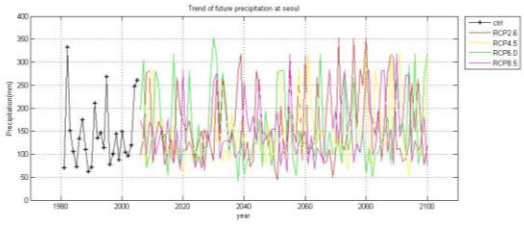

Image 4. Trend of future precipitation (Seoul)

3. Results and Discussion - Using the previously established scale-invariance relationship, future IDF curves for sub-daily durations are probabilistically projected.

4. Conclusions - As a case study, the proposed methodology will be applied in several rain gages in Korea.

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Modelling of Long Term Permeability of Compacted and Consolidated Clays Permeated With Leachate

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1. Introduction- Compacted clay soils used for municipal solid waste (MSW) landfills and causes significant threat to surface water and groundwater. However, certain chlorinated hydrocarbons of solvent type attack integrity of clay liners, causing them to be highly permeable[1]. Concentrated organic chemicals can increase permeability of compacted clay due to reduction in thickness of diffuse double layer that surrounds particles of clay. This study has determined variations in the permeability of clay soil and removal rate of present ions in leachate on the clay soil. Penalized linear regression (lasso) and support vector regression methods are applied in order to model the relationship of the metal ions on the permeability.

2. Experimental- Leachate obtained from the Şile – Kömürcüoda Landfill Area, located on the Asian side of Istanbul, were compacted and consolidated clay sample. The effects of leachate on the permeability and removal rate of compacted and consolidated clay soil samples have been analyzed. Penalized **linear regression** and **support vector regression** methods are applied in order to model the relationship of these metal ions on the permeability.

3. Results and Discussion- The datasets, **"Compacted Contaminated Clay Soil"** and **"Compacted-Consolidated Contaminated Clay Soil"** are high-dimensional datasets with many collinear regressors. Therefore, to generalize as accurately as possible, a penalized linear regression method is

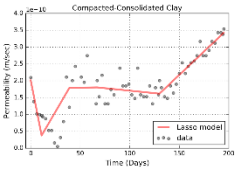

Figure 1. Lasso regression model for compacted-consolidated clay sample

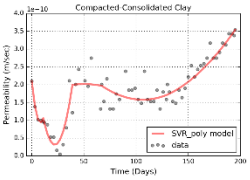

Figure 2. SVR model for compacted-consolidated clay sample

and the method is fast. However, a nonlinear method would have been performed well. Thus, another method is implemented in the modeling process. This time, a nonlinear method, support vector machine regression (SVR) is performed.

4. Conclusions - In this study, The [regression] results showed that SVR has better accuracy, but slower than Lasso. Lasso method is also used for selecting important features. First, the Lasso regression is performed to get the appropriate number of features, and then these features are used in Lasso and SVR implementation.

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Development of a Chlorination Injection Control System using Different Filtering Particle Size for Small Drinking Water Facility

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1. Introduction – Reducing deaths from waterborne diseases is a major public health goal in a remote region or developing countries. Simple technique for treating water, such as chlorination, could save a huge number of lives each but chlorination injection amount control is difficult in small water facilities. This study presents a development of a chlorination injection amount control System for small and remote drinking water facilities. The filter is built on the basis of the fact that the intrinsic permeability varies with the particle size. The filter is filled with 5, 10, 15, and 20 μm particle samples each, and is tested for the capability of chlorination injection. The final goal of the study is to build a small drinking water facility that controls the amount of chlorination injection constantly and to deploy it for remote non-electric region or developing countries.

2. Theoretical background – From the Darcy' law

$$Q = -KA\left[\frac{dh}{dl}\right], \quad K = \frac{-Q}{A\left(dh/dl\right)} \tag{1}$$

$$\text{to give } Q = -\frac{Cd^2\gamma A}{\mu}\frac{dh}{dl}, \quad K = Cd^2\frac{\gamma}{\mu}, \tag{2}$$

Where C is a constant, d^2 is a media characteristics, γ and μ are fluid characteristics, and K is an intrinsic permeability.

3. Experimental and results– A cylindrical filter is built and it is filled with 5, 10, 15, and 20 μm particle samples in turn. Then the amount of chlorination injection is measured for each filter. The amount of chlorination injection is controllable up to 1 ppm for each particle size. It implies that intrinsic permeability is dictated by particle size and accordingly the amount of chlorination injection is nicely controlled for small drinking water facilities.

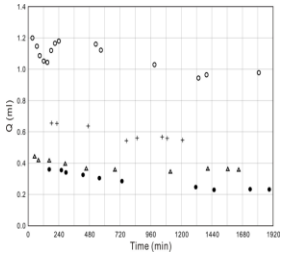

Image 1. Chlorination injection as a function of time

4. Conclusions – The developed system is easy to build and uncostly. It will contribute to major public health for small drinking water facilities. Especially it might be very useful for a remote region or developing countries because it is non-electric.

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Application of nanofiltration for concentration of waste inorganic salts solutions

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1. Introduction – Different branches of chemical industry generates significant amounts of waste sodium sulphate solutions. Among them, productions of: cellulose fibres (Ryon), synthetic silica , fatty acids, cyclohexanone and catalysts are the most important. Usually, further processing of waste solutions is energy consuming due to low concentration of salt. Here, pressure-driven membrane processes, such as nanofiltration (NF), represent an promising alternative to classic separation techniques. For concentration of waste inorganic salts solutions application of NF is favourable to reverse osmosis (RO), as it requires lower pressure and the process efficiency is higher.

2. Experimental –Waste salt solutions used in this work originated from catalyst production and initially contained about 25 g/dm^3 of Na_2SO_4 (at pH ca. 9). Final concentration in range of 90-100 g/dm^3 of Na_2SO_4 was required for further processing of solution, e.g. recovery of sulphuric acid sodium hydroxide by electro-electrodialysis process [1]. Permeation rates and retention characteristics were determined for four different membranes (MPF-34, MPF-36, DL GE, NF-270). Fig. 1 shows dependency of permeation rate under sodium sulphate concentration at pressure of 40 bar. Experiments were conducted in cross-flow module SEPA II with active surface of 140 cm^2. The applied pressure ranged between 10 and 40 bar.

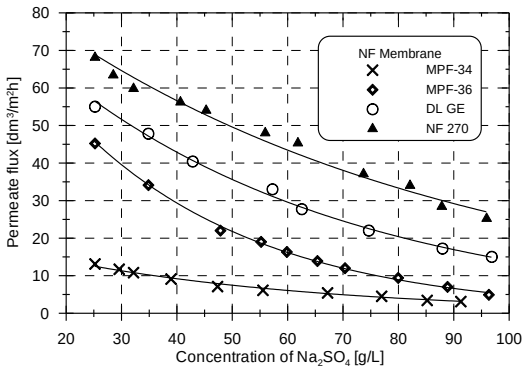

Fig 1. Dependency of permeation rate under sodium sulphate concentration at pressure of 40 bar

3. Results and Discussion – Experiments confirmed an linear relationship between permeation rate and applied pressure. Highest permeation rates were observed for NF-270 (DOW FilmTec)

membrane. All investigated membranes showed considerable smaller difference in retention rates of sulphate and hydroxide ion, in favour of OH^-.

4. Conclusions - Obtained results confirmed applicability of nanofiltration as a method of concentration of waste sodium sulphate. Concentration as high as 100 g/dm^3 of Na_2SO_4 was possible to obtain. Therefore, NF can be used as method for pre-concentration of waste sodium sulphate solution, before further processing.

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ZERO-VALENCE IRON NANOPARTICLES APPLIED IN THE DESALINITATION OF SEA WATER

by

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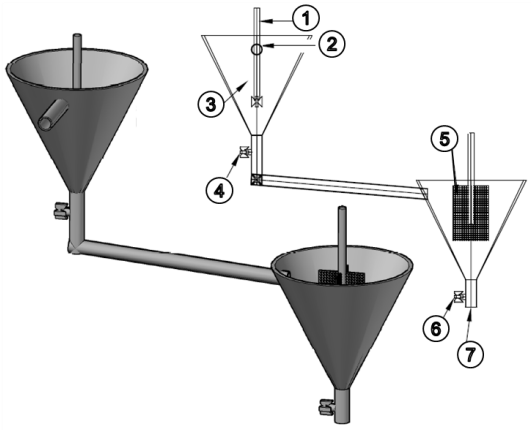
1.-Introduction.-The proposal is to use zero-valence iron nanoparticles to extract the sodium chloride from seawater using static magnetic fields.

2.-Explanation.- Because the UV-VIS frequency of the good quality zero-valence iron nanoparticles is in resonance with the sodium chloride frequencies in the ultraviolet range, strong links among the magnetic iron nanoparticles and the sodium chloride are created so that all together can be extracted from solutions by means of static magnetic fields.

3.-Description of the process

3.1.-Add the zero-valence iron nanoparticles to the sea water solution (1,2,3) and then shake. 3.2.- Apply powerful magnetic fields that attract the magnetic nanoparticles of zero-valence crowded with sodium choride salt. 3.3.- By means of static magnetic fields (5) , the extraction of iron nanoparticles together with the salt can be carried out.

1-stirring; 3.-sea water solution+nanoparticles; 5.-magnetic alloy+magnetic fields



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Experimental Investigation of Ignition Characteristics of Composite Liquid Fuels Based on Coals of Different Metamorphism Grade

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1. Introduction. Utilization of coals of various ranks, coal processing wastes, waste combustible petrochemicals is possible by their combustion as components of composite liquid fuels (CLF). Perspective direction is the low-temperature ignition of CLF (air temperature less than 1000 K). The transfer of solid coal fuels into CLF and the temperature decrease on the stages of fuel preparation and combustion allow to reduce significantly the emissions of sulfur and nitrogen oxides compared with conventional combustion of pulverized coal.

The significant disadvantage of CLF is relatively high ignition inertia at low-temperature ignition, connected with additional time and heat costs for the water evaporation (in comparison with the ignition of pulverized coal). The ignition inertia is also increased by using high quality coals, which have high energy value, but at the same time, low reactivity (high temperatures are required for their stable ignition). One of the ways to reduce ignition inertia of CLF is the inclusion of the highly reactive additives, such as combustible petroleum liquids or highly reactive coals.

The aim of the present work is experimental investigation of integral characteristics of ignition of CLF based on coals of different metamorphism grade.

2. Experimental. By means of high-speed video recording the ignition and combustion of seven different CLF compositions were investigated. For their preparation we used water, coals of different quality (brown, bituminous, anthracite), as well as the carbon residue of low-temperature pyrolysis of tires. Waste motor oil was used as the liquid combustible component of the investigated fuels. The experimental method is based on the placement of single fuel droplet (radiuses were changed from 0.5 mm to 2 mm), which was fixed on the thermocouple junction into the flow of heated air. The temperature and the velocity of the air flow were varied in the ranges 600–1000 K and 0.5–3 m/s.

3. Results and Discussion. The stable ignition of the most of the investigated CLF was implemented at the air temperature 600–800 K. In addition, it is viable to use low-grade coals with high content of volatiles to intensify CLF ignition at a lower air temperature. In accordance with the experimental data, the additive of brown coal (with the mass fraction 5 %) into CLF based on bituminous coal reduces the minimum ignition temperature of nearly 17–25%.

4. Conclusions. The results of investigation illustrate the prospects of using coals of different ranks in the CLF. Such approach allows to rich an acceptable ratio between the time of combustion initiating and combustion heat of such fuels in the conditions of low-temperature ignition. It was shown that even a small addition of the coal with high volatile content (low-grade coal) leads to an intensification of the low-temperature ignition of CLF based on bituminous coal and even anthracite. At the same time the presence of high-rank coals in the CLF leads to a significant increase of temperature in the combustion zone and the combustion duration (as a consequence, improve the heat production).

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"Integrated solid waste management turns garbage into gold: A case study of Jabalpur city"

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Abstract

Solid waste generation is an inevitable consequence of anthropogenic activities, which needs an enormous effort for its proper management to avoid filthy situation in the city and around the residential areas, but unfortunately the responsible authorities as well as residents don't pay heed to cope with the deteriorating situation. Rapid urbanization and speedy population growth have accelerated the problem and the circumstances are more grim and severe in developing countries. India is also experiencing a dire state due to the lack of proper disposal of burgeoning solid waste and the situation in Jabalpur is also about to skid from grip of the authorities. The study attempts to explain the current scenario of solid waste management (SWM) in Jabalpur city, which is known as 'Sanskardhani' (capital of etiquette). Depiction of the running system of SWM in the city, identification of the causes for inefficient solid waste collection and its improper management and derivation of ideas to mitigate the problem and to improve living conditions are the objectives of the study. The information and relevant data have been compiled from Jabalpur Municipal Corporation (JMC), related stakeholders supplemented by field observations and self-administered questionnaire. An intensive review of related literature has been embraced too to have a sound knowledge of the problem and to augment solutions of this catastrophe. Finally, the study will deliver concrete insights to the policy makers to enrich the plans, which could assist them in the battle field of integrated and sustainable management of solid waste.

Key words: anthropogenic activities, filthy, urbanization, burgeoning, mitigate

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Optimizing post-aeration time in a anaerobic-anoxic/ nitrifying sequencing batch reactor/ induced crystallization process

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1. Introduction –An anaerobic-anoxic/nitrifying sequencing batch reactor (A_2N-SBR) two sludge process coupled with induced crystallization(IC) called A_2N-IC-SBR process was operated for wastewater nutrient removal and phosphorus recovery[1]. The post-aeration phase is after completion of the anoxic phase in A_2N-IC-SBR process, and the length of post-aeration time was chosen to investigate in order to optimize A_2N-IC-SBR system performance in this study.

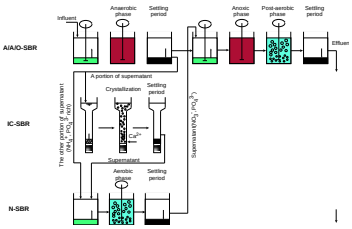

Image 1. Schematic diagram of A_2N-IC SBR process

2. Experimental - The lab-scale A_2N-IC-SBR process (Image 1) consisted of biological phosphorus removal system and chemical induced crystallization system. The biological system proposed and described by Kuba et al. [2] and Wang et al. [3] is A_2N two sludge process. The crystallization system consisted of a reagent zone filled with $CaCl_2$, a stripping zone for alkalinity reduction and pH increase, and a crystallization reactor for phosphorus recovery. Calcite was used as the seed for crystallization. The effluent of crystallization reactor flowed into the aerobic tank. And four A_2N-IC-SBR reactors with different post-aeration time (0 min, 30 min, 60 min and 120min, respectively) were in a long term stable operation.

3. Results and Discussion –The performance of A_2N-IC-SBR reactors were observed in long time operation. Tabla I shows effect of post-aeration time on performance of A_2N-IC-SBR reactors. Obviously, higher removal efficiency observed in longer post-aeration time is because of the assistance of further aerobic phosphorus uptake. However, the anoxic phosphorus uptake was deteriorated with longer post-aeration time. Additionally, though FISH quantification on DPAOs sludge, it was found that PAO decreased and GAO increased with the prolonging post–aeration period. Therefore, 30 min post-aeration time can be benifical for phosphorus removal without deteriorating sludge. Moreover, the effluent concentration of ammonia decreased from 2.77 mg/L to 0 mg/L with the increasing post-aeration time. This is due to the longer aeration time could increase the amount of nitrifying bacteria. And the effluent of the nitrite

Tabla I. Effect of post-aeration time on performance of A_2N-IC-SBR reactors

Post-aeration time	TP removal efficiency(%)	Ammonia removal efficiency(%)	PAO(%)	GAO(%)
0 min	85.01	85.90	83±2	12±2
30 min	95.25	90.75	78±3	19±2
60 min	95.37	97.96	67±4	29±4
120 min	96.59	99.85	58±3	41±4

concentration in reactors without post-aeration time was remain 1.92 mg/L, the rest of reactors have no nitrite in effluent. And the effluent of the nitrate were almost zero, which could because of simultaneous nitrification and denitrification inside of the reactors.

4. Conclusions - Overall, this study shows that short time post-aeration can be beneficial for A_2N-IC-SBR selecting for PAOs over GAOs. And the application of post-aeration time 30 min was suggested in A_2N-IC-SBR

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Pharmaceuticals and Sewage Sludge Compost

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1. Introduction – Residues of pharmaceuticals and other organic pollutants present in land-applied sewage sludge bring along a potential danger to environmental and human health. Pharmaceuticals consumed in very small amounts with everyday food are able to initiate strains of resistant bacteria in human and animal organisms. Active studies on the fate of pharmaceuticals in the environment were launched some 25 years ago, and most of the work dealing with their degradation has been published after 2010. The major pathway of spreading pharmaceuticals into the environment is *via* sewerage systems. In Estonia the yearly amount of sewage sludge produced exceeds 300,000 tons (dry weight). Composting is among the most cost-effective and environmentally friendly ways of intelligent treatment of this originally hazardous waste. It is important to identify the content of pharmaceuticals in sewage and its sludge and to determine the efficiency of their degradation during composting. The aim of our work is to develop the most efficient composting technologies leading to the safe and reliable application of sewage sludge for securing the fertility of low–nutrient soils in Estonia. Our recent studies have involved the fate of the most widely used pharmaceuticals – fluoroquinolones, sulphonamides and tetracyclines – in sewage, sewage sludge, sewage sludge compost, food plants. Attempts have been made to develop composting technologies, efficiently dealing with the degradation of organic pollutants present in sewage sludge and the results look promising.

2. Results – The presence of fluoroquinolones, sulphonamides and tetracyclines was apparent in the sewage of the two largest cities of Estonia – Tallinn and Tartu [1]. In sewage sludge samples the concentrations of ciprofloxacin, ofloxacin and norfloxacin often exceeded the relevant trigger values for manure. In compost samples the highest concentrations of these pharmaceuticals sufficiently exceeded the threshold concentration – 1 μg/kg – for pharmaceuticals in soil.

Studies have shown that the uptake of pharmaceuticals by several food plants is apparent [2]. Wheat grains had low or zero concentrations of the analysed pharmaceuticals, but the uptake of fluoroquinolones and especially sulfonamides by plants like potato and carrot might present health risk.

Composting remarkably reduces the concentrations of of pharmaceuticals. Our current research is involving the development of novel composting technologies that provide more efficient degradation of pharmaceutical residues. Both vermicomposting and fly larve composting offer certain advantages. Promising results were obtained when sewage sludge was mixed with sawdust. In the case of using straw or peat as bulking agents the decomposition efficiency was lower.

3. Conclusions – Although sewage sludge compost appears to be a nutrient-rich fertilizer and its application for improving the quality of soils is very promising, this might also lead to undesired environmental pollution. This drawback will be eliminated through the development of novel reliable composting technologies and efficient compost quality monitoring methodologies.

4. Acknowledgement - This work has been undertaken thanks to a project supported by the Environmental Investment Centre of Estonia

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Building natural capital in multi-functional ecologically engineered water treatment systems: an analysis of cultural ecosystem services

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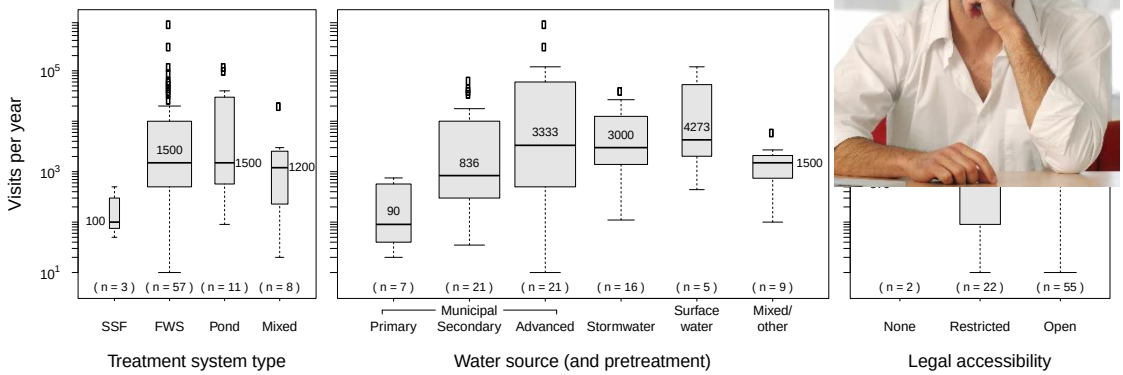
1. Introduction – Ecologically engineered systems (EESs) for water treatment are sources of cultural ecosystem services but quantification of these ancillary benefits has been lacking. A critical assessment of recreational and educational benefits in EESs is provided, including monetary valuation; the use of geotagged photos from social media is explored as a proxy of visitation rates where these are not tracked.

2. Experimental - A database of 166 EESs with public use is constructed based on literature data and a survey of wetland managers. Visitation rates are retrieved for 62 sites and enriched with site- and context-specific characteristics. Drivers of public use intensity are identified using multiple linear regression analysis. Monetary benefits are estimated using value transfer techniques. Geotagged photos from social media are retrieved for all identified EESs. The number of photo-user-days/year is estimated for each site, after controlling for multiple uploads by individual users and duplicate photos. A regression model is calibrated to test the accuracy of photo-user-day as a proxy of visitation rate.

3. Results and Discussion - Image 1 shows the distribution of observed visits over different EES characteristics. The observed sites host on average 26,909 annual visits (±102,061; median=1500). The hypotheses of equal medians across water quality and legal accessibility groups are rejected. Where permitted, passive and contact recreation respectively results in a three-



and tenfold increase in visits. Interpretive signs, wildlife observation points and accessibility are positively correlated with visitation rate. Monetary estimates of recreational values range between 0.87 and 82,000 €/ha/year.

A high correlation is found between photo-user-days and annual visitors ($r = 0.814$; p-value < 0.001; $N = 62$). The fit increases when photo counts from multiple social media sites are used and when photo-user-days are corrected for local internet penetration. Such empirical relationship is used to estimate visitation rates in all EESs in the database and derive monetary estimates of their recreational benefits.

4. Conclusions - The findings call for increased integration of cultural benefits into the decision making process concerning EESs and further investigation into best design and management practices.

Scientific CV – Dr. Andrea Ghermandi

Dr. Andrea Ghermandi is an Assistant Professor at the Department of Natural Resources and Environmental Management at the University of Haifa (Israel) and a member of the Global Young Academy. He is the academic head of the Global Green MBA program at the University of Haifa's Faculty of Management and a member of the Executive Committee of the Natural Resources and Environmental Research Center (NRERC). His scientific research focuses on the multi-disciplinary analysis and evaluation of sustainable environmental management practices. Among his main research interests are the technical and economic evaluation of sustainable technologies for water management, the economic valuation of freshwater and coastal ecosystem goods and services, and the development of techniques for transferring and mapping ecosystem service values. He received a Ph.D. in Analysis and Governance of Sustainable Development from the School for Advanced Studies in Venice Foundation at the University of Venice in 2008. In recent years, Dr. Ghermandi has contributed to international initiatives such as TEEB-The Economics of Ecosystems and Biodiversity (as lead author in the estimates of monetary values of coastal ecosystem services), the UNEP/GEF Project for Ecosystem Services (ProEcoServ), the Ocean Health Index, and the Ecosystem Service Partnership. He has published more than twenty-five original research articles in international, peer-reviewed academic journals.

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Solar-powered desalination of brackish water with nanofiltration membranes for intensive agricultural use in Jordan, the Palestinian Authority and Israel (AGRISOL)

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1. Introduction – Agriculture is a major source of livelihood for many rural communities in the Middle East, despite the severe lack of freshwater that affects the region. Brackish groundwater aquifers are often exploited as sources of irrigation water, but the practice is highly unsustainable, as large volumes of water are needed to leach the salts from the soil. The ongoing AGRISOL project aims at designing, developing and testing a cost-effective desalination system for application at farm-scale to the production of irrigation water and high value crops in semi-arid environments. The AGRISOL project aims at advancing more sustainable, high-technology farming practices by developing a cost-effective desalination system for application at farm-scale to the production of irrigation water and high value crops in semi-arid environments and experimentally testing its potential to (1) reduce the current rates of groundwater abstraction, (2) increase current agricultural yields, and (3) enhance farmers' overall wellbeing by enlarging their currently available portfolio to cash crops with low salinity tolerance.

2. Experimental - Our proposed approach involves developing and testing a new generation of solar-powered, low-pressure membrane desalination plants. The plants are fitted with recently developed nanofiltration (NF) membranes that operate at low pressure, improving the affordability of desalination in agriculture and compensating for the drawbacks of irrigation with reverse osmosis desalinated water, such as high energy consumption and lack of elements that are essential to the crops like Mg^{2+} and Ca^{2+}. Two pilot plants are being designed and installed, one in Hatzeva (Israel, EC = 2.8 dS/m) and one in Karama (Jordan, EC = 3.1 dS/m), and agronomic experiments with different crops are conducted to determine the technical and economical

viabilities of the new technology. The potential market penetration of (solar) desalination in the regional agriculture is explored through farmers' surveys, which aim at characterizing the brackish water irrigation sector and eliciting farmers' interest, willingness to pay and potential concerns regarding the new technology.

3. Results and Discussion - This paper will provide a general description of the study as well as the expected major technological outcomes. The paper will explore the design of the pilot desalination plants in Hatzeva and Karama as well as present first results from agronomic experiments conducted in Hatzeva with a range of crops including pepper, maize, and potato. The economic viability of the technology will be discussed in light of the collected information regarding the current agricultural practices in Israel, Jordan and Palestinian Authority, and based on the results of a pilot survey of Jordanian farmers. Overall, our findings support the notion that the introduction of solar-powered brackish water desalination may be a valuable strategy towards more sustainable water management practices in arid land agriculture.

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Characteristics of RDF using food waste by pyrolysis

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1. Introduction – The food waste is produced much above 30 % of domestic waste due to Korean food culture. The food waste is mainly recycled by composting, but the compost would be not consumed because of its quality and seasonal unbalance of supply and demand. Accordingly, RDF(Refuse Derived Fuel) of the food arise from a new alternative on food waste recycling. Pyrolysis could be preferred to drying for RDF of food due to its antibacterial, stock preservation and energy density.

Food waste was classified as 3 groups of grains, meats and vegetables, and changes of their 3 components, calories and atomic constituents was investigated according to changes of the pyrolysis temperature and detention time comparing with the dried food waste.

In this paper, we tried to examine the characteristics of RDF using the food waste for enhancing the recycle effectiveness of food waste

2. Experimental – Raw Samples in the experiment were boiled rice, Chinese cabbage and boiled pork. Raw samples were sliced within 1 cm dia., dried in the dry oven and then sintered in pyrolysis furnace under nitrogen supply. Pyrolysis conditions ranged in temperature 200-500 ℃ and detention time 0-60 minutes. The pyrolysis furnace was equipped with a nitrogen inlet, a sample vat, a pyrolysis reactor(to 1,100 ℃), a cooling apparatus and a gas burning unit. Samples were analysed in water and organic contents, calories, atomic constituents and others by the standard test method and analysers. .

3. Results and Discussion – Water content of the food waste range 62 – 87 % and organic content was high in order of vegetable, meat, and grain. Calories of dried samples were vegetable 3,800 kcal/kg, grain 4,200 kcal/kg, meat 6,100 kcal/kg. Grain and meat were high in calorie for RDF. Vegetable is highest in water content and lowest in calorie, so it is desirable to be recycled by composting and the by-product of food waste compost is supposed to be applicable to RDF.

Pyrolysis can enhance calorie and carbon content. Calorie increased to above 6,000 kcal in meat, about 6,000 kcal/kg in grain and above 4,000 kcal/kg in vegetable by pyrolysis. Also residuals of 3 samples also were similar and reduced to 30 % of dried samples. It was because vegetable had low organic, but high ash content compared to meat and grain of high organic content.

Pyrolysis was completed rapidly with shorter detention time according to increase of the sintering temperature. Since detention time to be needed in a pyrolysis temperature would be arrived,

calorie and residual is not nearly changed. And detention time was very short and pyrolysis was complete with short term. In 500 ℃, pyrolysis required about 10 to 15 minutes, and had been completed for 5 to 10 minutes since 5 minutes detention time.

4. Conclusions – RDF of food waste by pyrolysis could have the higher energy density to above 6,000 kcal/kg compared to the dried food waste. It makes enhance the value of the fuel with other merits such as antibacterial and preservation. Pyrolysis requires only about 10 to 15 minutes for completion. In addition , meat and grain of food waste have better characteristics for pyrolysis and vegetable would be desired to be composted.

5. Acknowledgement

This study was supported by the major project (2016-0120) of the Korea Institute of Civil engineering and building Technology (KICT).

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Integrated system of preventing the bulking of activated sludge in wastewater treatment plants - project outcomes

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1. Introduction

Activated sludge is a very efficient biological method successfully applied to wastewater treatment all over the world. However, some problems with proper exploitation may cause high ecological and economical costs. The most common is bulking of activated sludge caused by overproliferation of filamentous bacteria. Project No GEKON1/O3/214361/8/2014 realized by Jagiellonian University and Biospekt finansed by the National Centre for Research and Development (NCBR) and the National Fund for Environmental Protection and Water Management (NFEP&WM) is intended to application of an innovative, biological method of controlling the activated sludge bulking by usage of *Lecane* rotifers and development of the software BIOLAN for monitoring and management of purification process.

2. Experimental

Numerous experiments under laboratory conditions and in the wastewater treatment plants located in southern Poland were conducted. The huge number of biological and physicochemical analyses of the activated sludge samples were applied to BIOLAN software and will be used for optimization and adequate technological decision in the sewage purification process and management.

3. Results

To achieve the results of the project we found rotifer species which feed on filamentous bacteria and cultivate several clones of rotifers within two species *L. inermis* and *L. tenuiseta* which can complement between cold and warm season [1]. The mass *Lecane* rotifers culturing under laboratory is maintained at the efficient and economical level. Laboratory experiments shown that *Lecane* improve sludge settleability and sludge volume index without exerting any negative effect on chemical parameters of the effluent [2]. Furthermore, these rotifers were monitored in several wastewater treatment plants as a factor preventing high filamentous bacteria abundance. To integrate knowledge about activated sludge biology, physico-chemical parameters, plant

configuration and wastewater treatment technology we developed BIOLAN software which combines all the data in one easy-to-use computer program available by Internet.

4. Conclusions

Promoting *Lecane* rotifers growth in activated sludge and using them as innovative biological tools to prevent sludge bulking, seems to be economically reasonable and environmental friendly method for many wastewater treatment plants. Developed BIOLAN software will be a professional tool in controlling and improving the whole processes of wastewater purification.

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An Evaluation of Operation and Maintenance Costs of Wastewater Treatment Plants: Gebze Wastewater Treatment Plant Sample

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Abstract

Gebze Wastewater Treatment Plant (GWWTP), is one of the biggest wastewater treatment projects of Kocaeli Metropolitan Municipality, which is the leading industrial zones in Turkey, and it has been built to collect and treat domestic wastewater coming from a population of 670.000 living in Çayırova, Şekerpınar, Eskihisar, Darıca and Gebze settlements in city of Kocaeli. GWWTP has been designed to have a dry-air flow rate of 120.000 m^3/day and a wet-air flow rate of 144.000 m^3/day. The initial investment cost of the GWWTP project is $44.156.226,49 as of 04.11.2008.

The system is made up of pre-treatment, biological removal of phosphorus, denitrification through extended aeration, nitrification and final clarifier. In the plant, removal of many contaminants has been aimed, mainly that of Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD_5), Suspended Solids (SS), Nitrogen and Phosphorus. Approximate removal efficiency of COD, BOD_5, SS, Total N and Total P are determined to be %96, %93, %95, %88 and %70 respectively. As the treatment of the wastewater has been succeeded with the treatment plant, flow of wastewater into the rivers in the region has been prevented, as well.

Annual operation and maintenance costs of GWWTP consist of 4.000.000 Turkish Liras(TL) for personnel services, 11.000.000TL for removal and transportation of sludge services, 1.500.000TL plant maintenance services, 250.000TL for energy services, 100.000TL for laboratory services, 50.000TL for measurement services. Thus, the total

annual cost is 16.900.000TL. Unit wastewater consumption cost is 0,39 TL/m^3. Thanks to these costs, the water pollution is avoided by the treatment of wastewaters.

In accord with relevant national legislation and the standards declared in UN directives, treatment of the wastewater produced in the Gebze district is provided in order not to cause any harm neither on the environment nor on the public health. Decreases in costs can be attained by the convenient operation of the plant.

Key Words: Gebze Wastewater Treatment Plant, Operation cost, Biological treatment

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Different population growth among clones of rotifers *Lecane inermis* preselected to low temperature

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1. Introduction – Seasonal temperature fluctuations of activated sludge in wastewater treatment plants (WWTPs) have negative impact on proliferation and survival of *Lecane inermis* rotifers. The growth rate of the rotifers decreases with decreasing temperature. It was found that rotifers are important components of the activated sludge where they control filamentous bacteria proliferation. The aim of this study was to investigate whether culturing the rotifers for many generations at lower temperature can lead to selection of rotifers with higher growth rate at similar thermal conditions in comparison to clones cultured at higher temperatures.

2. Experimental - We used clones of *Lecane inermis* isolated from WWTPs and cultured in different thermal conditions for many generation. Clone LkV4 originating from Spain has been cultured at 20ºC for five years. Two other clones obtained from Polish WWTPs have been maintained at 8ºC (clone PŁC6) and 15ºC (clone 1.A2.15) for two years. Five separately isolated individuals were placed in each of the 8 wells of 24-wells tissue test plates (TPP), with 1 ml of spring water and 25 µl concentrated nutrition powder as a food source (patent pending procedure EPO EP 14731401.7). The procedure was repeated for each clone. The plates were kept in darkness at 8º, 15º and 20ºC. We counted alive individuals in each well on 3, 6, 9, 12 day of experiment and additionally on 18 and 24 day in case of 8º, and 15ºC due to longer period of acclimation. We used repeated measure ANOVA to compare changes in number of individuals during the experiment for each temperature separately.

3. Results and Discussion – The number of individuals at 8ºC depended on clone ($F=54.74$, $p<0.001$), and changed in time ($F=34.0$, $p<0.001$). There was an effect of interaction ($F=21.9$; $p<0.001$). At the beginning, the number of individuals decreased except for rotifers of LkV4 which number was decreasing throughout the whole experiment. Clone PŁC6 acclimated apparently earlier to this temperature than 1.A2.15 but the final population density was similar for both clones and reached 16.50 and 16.88 ind./ml ($p>0.05$) respectively. Origin of the clone ($F=10.3$, $p<0.001$), time ($F=1703.0$ $p<0.001$) and both factors interaction ($F=7.1$, $p<0.001$)

influenced the number of rotifers at 15ºC. Both clones 1.A2.15 (1691 ind./ml) and PŁ.C6 (1566 ind./ml) had higher population density than LkV4 ($p<0.001$, 787 ind./ml) but their abundance was similar on the last day of experiment. At 20ºC rotifers from clone PŁ.C6 had the highest abundance at the end of experiment with the average 2983 ind./ml while for 1.A2.15 it was 1887 ind./ml and in case of LkV4 – 1579 ind./ml. However, the differences were not significant.

4. Conclusions – The results show that it is possible to preselect clones proliferating at lower temperature. Such clones could be applied to WWTPs in a cold season as a potential consumer of filamentous bacteria and bulking prevention. Moreover, at the highest temperature both clones PŁ.C6 and 1.A2.15 selected to lower temperatures reached higher abundance in comparison to LkV4 which was selected at 20ºC.

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International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

Assessing The Relative Impact of an Urban Water Conservation Campaign

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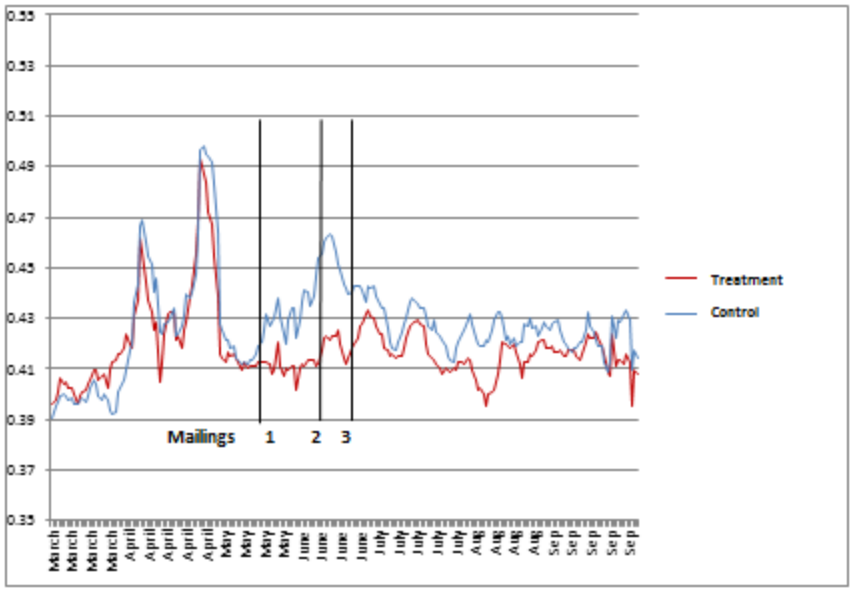
1. Introduction – Demand management is increasingly important in natural resource policy. Information and public awareness campaigns encouraging conservation are among the tools commonly used, especially in times of acute scarcity, such as droughts. However, during such periods, policymakers often use a mix of pricing and other economic incentives, along with a variety of regulations and use-restrictions, making it difficult to isolate and measure the effectiveness of the campaigns (or any one particular policy instrument).

2. Experimental - This study presents the results of a large-scale longitudinal field experiment, which involved a campaign encouraging water conservation among 1,000 households. By comparing daily household water consumption in houses receiving campaign materials to that in a control group of houses not receiving any, we were able to capture the effect of such a campaign. Because the daily monitoring covered a period of several months, prior to and following the campaign, we were also able to determine the duration of the effect of the campaign.

3. Results and Discussion - Results indicate that relative to the control group the intervention reduced water consumption by above 7.5% over a period of five weeks (See Figure 1). This relatively simple intervention was compared to common supply and demand management options (desalination and price increases) and found to be more cost effective than either.

Figure 1. Useful data



4. Conclusions – While it is often difficult to assess the impact of water conservation campaigns as they are generally implemented concomitantly with other conservation policies, this experiment demonstrates that they can be cost-effective, efficient means of addressing water shortages, especially for situations with short time frames.

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Investigation of Fruit Juices Industry Wastewater Treatment with a Membrane Bioreactor using Nanoparticles Coated Membrane

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1. Introduction-Membrane fouling which decreases permeability and increases energy consumption is still a serious problem in membrane bioreactor (MBR) processes which limits the widespread application of MBRs [1]. Over the last decade, several studies have attempted to prevent membrane fouling. However, recent studies have demonstrated that fouling cannot be prevented an easy way [2]. Concentrated fruit juice industries, almost all industries, use large-scale water for washing and fruit processing and consequently generating a wide volume of wastewater. Fruit juice wastewaters (FJW) must be treated properly for discharge into receiving environment. Biological treatment methods have been used to treat fruit juice processing industries wastewater because of high organic content [3]. The objective of this paper is to treat fruit juices industry wastewater applying MBR technology and prevent fouling of membrane coated with nano-sized silver (nAg) particles using three different methods.

2. Experimental- For the first method (M1-Ag), polyethersulfone (PES) membrane was placed in membrane module and nAg solution was passed through the membrane for 24 h. For the second method (M2-Ag), PES membrane was placed in a beaker using the same solution in M1-Ag, and beaker was stirred for 24 h at 25°C at 150 rpm. For the third method (M3-Ag), nAg was loaded to PES membrane in 0.1 mol L^{-1} L-ascorbic acid solution at pH 2 for 24 h at 25°C at 150 rpm. Neat PES and modified PES membranes were characterized using contact angle goniometer, scanning electron microscopy (SEM) and permeation tests. Anti-fouling performance was examined using activated sludge. In this study, laboratory-scale submerged MBR was used. A real activated sludge was used and cultivated in laboratory scale aeration tank treating synthetic FJW. The mixed liquor suspended solids (MLSS) of the sludge was about 4250 ± 350 mg/L. The MBR system was operated at SRT of 30 days. The HRT of the MBR was controlled during 24 h. 1600 mg/L organic loading rate (OLR) was applied.

3. Results and Discussion -Modified with M-1Ag/PES membranes contact angle decreased from 75 to 68°. The contact angle value of M-3Ag/PES membrane decreased from 75 to 37°. More hydrophilic membrane was acquired with M-3Ag/PES coating method. The results showed that M3-Ag had the best flux and anti-fouling performance among the nAg coated membranes. The

authors described this phenomenon like that Ag particles had low surface tension of pristine PES and so the water can easily spread on membrane surfaces.

4. Conclusions- Because of the increased hydrophilicity the best flux and antifouling obtained with M3-Ag.

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Simultaneous removal of phosphates and nitrates from water bodies by adsorption processes

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1. Introduction – Eutrophication of water bodies caused by the increased amount of nutrients has become a problem throughout the world [1]. This phenomenon is causing aquatic environment degradation, as well as serious problems for the use of waters, especially for purification processes [2]- [3].

Phosphorus is considered a key element accelerating eutrophication, leads to abundant development of aquatic plants and algae growth. This affects water quality directly through oxygen depletion which in turn, harmfully affects various species that inhabit the lake as microorganisms, invertebrates, fish and even insects growth. The high concentration nitrate in drinking water is the main cause of methemoglobinemia. The nitrate can be reduced to nitrite by intestinal bacteria stomach and pass blood, the oxidation of Fe (II) hemoglobin and methemoglobin production, unable to bind and carry oxygen to tissue**s** [4].

The purpose of this investigation was to study, at laboratory scale, different adsorption processes allowing to decrease phosphates and nitrates concentration in natural waters. The study was focus on the adsorption of these anions in three different adsorbent materials such as dolomite, hydroxyapatite and slag.

2. Experimental - Laboratory batch experiments were conducted in order to assess the performance of these adsorbents for removing totally o partially nitrate and phosphate from water bodies in agricultural regions. Synergism and antagonisms behaviour as well physical and chemical parameters were evaluated.

3. Results and Discussion - In this regard, the hydroxyapatite was the best absorbent for phosphate removal with a 1.2 mg / g of adsorbent while dolomite produced a clearance of 0.25 mg / g of adsorbent and slag from 0.13 mg / g adsorbent. In the case of nitrate removal, no significant differences for the adsorbents studied were achieved. In all cases the equilibration time was about 60 minutes. The presence of nitrate levels did not change phosphate removal in either study inference made.

4. Conclusions - Searching for systems that decrease the concentration of nutrients in water bodies is a good starting point for attempts eutrophication the problems, recovery affected water systems and water purification**.** In this sense, the hydroxyapatite was prove to be the most adequate adsorbent

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A study on Pyrolysis Characterization of Organic wastes; Forcus on energy conversion

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1. Introduction

Dumping of organic wastes in ocean was banned since 2015 based on the agreement of the London Convention. Therefore, as an alternative method of organic waste management, solidification, dry fuel reduction, incineration, composting, and lot of other research on land treatment and recycling (For example carbide) of these wastes has been carried out. However, organic wastes are juicy and prone to decay and create difficulty in processing, storage and ultimately their configuration in the biomass has also experienced some problems. In addition, organic wastes are also used as auxiliary fuel in cement kilns and thermal power plants for waste heat recovery (3,000~5,000 kcal/kg after drying). However, such a drying methods are not seen as efficient methods for long term storage of as it uses additional energy source for drying which entails for higher operational costs and high risk of spoilage and fire.

In this study, characterisation of organic waste and its intermediate products during pyrolysis is examined which focuses in generating stable carbon product which can be stored and used as an energy source.

2. Experimental

A. Characteristics analysis of sewage sludge and food wastes

- In order to understand properties of organic wastes, componential analysis, elemental analysis and heating value were studied.

B. Characteristics analysis of Pyrolysis products

- In order to understand properties of pyrolysis products, analysis of components, elemental analysis, heat value, and concentration of hydrocarbons were performed.

C. Pyrolysis treatment conditions

- Pyrolysis under nitrogen atmosphere, was carried out in a reaction time of 30 minutes to 1 hour at at the temperature range of 300 to 500°C

3. Results and Discussion

Result from this study illustrated the accumulation of heating value to 3,500~6,700 kcal/kg after pyrolysis treatment. Sewage sludge showed that dry heating value appeared at 3,500 kcal/kg, increased to 5,000 kcal/kg at the time of pyrolysis treatment. Gases produced during pyrolysis were found to be carbon monoxide, hydrogen, methane and nitrogen monoxide. Increment in pyrolysis temperature resulted in higher production of gas lowering the pyrolysis time.

4. Conclusions

The results show that through the pyrolysis treatment of organic wastes, it is not only possible to save the energy in managing food waste but also generate more secure and high-calorie energy.

5. Acknowledgement

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Electricity Generation from *Jatropha curcas* Oil Mill and Degradation of Phorbol Esters in Microbial Fuel Cell

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1. Introduction – *Jatropha curcas* has recently been the focus of intense research as a raw material of biomass fuel. However, the carcinogenesis promoter action of the phorbol esters in the J*atropha curcas* raises concerns for health and environmental risk [1]. *Jatropha curcas* oil mill is a kind of waste from *Jatropha curcas* biomass fuel process and also contains toxic phorbol esters. Thus, useful and safe managemnet of *Jatropha* oil mill is presently required. The purpose of the present study is to produce electricity from *Jatropha curcas* oil mill and degrade phorbol esters in the mill in microbial fuel cell.

2. Experimental - 200 g of *Jatropha curcas* oil mill and 100, 200 or 300 g of water was incorporated in a 500 ml beaker. Carbon cloth (60 x 60 cm, TR3 110M, Mitsubishi Rayon) was used for cathode and anode. A 47 ohm resister was connected between the electrodes. The microbial fuel cells are incubated at 25 degrees Celsius. Phorbol esters in the oil mill were extracted into methanol. The concentration of phorbol esters in the extract was analyzed by high-performance liquid chromatography (Prominence UFLC, Shimadzu) [1].

3. Results and Discussion - Changes on voltage of MFC is shown in Figure 1. The MFC with 200 g oil mill and 300 g water showed the highest voltage of 225 mV after 13 days of incubation. Other two MFCs showed low voltage outputs. The concentrations in phrobol esters are shown in Figure 2. Phorbol esters were degraded in MFCs after 21 days of incubation.

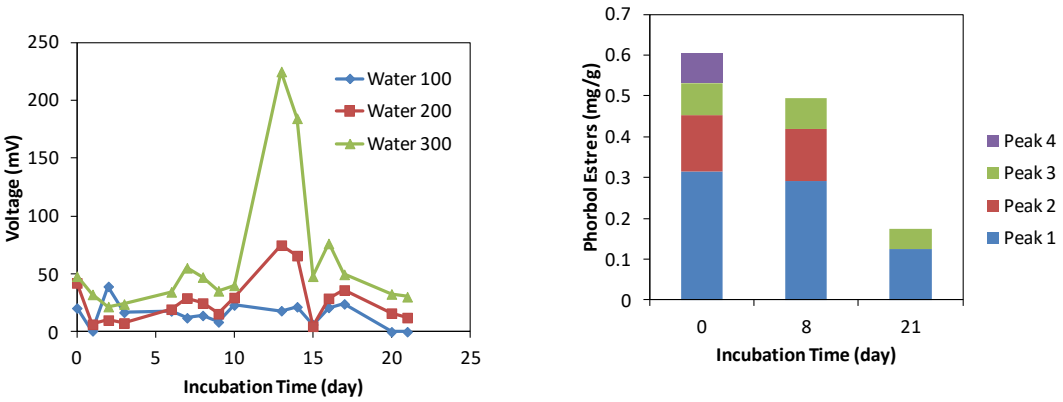

Figure 2. Degradation of Phorbol Esters in MFC

4. Conclusions - The main results are summarized as follows: (1) Electricity can be produced from Jatropha curcas oil mill in microbial fuel cell. (2) Phorbol esters in Jatropha curcas oil mill can be degraded in microbial fuel cell.

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Potential valorization as fertilizers of Humic Substances extracted from landfill leachate

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One of the most worldwide options for Municipal Solid Waste (MSW) treatment is landfilling. Although other options arise, several experts still support this option as the most adequate for this purpose. The wastes storage in landfill generates leachates that are a complex mixture of organic contaminants and water. During the wastes stabilisation process, the biodegradable fraction of organic compounds in leachates decomposes and refractory humic substances, mainly humic acids and fulvic acids are produced. These substances have a major role as fertilizers and land correctives, and may be applied in soils however its toxicity must be previously evaluated.

Taking this in mind, the leachates from 3 different landfills were characterized and fractionated, to understand the decomposition degree and to evaluate their potential as an agent for fertilization. Humic substances (HS) were extracted, quantified, chemical characterized and further fractionated in Humic Acid (HA) and Fulvic acid (FA). The phytotoxicity of HS, HA and FA solutions was evaluated on cress seed germination in order to study their potential valorisation as an agent for fertilization.

For the HS extraction from the leachates the methodology applied was the sorption with Amberlit XAD-8 resin, using sodium hydroxide and hydrochloric acid as eluents, after resin cleaning condition with sodium hydroxide, ethylic ether, acetonitrile and methanol. The HS fractionation in FA and HA was achieved by a selective precipitation process with pH control, using concentrate sulphuric acid. The aromaticity was assessed by electromagnetic absorption measurements in ultraviolet range. The phytotoxicity evaluation was conducted performing germination tests, using *Lepidium sativum* (water cress) as tested seed. This bioindicator was chosen due to its rapid growth and high sensibility to toxins. All the tests were performed with seven replicates with fifteen seeds, in Petri dishes with sterile filter paper humidified with 4 millilitres of the testing solution. Blank tests were also done. Some of the HS solutions were dialysed or diluted in order to decrease the electric conductivity to values lower than 3 mS/cm, while others solutions were used without any further treatment.

The HS concentration was similar for all the leachates evaluated and was higher than 750 mg/L of total organic carbon. All the leachates analysed registered higher FA concentration than HA. The chemical characterization indicated that HA had a relatively higher aromatic character than the FA obtained from same sources. These results suggest that the HS from landfill leachates were in an early stage of humification, once the degree of humification increase as the landfilling age increase. Overall, the HS extracts showed absence of phytotoxicity, with germination index greater than 80% for samples treated to achieve low electric conductivity values. This suggests that the HS from the leachate may be used to produce liquid organic fertilizers. Moreover, the conductivity is an important chemical parameter in the toxicity once the samples without treatment showed absence of germination.

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The LIFE programme – Over 20 years upscaling water, waste and energy management in the EU

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1. Introduction – The LIFE Programme is the EU's only dedicated funding instrument for the environment. The general objective of the programme is to contribute to the implementation of EU environment policy and legislation by co-financing pilot or demonstration projects with European added value. Since its beginning in 1992, LIFE has co-funded over 4 300 projects, aimed at reducing the impact of all human activities on the environment.

In the case of water, LIFE has helped develop new solutions for maintaining the quality and quantity of water resources, thereby significantly advancing the implementation of the Water Framework Directive (2000/60/EC).

Regarding waste, LIFE waste projects have been particularly successful in developing innovative technologies and methods for recycling specific waste streams as well as linking waste management issues to other environmental topics such as soil, air and water.

As for Energy, LIFE has supported progress on the supply and demand sides of the energy equation, making a significant contribution to the fight against climate change.

In terms of energy supply, LIFE has focused on the further development of green energy sources such as hydropower, solar, wind and geothermal. LIFE has made a particular contribution to the development of the biomass energy sector, notably through new approaches and technologies for exploiting waste biomass. LIFE projects have also targeted improved energy efficiency, especially in the construction, transport and housing sectors.

2. Project examples

Waste - POLYMIX demonstrated the feasibility of using polymers waste (PE, PP, PS and end-of-life tyres) in asphalt mixtures. The asphalt thus developed complies with European regulation. The project trials resulted in savings in the use of 60 tonnes of aggregate, emissions reductions and less waste going to landfill.

Water - UFTEC demonstrated the environmental and economic benefits of using direct ultrafiltration (UF) for the pre-treatment of wastewater. In particular, the tested technologies allowed a 48-82% reduction in the use of chemical reagents and improved pre-treated water quality in terms of fouling factor and microbiological parameters.

Energy – MOVEABLE HEPP developed a more efficient hydroelectric power plant that works in river weirs without hindering the natural ecosystem functions of river habitats. This is possible

thanks to its moveable components that are able to work at different heights and allow fish to swim. Compared to traditional technologies, the MOVEABLE HEPP technology produces 11% higher energy returns and reduces costs by 16%.

3. LIFE and the 3rd Int. Congress on Water, Waste and Energy Management - LIFE proposes:

- A presentation of good practices and technologies developed by LIFE on the themes discussed in this abstract: water, energy and waste.
- Should an exhibition be set up: a stand where our experts could provide information on the technologies and methodologies developed by LIFE projects and distribute our communication material which includes technical brochures, posters and other publications.

4. References

All the information provided in this abstract come from the LIFE Programme project database: http://ec.europa.eu/environment/life/project/Projects/index.cfm

International Congress on Water, Waste and Energy Management
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Effect of magnetic equipment on water quality and on agriculture

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1. Introduction – In the world and particularly in Tunisia, coastal and arid areas suffering from water quality problems especially those loaded with sodium chloride and also calcium carbonate. These problems affect networks and pipelines and on the plant and soil in agriculture.

To compensate in part to water salinity problem and soil salinization, various methods are put to the test, including the magnetic process.

In this context, this project is to illustrate and confirm the results of the magnetization of irrigation water through field tests and other laboratory.

Magnetic treatment of water is in fact based on the principle of the reorientation of the particles [2]. And salts such as the calcium carbonate precipitates out of solution as a slurry and can be easily removed from the system since it does not adhere to the walls of the tubes [1]. Thus, we come to reduce the amount of soluble salts in the irrigation water.

2. Experimental - The study was carried in agriculture sandy soil at Sectorial School in Vocational Training in Agriculture Agrume and Viticulture Bouchrik-Nabeul (Tunisia). The analyses are processed at Water Researches and Technologies Center Borj-Cedria Technopark (Tunisia).

The experimental device was randomized complete block design with three replications. In each block, the 2 treatments were randomly assigned to the 2 right and left sides of the greenhouse. The blocks were formed in the direction perpendicular to the length of the greenhouse. In each block, the same treatment was applied to 90 plants spread over two hills, each carrying two planting lines. In this work, some is treated and a control portion control.

The procedure measures the ion concentration of samples of the treated water. This is mainly water to a conductivity of 3.7 ms/cm^2.So to determine the state of development of the plant, we conducted the action of the leaf number, flower number, fruit number and yield.

3. Results and Discussion –

A clear difference between magnetized water and untreated raw water. Table I shows a slight variation of the ion concentration. Moreover magnetized water positively influences the number of flowers and fruits. The Table II and III shows that for the two treated magnetized lines (LM1-LM2), the number of flowers and leaves is higher than the number of irrigated rows from a raw water (LT1, LT2).

For the crop yield of strawberry, Figure 1 shows that for ten crops of fruits: the result is clear that the performance of plants irrigated by magnetized water is greater than irrigated with untreated water. performance magnetized cultures is greater than 44% on irrigated agriculture for raw water.

Table I. Comparison of chemical properties between raw water and treated water

[ ] (mg/l)	Raw water	Treated water
HCO3	203.6	192.4
Ca	234.4	222.4
Cl	666.46	671.18
Mg	428.75	402.6
SO4	420.25	313.13
NO3	36.8	51.3
K	254.65	284.03
Na	662.76	448.34
F	0.755	0.883

Table II. Average leaves on 10 randomly selected plants per block

Bloc i	LM1	LM2	LT1	LT2
18/02/2015	2	2.1	1.8	2.1
26/02/2015	3.1	3.2	2.4	3
05/03/2015	4.3	4.2	3.3	3.9
12/03/2015	5.5	5.4	4.1	4.9
19/03/2015	6.1	6.1	5.1	5.6
02/04/2015	7.2	6.9	5.6	6.6
10/04/2015	8.2	7.4	6	7.3

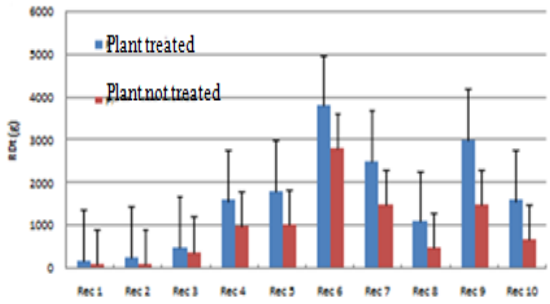

Figure I. Crop yield

Table III. Evolution of the number of fruits

Bloc 1	LM1	LM2	LT1	LT2
18/02/2015	4	5	1	4
26/02/2015	12	14	11	12
05/03/2015	28	29	29	18
12/03/2015	45	67	40	32
19/03/2015	55	80	50	41
26/03/2015	65	90	61	52
02/04/2015	85	136	80	62
06/04/2015	100	176	90	77
10//04/2015	112	194	104	81
13/04/2015	121	210	109	90

4. Conclusions - Irrigation strawberry crop with a magnetized water increases the performance of these plants and then returns. This can increase performance by 44% for irrigated with magnetized water compared to untreated water.

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Actually I lead a line of research 'Effects of magnetic equipment on the water and agricultural crops'.

I have written more than 15 articles in international journals and more than 25 papers at international seminars.

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From water to energy: characterization of urban and rural domestic consumptions

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In a time where resources scarcity and climate changes are concern issues, it is vital to develop research work that enables characterizing consumptions of different types of resources. Water and energy are essential purchases, and its rational use should be encouraged.

According to the literature review, water consumption directly affects energy consumption and are inseparably linked resources. This is the energy to water part of the water/energy nexus, increasingly highlighted as an important issue for future planning and strategic policy considerations.

It is well known that there are important differences between the water and energy consumption pattern in rural and urban areas, however these differences are not yet evaluated. This is an increasingly emphasised subject as an important issue for future planning and strategic policy considerations. In this work it is expected to do the design of a survey to be applied, where the main factors that influence water/energy consume will be researched. Taking into account that the typical load curves for both water consumption and energy consumption reveal that the periods of highest consumption values for energy and water occur at approximately the same time, the analysis of the factors that influence this relationship should be carried out. It is expected to identify some of the differences between rural and urban areas consumptions.

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Characterization of MSW rejected fractions to fulfill RDF requirements and utilization

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ABSTRACT

In order to fulfill European and Portuguese legal requirements, adequate alternatives to traditional municipal waste landfilling must be found namely concerning with organic wastes and others susceptible of valorisation. In this sense, waste management organizations are developing infra-structures, such as mechanical treatment operations to recover the biodegradable fraction from municipal wastes. From these operations, fractions of unwanted wastes arise. Otherwise, the selective collection of specific materials, like polymeric materials and its ensuing management, also lead to rejected fractions of wastes. That is, although specific fractions of household wastes can be valued, scraps are always produced that usually are disposed in landfills. These rejected fractions may also itself be valued through the production of refuse derived fuels (RDF) that may be used in specific industries. According to the Portuguese Standard NP 4486:2008, the RDF classification is based on three main parameters, namely: lower heating value (considered as an economic parameter), chlorine content (considered as a technical parameter) and mercury content (considered as an environmental parameter).

The purpose of this study was to characterize the rejected streams resulting from the mechanical treatment of unsorted municipal solid waste, from the rejected residual fraction from plastic municipal selective collection and from the rejected fraction from the composting treatment, in order to evaluate their potential as RDF.

To accomplish this purpose, in the present work, five sampling campaigns were performed. Previously, physical characterization of rejected streams was done, namely the content in food wastes, green wastes, wood, paper/cardboard, plastics (several plastic polymers), fabrics, glass, iron materials, aluminium, non

magnetic metals, inerts, electric and electronics, and a final class of others (not classified above). The chemical characterization embraced the proximate analysis – moister content, volatile matter, ashes and fixed carbon, as well as trace elements. To classify the possible RDF, the parameters established in the Portuguese standard were also evaluated: heating value, chlorine and mercury.

As expected, results show that the refused stream from mechanical treatment, the rejected from the composting treatment and from the selective collection are rather different in moister, energetic matter and ashes, as well as heating value and chlorine. Preliminary data allows us to conclude that studied materials have a very interesting potential to be used as RDF. In fact, the rejected from the selective collection has a heating value similar to coal. Thus, an important key factor should be the blending of these materials with others of higher heating values, after pre-processing in order to prepare fuel pellets with good consistency, storage and handling characteristics and, therefore, combustion behavior.

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Adsorption of heavy metals from aqueous solution using Dolomite

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1. Introduction – Water is a natural resource essential for life. However, despite its importance, water is one of the most underused resources. Also, industrial and wastewater discharges have contributed to the deterioration of the quality of water bodies available for vital activities [1]. It is a fact the increase of heavy metals and other pollutants in water and sediments, so some heavy metals like lead, cadmium, copper, chromium, and others become one of the major threats to human health [2]. In this context, it was performed the removal of lead, copper and chromium from aqueous solution through an adsorption process using a material available in Argentina, dolomite.

2. Experimental - The metals adsorption runs were carried out in the batch mode using a horizontal shaker at temperature level 25 ±1°C, pH of 7±0.2, and particle size between 73-54 μm. The metal solutions after contact with the adsorbent – under the predetermined dosage, concentration, pH, shaking speed and time – were filtered through filter papers (Whatman No. 40), and then analyzed for the residual adsorbate concentration using an atomic absorption spectrophotometer (Model 210 DGP). Each adsorption run was performed at least two times under identical conditions. The dolomite before and after each adsorption process was analyzed using a Fourier Transform Infrared Spectrometer under ambient conditions. The spectra were recorded from 4000 to 400 cm−1 using KBr window.

3. Results and Discussion - It was found that dolomite is a good material for the removal of metals studied, as in aqueous solutions containing lead between 200 and 500 $mg.L^{-1}$ removal percentage of 100% was achieved, 81% for copper removal to 65 ppm and 18% for a chromium solution with an initial concentration of 20 ppm. For the last result, a thermal treatment to the material could be added in order to achieve a higher adsorption percentage, so the study of this material and the kinetics of the process will be continued to better understanding the mechanisms. In examining the possible interference that might have the presence of copper in the adsorption of lead, it was found to be very low. Percentages above 95% working under the same conditions for individual removal system were obtained. From dolomite FTIR analysis, it was established that aliphatic and aromatic groups and the CO bonds of carboxylic acids and alcohols, would be primarily responsible for the adsorption of the studied metals.

4. Conclusions - From this study, it can be concluded that dolomite can effectively remove some heavy metal ions from aqueous solution under determined conditions of pH and temperature.

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Chemical recycling of PET waste and their use in high spec Polymers composites.

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1. Introduction – The main objective of this project was to development unsaturated polyester and alkyd resins from chemical recycling of PET waste, develop a new recipe and process to substantially improve the process of chemical recycling of PET waste in universal polymerization reactors to be used in Unsaturated Polyester and alkyd resins for later use in final applications of composite materials and coatings.

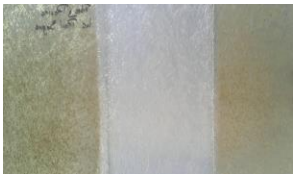

Image 1. fiberglass with different % conversion to chemical recycling

Typically the manufacturing process of resins based PET, in depolymerization step of PET, it is produced bis -hydroxyethyl terephtalate monomer (BHET) and typically is formed in 80-85% of conversion, which allows their use with acceptable cost in manufacturing resins with characteristics in final application of lower quality resins using pure terephthalic acid.

2. Experimental - The main experimental in first stage consisted of the development at laboratory, and pilot plant scaling formulations and processes to achieve high conversion of bis -hydroxyethyl terephtalate monomer (BHET) that allows turn achieve properties closer to the use of terephthalic acid. in the case of unsaturated polyester resin the second stage comprises adding maleic acid and glycols and continue the process until final specifications of the resin. And in the case of alkyd resin, the second step comprises the transfer of the product obtained to a polymerization reactor where has been positive monoglyceride of alkyd resin and continue the process until final specifications of the resin

3. Results and Discussion - The results obtained in pilot plant and industrial reactor indicate higher conversions to 93% at costs equivalent to the above process and to 95 % with a slightly higher cost having great benefit of the final properties of the resins , with standard processes and low cost .

In the final applications obtaining high quality products for segments of composite materials was achieved from unsaturated polyester resin and alkyd coatings. Getting new sustainable technologies with high quality and low cost in sectors such as automotive, reinforced plastic , construction, coatings, etc.

4. Conclusions - This project allows the development of a new recipe and process to produce Unsaturated Polyester and alkyd resins for later use in final applications of composite materials and coatings.

With this project we contribute to the development of high efficient chemical recycling of PET.

Final applications include automotive parts for buses, aircraft, vessels; prefabricated construction modules, sheets, reinforced plastic , construction, coatings, etc.

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Hydrogen-rich gas from gasification of refuse derived fuel

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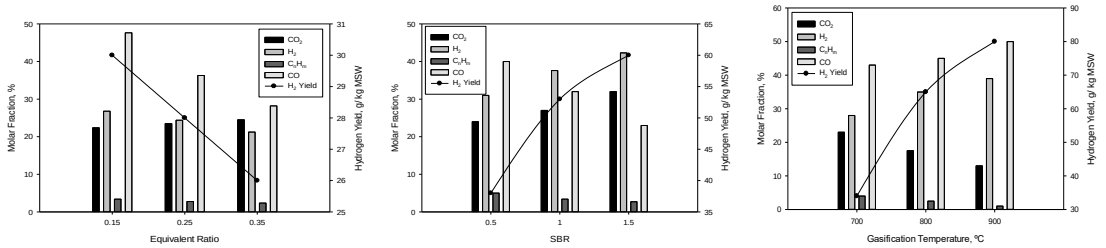
1. Introduction – A two-dimensional CFD model was developed in order to predict the gasification of refuse derived fuel (RDF). The model is based in an Eulerian-Eulerian approach to describe the transport of mass, momentum and energy for the solid and gas phases. The model is applied to a semi-industrial fluidized bed gasifier to full predict and analyze the viability of the hydrogen generation taking into account the equivalence ratio, steam-to-biomass ratio and reactor temperature. Conclusion could be drawn that the increase of equivalence ratio has a negative effect on hydrogen production because the oxidation reactions are favored. The introduction of steam to RDF gasification is favorable for improving hydrogen yield, because it increases the partial pressure of steam inside the reactor which favors the gas-phase reactions. Higher gasification temperature contributes to higher hydrogen content, because the main reactions of the gasification are endothermic and thus strengthened by increasing temperature.

2. Mathematical Model - A previously developed and validated two dimensional CFD model for MSW gasification has been used to predict and analyze the viability of the hydrogen generation from RDF gasification [1].

3. Results and Discussion - Figure 1 shows the influence of ER, SBR and temperature on H_2 yields. Gasification temperature and SBR shows to have a positive effect on hydrogen yield. On



the other hand, ER has negative effect.

4. Conclusions - The increase of ER has a negative effect on H_2 production because the oxidation reactions are favored when the reaction medium had higher contents of oxygen. On the other hand, the increase of ER has a positive effect on the reduction of tar content with increased gas yield. The use of steam as a gasifying agent results in the decomposition of hydrocarbons and increasing contents of H_2. The reactor temperature, since the main reactions of the gasification are endothermic, contributes to higher hydrogen content.

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Hydrodynamics of a pulsating flow in a desalination membrane

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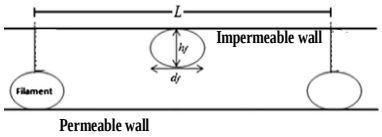
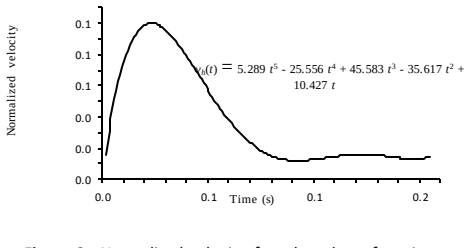
1. Introduction- One of the most serious problem inherent to the membrane separation processes is the accumulation of solute on the wall of the membrane with the consequent reduction of the permeate flux. In this research, the effects of a pulsating flow with the profile of a heartbeat on the hydrodynamics of feed channels of a desalinization membrane filled with spacers in zigzag arrangements and transverse to the flow were investigated.

2. Experimental - Numerical solutions were obtained with Fluent for pulsating laminar flows in channels filled with two different elliptical spacers (*F1, F2*) and two lengths (*L*=4 mm, *L*= 6 mm) of cells (Fig.1). Hydrodynamics was investigated for unsteady-state, using a characteristic function of a heartbeat, in order to study the influence of temporal variation in the hydrodynamic behaviour (Fig.2).





3. Results and Discussion - Figure 3 illustrate the velocity field for Re =100 and L = 4 mm when F1 and F2 are used for both impermeable and permeable cases. A comparison between impermeable and permeable cases shows that the maximum velocity decreases 0.2% and 3.1% for F1 and F2, respectively. This difference can be explained by the less useful area of permeable membrane to the F1 spacer. The reduction in the distance between the filaments of the spacers,

leads to the appearance of more active recirculation zones that can promote mass transfer and decreasing concentrations layers.

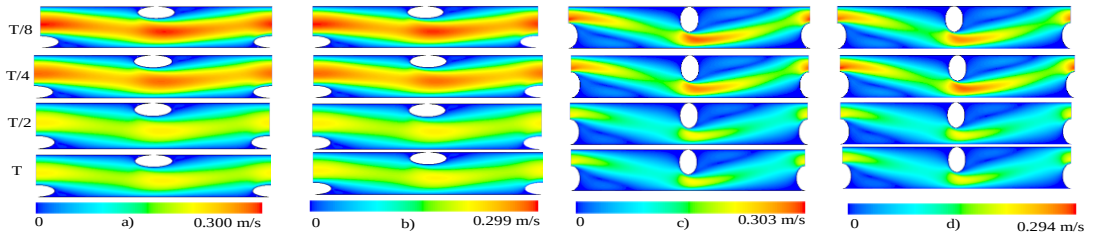


Figure 3 Velocity field during a period, for t = T/8, T/4, T/2, and T, and L = 4 mm for: a) $F1$ and v_p = 0 mm/s; b) $F1$ and v_p = 0.1 mm/s; c) $F4$ and v_p

4. Conclusions - This study suggests that the reduction of the inter-filaments length combined with the flow variation characteristic of a heartbeat can control the development of concentration polarization and thus reduce the probability of fouling.

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Chemical Pools of Sorbed Zinc in Sewage Sludge-Amended Soils

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1. Introduction – The sequential desorption of sorbed metallic trace elements is an important factor in determining anthropogenic metal availability in soils amended with sewage sludge. Although there have been several studies on the fate of zinc (Zn) in soils without amendments, few have examined the chemical pools of anthropogenic sorbed trace metals in soils previously amended with municipal sewage sludge (MSS). Viets [1] defined five distinct pools for micronutrients : i) water soluble, ii) exchangeable, iii) adsorbed, complexed and chelated species, iv) associated with secondary minerals and insoluble metal oxides, and v) associated with primary minerals. Other schemes of available forms have been proposed by several authors [2-6].

The objective of this experiment was to assess the distribution of sorbed Zn in soils amended with MSS among readily (soluble plus exchangeable Zn), moderately (sorbed and complexed Zn), and very weakly plant-available (chemisorbed or occluded Zn and precipitates) pools.

2. Experimental - Six Quebec (Canada) soils amended with increasing amounts (0, 5, 10 and 20%) sewage waste (pH 6.9) were investigated in the experiment: Des Crêtes sand (S1), St-Jude loamy sand (S2), St-Augustin loam (S3), St-Lambert silt loam (S4), Kamouraska silty clay loam (S5) and Ste-Rosalie heavy clay (S6). The soils were equilibrated with 25 mg/L of Zn as $ZnCl_2$ in 0.01 *M* $CaCl_2$ for 48 hours at room temperature. After the sorption step, the soil samples were sequentially extracted [4] with 0.05 *M* $Ca(NO_3)_2$ (Zn-Ca), 0.1 *M* $Mg(NO_3)_2$(Zn-Mg), 0.0005 *M* DTPA-0.1*M* TEA-0.01 *M* $CaCl_2$ (pH 7.3) (Zn-DTPA), and 0.1 *M* HCl (Zn-H).

3. Results and Discussion - Desorption of the sorbed Zn increased with an increase in MSS content. The plant-available Zn pools were found to be of the order $Ca(NO_3)_2 + Mg(NO_3)_2$ < DTPA < HCl. The highest strongly bonded Zn pool (Zn-H) was in soils with the highest silt+clay contents (S4, S5 and S6). The three fine-textured soils contained 2.2- to 3.7-fold Zn-H than the coarse-textured soils (S1, S2 and S3) indicating that a large fraction of sorbed Zn is strongly retained in fine-textured soils.

Easily available Zn pools (Zn-Ca + Zn-Mg) correlated negatively and significantly with initial soil pH (r = -0.86* to 0.88*) and silt+clay contents (r = 0.81* to 0.83*), suggesting that soils with high silt+clay contents have high retention capacity of sorbed Zn. The high Zn-Ca and Zn-Mg values (33 – 61 mg/kg and 13 – 31 mg/kg, respectively) are evidence of a potential risk of Zn mobility in the coarse-textured soils.

4. Conclusions - (i) MSS provide sorption sites that have a strong affinity for Zn, (ii) fine-textured soils amended with MSS have a high Zn fixation, and (iii) both soil texture, especially silt+clay content, and soil pH are the main factors controlling anthropogenic Zn desorption in the MSS-amended soils.

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The assessment for SRF quality with inclusion of bulky waste and disposable plastic bags in South Korea

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ABSTRACT

The Korean government has decided to introduce a mandatory of Renewable Portfolio Standards (RPS) since 2012. Therefore, the renewable energy market is expected to expand significantly. Since the 1960s, Seoul city has showed the highest population growth with economic development and urbanization. The amount of municipal waste is proportional to the population and the use of disposable plastic bags and bulky waste has also increased. The purpose of this study is to investigate the applicability of the inclusion among bulky waste and disposable plastic bags based on Korean solid recovery fuel (SRF) standards. Moreover, energy potential of SRF generated in this study has compared to bituminous coal. For the first time, the district with representative was selected in Seoul; 1. the district with average amount of bulky waste generation in Seoul, 2. the district with systematic facilities for treatment bulky waste in Seoul. As a result, the Dongdaemun district has been selected as representative of Seoul. In Dondaemun district, scrap metals, wood, and sponge dismantled by hand have been recycled, and inclusion materials which are difficult to classify have been incinerated in present. In the result of physical properties for inclusion, wood was the most as 83.6%, and the combustibles that related with energy potential were ranged around 65.11~88.94%. Element analysis for inclusion showed that oxygen content was the highest as 46.47%, while carbon content was the highest as 81.25% when inclusion was mixed with disposable plastic bags. The concentration of SOx calculated theoretically is that a very wide range appeared to 16.31~92.21 ppm. The heavy metal analysis based on 'Korean Waste Management Act' was performed to confirm whether the inclusion would be classified as hazardous waste. As a result, Cd and As have not been detected, but Cu, Pb, Hg, and Cr^{6+} have been detected. However, the concentration of 4 heavy metals detected was less than the standard, so that the inclusion would be applied as raw materials for SRF. According to the 'Korean SRF quality standards', the water content has not to be more than 25% but only one sample exceeded the standard. This result could be caused by rainfall, it is expected to block with roof or other protection systems. In addition, the low calorific value was shown as 3,893~4,213 kcal/kg, it is satisfied with the Korean SRF quality standard. The other analysis parmeters for inclusion with the standard have also been satisfied. The ratio with 3:7, 5:5, and 7:3 (inclusion to disposable plastic bags) was suitable for using the raw material of SRF. The energy potential which is the most important factor for fuel was tended that the adding portion of disposable plastic bags was depended on increasing low calorific value. Eventually, the ratio of inclusion to disposable plastic bag has been the best case in 6:4, and the low calorific value has been measured about 5,950 kcal/kg as this case. Through the above results, it is verified that the inclusion and disposable plastic bags can be utilize with SRF for renewable energy.

Keywords: SRF (Solid Recovery Fuel), RPS (Renewable Portfolio Standards), Bulky waste, Disposable plastic bags

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A case study on water conditioning and corrosion remedy of thermal power plants in river Damodar basin in eastern part of India

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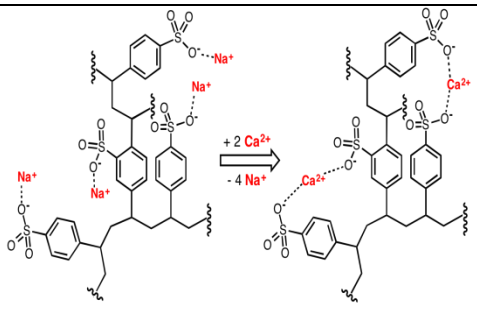
Abstract: A large amount of water is purified by ion exchange method. Cation and anion exchanger resins are used to remove the dissolved salts from water. Insoluble silica is removed by blow down process. Boiler corrosion is reduced using purified water in thermal power plant. Chemical analysis and proper treatment is done for conditioning the water for optimum power generation and to avoid the corrosion. Different parameters of raw water like; insoluble or suspended matter, conductivity, pH and hardness are controlled depending on the variable data in different seasons. To avoid the corrosion in boiler and to long term power generation (life time of generation) of thermal power plant, purified demineralised water is used as makeup water each and every moment. This water treatment is done by some chemical method followed by proper maintenance of boiler using some special chemical treatment.

Introduction

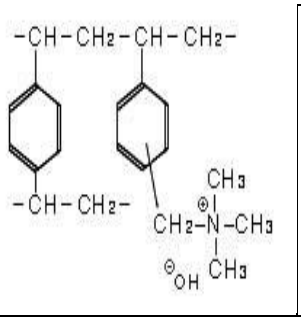
A large number of major industries are situated in the bank of Damodar River in Easter part of India, among them thermal power plants are major because good quality of coal and water are available. A huge amount of purified water is essential for power generation in thermal power plant and to reduce the corrosion. Chemical analysis and proper treatment is done for conditioning the water for reasonable power generation and to avoid the corrosion. Different parameters of raw water like; insoluble or suspended matter, conductivity, pH and hardness are controlled depending on the variable data in different seasons. To avoid the corrosion[1,2] in boiler and to long run power plant for power generation, purified demineralised water is used as makeup water each and every moment. Organic polymer based cation and anion exchanger resins[3-6] are used to remove the dissolved salts. This water treatment is done by some chemical method followed by proper maintenance of boiler using some special chemical treatment. The main parameters pH and Hardness (conductivity) of boiler water is maintained at 8.2-9.1 and 0.1 - 0.5 µS/cm respectively for better efficiency of thermal power plant.

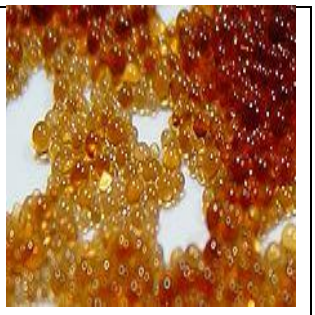
Experiment

Water soluble salts are arrested by cation and anion exchanger resin (a polymer insoluble in water) and kept in different cylindrical vessel with specially designed systematic way. The parameters like pH, Conductivity, Silica, Sodium, Dissolved CO_2, Phosphate and Chlorides are maintained as desired by corrosion controlled norms[1,2].



Structure and role of cation exchanger resin





Structure and role of anion exchanger resin

Result and discussion:

The water insoluble resin arrests the dissolve cation (mainly Na^+, Ca^{2+}, Mg^{2+} etc) and anion (like Cl^-, SO_4^{2-}, NO_3^-) in water by electrostatic force of attraction and after saturation it is regenerated by using dil H_2SO_4 and NaOH solution and become active for further removal of same. If and

when hardness and silica contain reach or cross the limit then blow down is done to reduce the hardness. Another parameters like pH and dissolve oxygen are controlled by using sodiumhexametaphosphate and hydrazine. Dissolve CO_2 (H_2CO_3) is removed by mechanical process to avoid consumption of chemicals or resin over load.

Conclusion:

To reduce the thermal power plant corrosion pH, hardness of water, dissolve oxygen and silica contain are controlled by removing soluble and insoluble salts in water. Organic resin caring sulphonic acid and quaternary amine are active to arrest the cation and anion, are suitable to remove the soluble salts and are regenerated for further use.

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Sonochemical degradation of food dyes in the presence of ZnO and H_2O_2

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1. Introduction - Food dyes have been increasing concerns on the high concentration of dye effluents from food industries wich are potentially harmful if discharged into aquatic environnement [1].

Sonocatalytic degradation is considered as a new technology for wastewater treatment. Phenomena of acoustic cavitation can be achieved by introducing ultrasonic waves with a frequency range between 20 and 1000 kHz into the water. Catalysts are added into the ultrasonic reaction system to reduce the activation energy so that the reaction can be accelerated [2, 3].

2. Experimental - The sonolysis of food dyes in aqueous solution was performed at 37 KHz using ultrasonic power of 60 W and aqueous temperature of 25°C within 60 min. The ZnO is used as a catalyst to assist the sonication process.

The effect of experimental parameters such as pH, H_2O_2 concentration and initial dye concentration on the reaction were investigated.

The structure and morphology of the catalyst ZnO nanoparticles were investigated using XRD.

3. Results and Discussion - It was recognized that in lower pH values the dye removal rate decreased. However, dye removal increased via increase in H_2O_2 concentration and lowering the initial dye concentration.

Kinetic studies revealed that the degradation process followed behanjady model with the high correlation coefficient for 50 and 10 mg/L for food dyes under experimental conditions.

4. Conclusions - The results proved that the new US/[ZnO]/[H2O2] process is capable of decolorizing acid food dyes. The results showed that power ultrasound can be regarded as an appropriate tool for degradation of food dyes.

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International Congress on Water, Waste and Energy Management
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Characterization Physical and Chemical of Storm Water and IMPACT of the Polluant on Receiver Environment

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Abstract

Rainwater will wash the surfaces on which it flows and also erodes the materials of surface. The contaminants may be either dissolved or be attached to the particles entrained by water. Streaming of rainwater on surfaces causes contamination in organic and inorganic micropollutants.

The aim of this work is to assess the quality of rainwater and also to highlight the impact of stormwater on the receiving environment while confirming the heterogeneous nature of these waters.

Rainwater is now recognized as a substantial source of pollutants to receiving waters. For that, different samples were collected from several sites to assess the concentration of pollutants in these waters. Increasing of pollutants concentrations depends of multiple factors: rainfall intensity, importance of streaming, nature of the material of surface, nature of activities on or near the surface.

Characterization carried on the analysis of physical and chemical parameters such as pH, electric conductivity, COD, BOD, toxic metals and ions of orthophosphate, sulfates, nitrates, nitrites, ammonium, potassium, calcium, magnesium and sodium. Descriptive analysis of physical and chemical parameters showed that waters are acidic and have very high concentrations of nitrite and metal ions above the potability standard.
Analyses are performed by UV-Visible spectrophotometry, flame spectrophotometry and atomic absorption.

Keywords: Pollution parameters, physical and chemical analysis, runoff, streaming.

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Design of small scale Hybrid Solar Wind RO-MSF Desalination System

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1. **Introduction –** Iran has desirable condition in terms of solar and wind energy and also is faced with shortage of fresh water resources. Hybrid solar wind RO-MSF desalination system that works with two clean and renewable energy resources of solar and wind, could be a sustainable resource for producing water.
2. **Results and Discussion** – Hence, in this paper for evaluating the performance of salty water desalination by hybrid RO-MSF desalination plants, this system is designed and the parameters of system is evaluated. Hybridization of Ro and MSF systems with two renewable energy resources of wind and solar were led to an increase in reliability, flexibility of system and was decreased the cost of produced water. In other words, water can be produced during the day time. Also quality of produced drinking water increase by mixing the Ro and MSF production. Thermal solar collector and MSF and RO systems and other required elements were designed. Mathematical modelling of desalination part of system (RO and MSF) was done by comparing the 6 different models of arrangement and all calculation was done in MATLAB software, one model of Simple RO-MSF, two models of Integrated RO-MSF, and three models of Integrated RO-MSF with heat rejection part. The 25 lit/h was chosen for entrance water to each model. Then these parameters are calculated: entrance saline water to RO and MSF, quantity of brain water, temperature of brain water, salt concentration of brain water, quantity of fresh water and the price of fresh water of each model. These parameters compared.

4. Conclusions - The best model was chosen. Then the other part of system arrangement (collector, solar photovoltaic panels and wind turbine) was designed and the best capacity of collector, solar photovoltaic panels, and wind turbine were chosen. Finally calculation of system yield were done based on chosen mathematical model.

Keywords:

Solar energy, wind energy, desalination of salty water, reliability, hybrid desalination system.

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Commissioning of Surface-flow Constructed Wetlands Dominated by Cladophora to enrich the Nutrients in diffuse domestic effluent

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1. Introduction To remove more nutrients in diffuse domestic effluent (DDE) discharged into Taihu lake to alleviate the eutrophication, microcosm surface-flow constructed wetlands (SFCW) dominated by cladophora was applied to concentrate nitrogen, phosphorus and inorganic carbon in the effluent from a sequential anaerobic/ aerobic reactor which widely used to treat DDE around watershed of Taihu lake in Jiangsu province of china.

2. Experimental Determination of fresh weight of cladophora and removal mass of nutrients including total dissolved nitrogen (TDN), total dissolved phosphorus (TDP) and total inorganic carbon (TIC) to calculate cladophora biomass and nutrient loading rates (NLR). The commissioning under flow rate of 10.8 m^3h^{-1} lasted about 70 days experienced 4 sequenced stages, breeding stage, growth stage, concentration stage, and decomposition stage, characterized by the range of cladophora biomass, 0～1.17g/L, 1.17～3.28g/L, 3.28～7.84 g/L and more than 7.84g/L. Microscopic morphology of microbes inhabited in cladophora assemblages for every stage also present in this paper.

3. Results and Discussion NLR tests indicated that maximum concentrating efficiency of nutrients appeared in the concentrating stage while TIC decreased to 0 mg/($g^{-1}d^{-1}$) earlier than TDN and TDP. NLRs correspond to Biomasses on dash line illustrated the slight stimulus of dilution of cladophora on nutrient removal capacity of SFCW by doubling water depth. More than 2×10^{10} spirilla were harbored in the microcosm SFCW during decomposition stage.

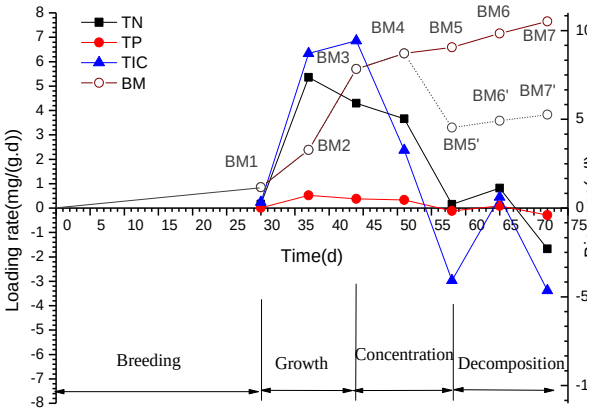

Fig 1. Cladophora biomass and nutrients loading rate during commissioning

4. Conclusions Commissioning of SFCW dominated by cladophora to concentrate the nutrients in diffuse domestic effluent indicated that good water quality can be achieved when SFCW being maintained in early or intermediate period of the concentrating stage.

5. Acknowledgements This research has been supported by the National Twelfth Five-year Major Projects (No. 2012X07101-005).

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Self-healing potential of activated sludge suffering from bulking

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1. Introduction

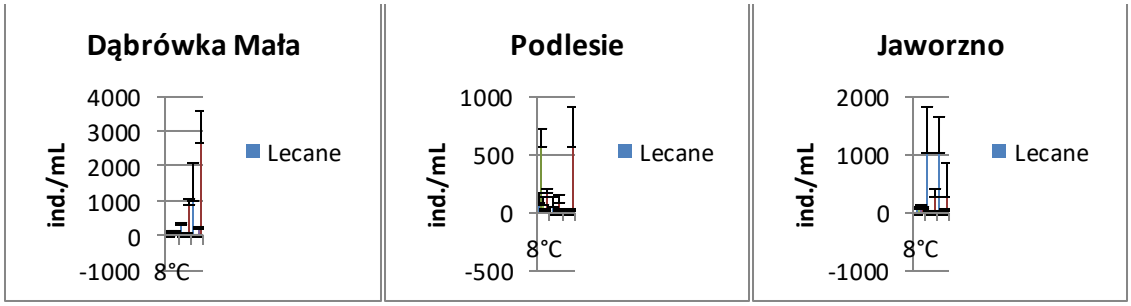
Wastewater treatment plants (WWTPs) in temperate zone commonly suffer from bulking of activated sludge, which is caused by filaments over proliferation. Control methods are limited to the usage of expensive and not always effective chemicals. Recently it was discovered that rotifers and testate amoebae are able to effectively reduce filamentous bacteria abundance. The aim of our study was to assess if it is possible to liberate self-healing potential of activated sludge by control of the process parameters.

2. Experimental

Activated sludge samples were taken in early spring from three different WWTPs in Poland. Each sample was divided into four subsamples per temperature: 8ºC, 15ºC and 20ºC. The experimental tissue culture plates were incubated in test chambers for three weeks to allow slow-growers to proliferate. Then we took thoroughly mixed subsamples from each well and counted the number of testate amoebae and rotifers belonging to Bdelloidea, *Lecane*, *Proales* and *Cephalodella*.

3. Results and Discussion

After three weeks of incubation in every subsamples the abundance of the most effective filaments-grazers: rotifers and testate amoebae was high enough to potentially control filamentous bacteria. They achieved the highest density at 20ºC. At 8ºC all studied groups were represented.



The common practice preventing sludge bulking is shortening of sludge age according to the hypothesis that filamentous bacteria proliferation is favoured by low loading of activated sludge. In this way slow-growing organisms, potentially able to reduce filamentous bacteria, are washed out of the system with the excessive sludge.

4. Conclusions

Our results shows that activated sludge has self-healing potential hidden in its inhabitants such as rotifers and testate amoeba. Usually, their abundance, especially in winter season is too low to effectively control filaments. Adjustment of sludge age to temperature-dependent growth rate of filamentous grazing organisms could be a procedure easy to implement to ovecome bulking problem..

Research founded by GEKON1/O3/214361/8/2014

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A Fuzzy Collaborative Intelligence Method for Forecasting Domestic Water Demand in Taichung City of Taiwan

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1. Introduction – Domestic water usage is one of the most important part of urban water consumption. Most of the existing methods apply feedforward neural networks to forecast the water demand in urban areas [1]. However, it is seldom that the water demand forecast is equal to the actual value, causing difficulties in making the related water management plans. To tackle such difficulties, fuzzy collaborative forecasting methods are an effective means. A common characteristic of fuzzy collaborative forecasting methods is the establishment of an interval forecast that is guaranteed to include the actual value. Such a characteristic is crucial to various planning purposes because it reduces the risk of incorrect forecasting [2]. The procedure for implementing the proposed methodology can be decomposed into eight steps (Image 1). First, a group of experts from related fields such as Taichung City Government, Taiwan Water Corporation, and departments of hydraulic engineering, is formed. Each expert must express their tolerance of the uncertainty of the water demand forecast on the left-hand and right-hand sides. Subsequently, these tolerances are incorporated into a fuzzy back propagation network approach [3] to forecast the domestic water demand in Taichung City.

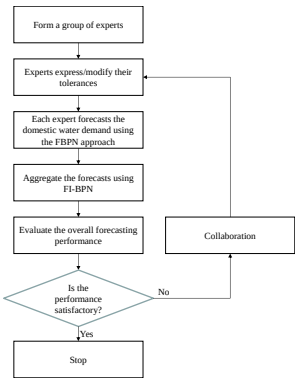

Image 1. The proposed methodology

2. Experimental - To demonstrate the application of the proposed methodology, the real data of the domestic water demand in Taichung City of Taiwan were used. Three experts from Taichung City Government, Taiwan Water Corporation, and departments of hydraulic engineering were invited to forecast the domestic water demand collaboratively. The forecasts were aggregated and defuzzified.

3. Results and Discussion - Three performance measures of the forecasting accuracy were considered: root mean squared error (RMSE), mean absolute error (MAE), and mean absolute percentage error (MAPE). Some existing methods were also applied to the collected data for a

comparison. The forecasting accuracy achieved by applying these methods were recorded and compared in Table I.

Table I. Performances of various methods

Method	RMSE	MAE	MAPE
Regression	0.118	0.104	8.2%
Feedforward neural network	0.146	0.115	9.3%
The proposed methodology	0.109	0.085	6.4%

4. Conclusions - The accuracy of forecasting the domestic water demand, measured in terms of MAE, MAPE, and RMSE, using the proposed methodology was significantly better than those of the existing methods.

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Effect of waste bricks powder on the rheological and mechanical properties of cement blended

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1. Introduction – Application of recycled materials in the building industry is essential for permanently sustainable development of a country. The mostly recycled materials come from the recycled waste of bricks, concrete, mixed construction waste, various types of aggregates and soil. Large amount of waste brick are produced annually. Environmental impact can be reduced by making more sustainable use of this waste. Therefore, utilization of waste bricks as a partial cement replacement in the production of new materials will help to protect environment. This strategy will have the potential to reduce costs, conserve energy, and waste minimization. Moreover, the use of mineral admixtures improves the rheological and mechanical properties of the mortar and concrete [1, 2]. In this work, effect waste bricks powder (chamot) as a partial replacement of cement ranging from 0%, 10%, and 15% to 20% by weight of cement on the rheological properties of cement pastes and 10% on the mechanical properties of mortar is analyzed.

2. Experimental - The materials used in this work are a CEM I 52,5 cement, a superplasticizer (SP) as high water reducer based on a polycarboxylate and phosfonate modified and waste bricks powder. To measure rheological properties of cement pastes, a high-accuracy vaned rheometer AR2000 was used. The rheological parameters such as shear stress, viscosity, compliance, loss and storage moduli have been evaluated by means of the flow test and the oscillatory and creep tests [3]. In the flow test, cement paste was shared by applying a sweep stress from 0 to 200pa within 2 min. During the creep and oscillatory testing, the 0, 03 Pa stress-controlled mod was used. Moreover, two formulations of mortars were performed containing 0% and 10% of waste bricks powder. For each mixture, three prismatic specimens of mortar (40x40x160 mm) were cast in steel moulds, stored in the water curing at the room temperature of (20°C ± 2°C) and were performed to compression and tensile bending tests at maturities of 1d, 3d, 7d, 14d, 21d and 28days.

3. Results and Discussion - The mineralogical composition of the chamot shows that these crystalline mineral phases are anorthite, illite and quartz, indicating the presence of amorphous materials. The chemical composition shows that it contains a high rate of silica compared to that of cement. This can increase the formation of hydrated calcium silicate C-S-H witch increase the mechanical strengths. Moreover, the rheological behaviour is strongly dependent on the chamot replacement rate. It improves the flowability because of the decreasing of shear stresses over those the control paste and exhibits a viscous behaviour of the cement pastes. In creep, the viscoelastic liquid and viscous liquid behaviour of pastes containing the chamot are highlighted compared to viscoelastic solid behavior of the control paste. In addition, the chamot increases the compressive and flexural strength of mortar approaching without exceeding that of the

reference mortar at different ages above 28 days. But especially at 28 days, the flexural strength increases and exceeds that of control mortar. This is explained by the continuity of the pozzolanic reaction.

4. Conclusions - The replacement rate of 10% of chamot is an optimum for better rheological and mechanical behaviour. This encourages the use of waste bricks powder as component for a high performance concrete designated for industry.

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Scientific CV

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Oil water separation using superhydrophobic steel mesh

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1. Introduction – Oil spills have greatly influenced the environment and ecosystem of oceans [1]. Besides the prevention of oil spills, a more realistic way is to separate oil from water using superhydrophobic mesh and hence to purify the ocean systems. Fabrication of artificial superhydrophobic surfaces is inspired by a lotus leaf, where water is able to travel freely without staining the surface, and to remove the dirt easily to make the lotus leaves dry and clean [2]. In this work, a superhydrophobic surface was developed on steel mesh substrates for oil water separation, that is, oil would go through the mesh while water was stopped. Copper chloride aqueous solution was used to etch the surface roughness of the steel mesh followed by the reduction of surface energy with Sylgard 184-chloroform solution. The average oil water separation rate of this superhydrophobic mesh was more than 96%.

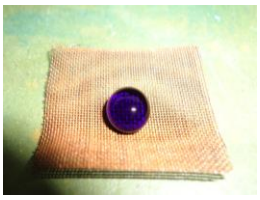

Image 1. Water droplet (dyed blue) beads on superhydrophobic mesh

2. Experimental - A mixture of random amount of cooking oil and water was poured onto the superhydrophobic mesh, a container was positioned under the mesh to collect the oil that was separated from the mixture. The collection rate was calculated as the percentage of the mass of collected oil from the poured mixture. The average oil collection rate was calculated from 15 repeated separations.

3. Results and Discussion - A water droplet beaded up on the prepared sueprhydrophobic mesh that stops water going through as shown in Image 1. However, cooking oil with a lower surface tension would easily travel through a superhydrophobic mesh. Table I shows the datasheet of oil water separation.

Table I. Datasheet of oil water separation. The separation rate = oil collection (g)/oil (g) × 100%

Round	11	12	13	14	15	16	17	18
Oil (g)	20.64	15.99	13.27	13.6	8.94	8.46	7.76	8.42
Water (g)	7.95	12.54	11.6	15.35	7.39	6.42	9.18	11.62

Oil collection (g)	20.31	15.5	12.69	13.37	8.53	7.97	7.53	8.11
Separation rates	98.40%	96.94%	95.63%	98.31%	95.41%	94.21%	97.04%	96.32%
Round	19	20	21	22	23	24	25	Average
Oil (g)	10.34	9.14	7.27	8.2	9.42	15.05	10.83	
Water (g)	7.32	12.06	11.59	10.48	14.5	11.24	12.78	
Oil collection (g)	9.86	8.74	6.86	7.72	9.06	14.63	10.71	
Separation rates	95.36%	95.62%	94.36%	94.15%	96.18%	97.21%	98.89%	96.27%

4. Conclusions – a simple copper chloride solution etching method followed by Sylgard 184 treatment was used to fabricate superhydrophobic steel mesh. The superhydrophobic mesh had an oil water separation rate more than 96%. This oil water separation method has great potential applications of cleaning up oil spills on ocean surfaces.

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[2] W. Barthlott, C. Neinhuis, *Planta* 202, (1997) p. 1.

Scientific CV (optional)

Mr. Yao Lu is currently a doctoral candidate from UCL Chemistry Department in the UK, under the supervision of Prof. Ivan Parkin and Prof. Claire Carmalt. He is interested in fundamental and practical research of nature inspired functional materials with extreme wettability, such as superhydrophobic, superhydrophilic and slippery liquid infused porous surfaces. To date, he has published 41journal articles, 2 conference proceedings and has 3 patents granted (H index: 13 on google scholar).

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International Congress on Water, Waste and Energy Management
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Modeling of a new model of drinking water treatment

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1. Introduction –The important role of settlers in the significant reduction in the rate of suspended solids in any treatment plant is well established.

The water treatment station in Chaiba intended for drinking water supply (AEP) of the city of Annaba and its capacity region of 1000 l / s shows a remarkable drop in its performance especially that of decanters pulsator kind.

Indeed performance decanters of the said station increased from 80% to 50% generating an abnormal clogging of sand filters whose washing frequency from 72 to 20 hours.

This issue to incite undertake the search for a technical solution scale model designed to give these decanters better performance.

Several tests were carried out on the model of the decanter the Chaiba station, one modifying each time the configuration of the slats namely the inclination angle, the spacing between the plates and their width.

According to these tests the maximum performance of the model of the decanter is obtained by using s trips with a width of 8 cm with a spacing of 7.5 cm between them and an angle of 40 ° of inclination.

2. Experimental –test equipment consists of:

1- the water supply pipes from the decanter real mixer model (if the current turbidity 22 NTU) and the volume of the mixer 1000 to the decanter model (if turbidity 450 NTU)

2- a pump capacity (Q = 5 l / min to 40 l / min) with their accessories (valve) for the flow control.

3- and Pulsator kind decanter reduced model built in safety glass scale (1/20)

4- initial dimension of plates (L *) = (91 * 12.50) cm² (first position) in the real equivalent to (18.20 * 2.50) ², it is constructed of sheet metal, it are the sum of 14 plates puts with an initial spacing of 5 cm and of size (38.5 * 12.5) cm² equivalent to (7.70 * 2.50) ² (second position)

5- a vacuum cleaner with an electrical control for adjustment of operating time.

6- A non-return valve for the purposes of the atmospheric pressure in the bell.

7- hub mud siphoning hoses.

3. Results and Discussion– The best performance efficiency model of the lamellar decanter Pulsator is given w ith the following parameters:

• angle of inclination of 40 °
• spacing of 7.5 cm plates
• width of the plates 8 cm

4. Conclusions– the idea of combining a lamellar arrangement of the existing pulsator clarifier has a real improvement in performance of the latter knowing that all tranquilisations right now are broken, or even nonexistent.

5. References–

Thesis Daniel Mathieu François DUFRESNE
Memory study end Pierre TANGUY

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Novel FeCuC aerogel with ultradispersed metal nanoparticles for heterogeneous electro-Fenton reaction in a wide pH range of 3–9

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1. Introduction – Bio-recalcitrant wastewater containing textile dyes, herbicides, antibiotics, and landfill leachate has become a global problem because of its negative impact on ecosystems and humans [1]. Hence, the development of environmentally benign technologies is imperative to treat wastewaters before they are discharged into natural water bodies. The electro-Fenton (EF) system is an attractive method because of its fast reaction rate, low toxicity, and clean treatment without sludge production. Recently, the use of composite cathodes with both high H_2O_2 productivity and efficient Fenton activity has emerged in the EF process. This type of heterogeneous EF process extends the acceptable pH range and increases the conversion efficiency from H_2O_2 to hydrogen radicals. However, these functionalized EF cathodes required multistep fabrications, and most of the Fenton catalysts were supported on the surface of carbonaceous cathodes [2]. In this work, we investigated iron–copper–carbon (FeCuC) composite aerogel as an EF cathode. In addition, a simple, elegant, and environmentally friendly activation method using CO_2 and N_2 at high temperature was explored. The role of CO_2 and N_2 activation in developing the porosity and surface area and enhancing the degradation and mineralization efficiency of the material was also thoroughly investigated.

2. Results and Discussion - The catalytic ability of the FeCuC aerogel was investigated by measuring MB degradation. The MB removal of the CO_2- and N_2- activated FeCuC aerogel was very efficient: 98% in 30 min. Comparatively, the time required to reach a similar value (~94%) using the homogenous EF system with C aerogel and Fe^{2+} was approximately 60 min. This enhanced degradation efficiency may be attributable to the increased surface area of the cathode, which increased the generation of H_2O_2. Considering the porousness of FeCuC aerogel and the anodic oxidation of BDD, the solo electrosoprtion (ES) of cathode and electrochemical oxidation (E) of anode were revealed, respectively. Around 18% MB removal was assigned to ES process and 47% MB removal was due to E-ES process at 60 min. The observation indicated that the heterogeneous EF oxidation was still the main mechanism for MB degradation.

3. Conclusions - Novel iron–copper–carbon (FeCuC) aerogel was fabricated through a one-step process from metal-resin precursors and then activated with CO_2 and N_2 in environmentally friendly way. The activated FeCuC aerogel was applied in a heterogeneous electro-Fenton (EF) process and exhibited higher mineralization efficiency than homogeneous EF technology. High total organic carbon (TOC) removal of organic pollutants with activated FeCuC aerogel was achieved at a wide range of pH values (3–9). The chemical oxygen demand (COD) of real dyeing wastewater was below China's discharge standard after 30 min of treatment, and the specific

energy consumption was low (9.2 $kW \cdot h \cdot kg^{-1}COD^{-1}$), corresponding to a power consumption of only ~0.34 kW·h per ton of wastewater. The enhanced mineralization efficiency of FeCuC aerogel was mostly attributable to ultradispersed metallic Fe-Cu nanoparticles embedded in 3D carbon matrix and the CO_2–N_2 treatment. The CO_2 activation enhanced the accessibility of the aerogel's pores, and the secondary N_2 activation enlarged the porosity and regenerated the ultradispersed zero-valent iron (Fe^0) with reductive carbon. Cu0 acted as a reduction promoter for interfacial electron transfer. Moreover, activated FeCuC aerogel presented low iron leaching (<0.1 ppm) in acidic solution and can be molded into different sizes with high flexibility. Thus, this material could be used as a low-cost cathode and efficient heterogeneous EF technology for actual wastewater treatment.

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The simultaneous wastewater treatment and hydrogen production through a solar-driven photocatalytic fuel cell

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1. Introduction –Energy and environment quality are two major issues faced by countries in modern society[1,2]. Simultaneous wastewater treatment and energy recovery by solar energy conversion is an attractive and promising technology. It is urgent for us to seek new and efficient methods for wastewater treatment to eliminate pollution and obtain energy. Therefore, a solar-driven dual photoelectrode PFC for simultaneous organic pollutants degradation and hydrogen production has come to the fore. As we know, the electrons and holes of semiconductor will be separated under light illumination and there will be a photovlotage. For the n-type semiconductor under the light illumination photo-generated holes is the majority for oxidation. In contrast, for the p-type semiconductor under the light illumination the photo-generated electrons is the majority for reduction [3,4]. So we consider whether the photovoltage difference between two different semiconductors can be used for the pollutant oxidation on photoanode and simultaneous hydrogen production on photocathode. If possible, the photoanode of the PFC should be an n-type semiconductor and has a good photocatalytic property for the pollutant oxidation such as TiO_2, CdS and so on. The photocathode of the PFC should be a p-type semiconductor whose ECB (VS. NHE) should be more negative than $E_{H+/H2}$ of 0V due to the purpose of hydrogen production, such as Cu_2O. What's more, same semiconductor with different microstructure have also been chosen. This work provides an effective and low energy consumptive approach for simultaneous environmental pollutant disposal and energy recovery by using photocatalyic system.

2. Results and Discussion - The PFC has a highest VOC of 0.41 V and a JSC of 0.50 mA cm^{-2} with TiO_2 NRs/FTO as photoanode and C/Cu_2O NWAs/Cu as photocathode. The best TOC removal rate of phenol and hydrogen production rate in 8 hours reaches 84.2% and 86.8 μmol cm^{-2}, which is much higher than other reported similar studies. Under light illumination, both of the two photoelectrodes can generate electron/hole pairs. The driving force of PFC is the difference of the Fermi level between the two photoelectrodes. The Fermi level of photoanode should be more negative than that of photocathode, so that a bias will be produced. Then the electrons of photoanode will transfer through the external circuit to combine with the holes on the photocathode. Then the holes will be accumulated on the photoanode and electrons at photocathode which is like a separated p-n heterojunction. So there is a cooperative synergistic facilitated effect. The VOC value of PFC mainly influenced by the difference of Fermi level between the two photoelectrodes.

3. Conclusions - A dual PFC has been fabricated, which can work without other external energy input except for light illumination. Several n-type and p-type semiconductors have been chosen

as the photoanode and photocathode, respectively. The PFC shows a superior performance of phenol degradation and hydrogen production with a maximum TOC removal rate of 84.2 % and a total hydrogen producing rate of 86.8 μmol cm^{-2} in 8 hours which is much higher than other similar researches. For the same semiconductors with different microstructure, the crystal facet properties also influence the VOC of PFC. And the VOC value of PFC increases with the ratio of high index crystal facet of photoelectrodes.

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Improvement of nitrate adsorption efficiency by using activated carbon impregnated with cationic surfactant

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1. Introduction - Water pollution by nitrates is a complex problem, it has a double risk. Ingested in large quantities, nitrates have toxic effects on human health. They help with phosphates to modify the biological balance of the aquatic environment by causing eutrophication phenomena. Adsorption is the process that is used to collect soluble substances in solution on a suitable interface. The present work is devoted to prepare an activated carbon from date stems which is an available agricultural by products in Algeria, with surface modification by impregnation in cationic surfactant solution. The adsorption efficacy of this novel material was proved by its application to remove nitrate from aqueous solutions. The effects of contact time, pH, adsorbent dose, initial nitrate concentration and temperature on the adsorption performance were investigated.

2. Experimental - Batch adsorption experiments were performed in conical flasks stirred in a magnetic stirrer (at 250 rpm) at ambient temperature (25 °C) and for different adsorbent mass (0.25 to 5g). An aqueous solution of nitrate with known concentration (varying from 100 to 600 $mg.L^{-1}$) was added to the adsorbent suspension, in the appropriate aqueous volume, to produce the required concentration. The samples were carried out at equilibrium time and then filtered through filter paper (Double Boxing rings 102). The nitrate concentration in the solution was determined by sulfophenic method.

3. Results and discussion - Adsorption isotherm plays a crucial role in the predictive modelling procedures for the analysis and design of an adsorption system. Therefore, in this study, the adsorption data of nitrate were tested with Freundlich and Langmuir isotherm models. The various constants relating to the two models were calculated and are gathered on Table I.

Table I. Constants of Langmuir and Freundlich isotherms for nitrate adsorption on date stems

Langmuir			Freundlich		
q_m (mg/g)	b (l/mg)	R^2	K_F $(mg^{(1-1/n)}.l^{1/n})/g$	n	R^2
83,33	0,0376	0,9942	21,02	4,28	0,9933

4. Conclusions - In this study, activated carbon was prepared from dates stems by $ZnCl_2$ chemical activation (AC) and was impregnated with Cetyl trimethyl ammonium bromide (CTABr) (ACMS). The preliminary results showed an improvement of nitrate removal from 20% for AC to 60% for ACMS. According to the experiments results, the adsorption process was fast, the equilibrium was achieved at the first 15 min of contact time. The adsorption process is dependent on pH, adsorbent dose and initial concentration of nitrate. The Langmuir adsorption isotherm was found to provide the best fit of the experimental data compared to the Freundlich model. Maximum adsorption capacity was evaluated at 83,33 $mg.g^{-1}$. Results of the present study indicate that the modification of AC surface with cationic surfactant could be used to significantly enhance the capacity of activated carbon to adsorb nitrate.

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Study of the degradation of drugs in a treatment plant of wastewater.

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Abstract

Nowadays, pharmaceuticals are detected in the aquatic environment. Residues of pharmaceuticals are increasingly detected in aquatic environment. Drugs can come from the pharmaceutical industries or municipal WWTPs. The municipal WWTPs don't completely remove most of the pharmaceuticals during the treatment. These substances in wastewater can thus affect the biomass.

For this goal, samples were collected from a treatment plants that treat urban wastewater using the activated sludge process. That plant is located in Boumerdes (Algeria).

The current work aims to study the degradation of residues of pharmaceuticals through to the treatment. The objectives of the study were: (i) characterization of physical and chemical parameters of sewage treatment plant (ii) to follow and to examine the efficiency of the biodegradation of drugs during the treatment of wastewaters. The experiences were performed with three types of drugs and with various concentrations ciprofloxacin (1 and 50mg/L), diclofenac(1 and 5mg/L) and loratadine(1 and 5mg/L) . The study field for drugs used in experimental design (2^3).

In order to evaluate compounds degradation, the physical and chemical parameters such as, the turbidity, the chemical oxygen demand (COD), the biological oxygen demand (BOD), the organic matter (OM) and the biodegradability ratio (k) were studied.

The results showed that the occurrence of drugs in wastewater has an effect on the physical and chemical parameters and the presence of drugs in wastewater is a risk to the aquatic environment.

Keywords: Urban wastewater, activated sludge, biodegradation, drugs, physical and chemical parameters.

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NANOTECHNOLOGY IN ENERGY PRODUCTION

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While fossil fuels are vanishing, day by day, they are also posing a great danger to the environment. Alongside new searches that can result in the usage and development of alternative and renewable energy sources like the developing technology, nuclear energy, solar energy, wind power, geothermal energy, hydroelectricity, biomass and bio-fuel. Development of new materials with superior properties via the rapid development of nano-science and nanotechnology has maintained that nanotechnology plays a key role in energy sector. The most prospective usage areas for nanotechnology and nano-materials will be solar cells, hydrogen transformation (hydrogen production, fuel cells) and thermoelectricity.

Photovoltaic cells, commonly known as solar cells, are tools that convert the solar power directly to electric energy by means of absorbing. Nano-materials are expected to play an important role in solar cell technologies in the next decade. The most common element in the universe, Hydrogen (H), is offered to be used as an energy carrier in hydrogen economy. It is expected that the costs of the nano-materials involved in hydrogen production. Fuel cells are such systems that they can convert electro-chemical matter with hydrogen, methanol, ethanol, and methan through an oxidation like oxygen or air at the electrotes. Fuel cells, as long as their reactives are usable, can produce chemical energy from external reactives and then turn it into electrical energy. Thermo-electricty (TE), which is known also as Peltier-Sebeck Effect, is meant to define the biased transformation of temperature differences to electrical potentials or the vice-versa.

Nano-technology, like all other new technologies, and its applications in energy sector, pose a great importance because of not only the decrease in green-house gases and pollutants but also the increase in the efficacy in energy transformation, although it also faces a lot of difficulties like stability, lifespan and high costs.

Key words: Nano-technology, Energy, Nanomaterials, Solar cells, Hidrojen production, Fuel cells, Thermo-electricty

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How climate change could affect solar and wind power production in the Iberian Peninsula?

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1. Introduction – The increase of the use of renewable energy is presented as one of the main mitigation plans. However some important renewable energies such as solar, wind and hydroelectric power could be vulnerable to changes in climate variability. Therefore, an estimation of how climate change projections at regional scale could affect future energy production coming from these sources is important.

2. Data and methods- Solar and wind power future projections are estimated using data from the ESCENA project [1]. The climate data from the regional climate models (RCMs) is used to calculate future projections of energy production under several green house emission scenarios and three different global models.

3. Results and Discussion – Results present that a small decrease, much lower that inter-annual variability, is expected for wind power production. Regarding solar power, it is expected a small increase in solar radiation. However the lost of efficiency of solar cells due to the higher temperatures compensates such increase.

4. Conclusions – In general almost no change is expected. Therefore, climate change seems that will not perturb significantly the solar and wind power availability in the near future

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Removal of zinc from industrial wastewater by electrocoagulation assisted ultrafiltration process

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1. Introduction – Heavy metals are one of the most important contaminants in water. They are discharged to the environment by different industries, such as mining, metallurgical, electronic, electroplating and metal finishing [1]. Zinc is a trace element that is necessary for human health. However, too much zinc can cause eminent health problems, such as stomach cramps, skin irritations, vomiting, nausea and anemia [2]. Removal of metal ions from wastewater in an effective manner has become an important issue [3]. Removal technologies of metal ions include chemical precipitation, ion-exchange, adsorption, membrane filtration, coagulation-flocculation, flotation and electrochemical methods [2]. This study was aimed to investigate the removal of zinc from industrial wastewater. Electrocoagulation assisted ultrafiltration for removal of zinc from industrial wastewater has been studied.

2. Experimental - The wastewater used in experiments was provided by metal finishing factory. Experimental system was shown in Figure 1. Electrocoagulation reactor combined with ultrafiltration unit (Sartocon Slice 200 Ultrafiltration System) were used in the experimental studies. Two different membranes (50 kDa and 100 kDa) were used in ultrafiltration system.

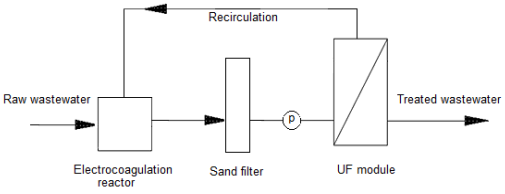

Figure 1. Experimental system

3. Results and Discussion - Firstly, the industrial wastewater was subjected to electrocoagulation process. After electrocoagulation process, the wastewater was passed through sand filter column and then ultrafiltration system. The effect of wastewater pH and molecular weight cut-off (MWCO) of membrane on zinc removal was investigated. It was found that zinc removal was majorly pH dependent and slower at lower pH. Based on the results, zinc removal efficiencies for electrocoagulation-ultrafiltration system of 50 kDa UF membrane are much higher than 100 kDa UF membrane. The maximum zinc removal efficiency was recorded as 99%.

4. Conclusions - In this study, the electrocoagulation assisted ultrafiltration was used for zinc removal from industrial wastewater. The effect of wastewater pH and MWCO of membrane on zinc removal was investigated. It was found that wastewater pH and MWCO of membrane affected the removal efficiency of electrocoagulation-ultrafiltration system. Results of this work will be useful for future scale up of the electrocoagulation-ultrafiltration system for the removal of zinc from industrial wastewater.

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Humic Acid Removal by Adsorption onto Iron Oxide Coated Zeolite

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1. Introduction - Humic substances (HS) are the most important reactive fractions and account for more than 50 % of natural organic matter (NOM) in groundwater, surface water, soils and sediments [1]. A serious environmental problem caused by humic acid (HA) has attracted considerable attention because the ubiquitous existence of HA in natural water can cause the water quality deterioration and disinfection byproducts (DBPs) formation. It is important to remove aqueous HA for both the environmental and healthy considerations [2]. To remove HA during water treatment, a great variety of processes have been developed, such as coagulation/flocculation, membrane separation, advanced oxidation, ion-exchange and adsorption. Of them, adsorption has been considered as an effective process due to its simplicity of design, ease of operation and high efficiency [3]. Recently, there is a great interest in development of new adsorbents for effective removal of HA from water. In this study, iron oxide coated zeolite (ICZ) was used to adsorb HA in aqueous solution.

2. Experimental - Humic acid sodium salt used in all experiments was purchased from Aldrich. Zeolite samples were coated by iron using reagent grade $FeCl_3.6H_2O$. Adsorption of HA was investigated by column experiments. ICZ was packed into a column and HA solution was continuously passed through the column at various flow rates (1, 2 and 3 mL/min) with a peristaltic pump. The effluent was sampled at regular intervals. The results were evaluated by removal of dissolved organic carbon (DOC) that specify organic matter, UV_{254} absorbance, and $Color_{436.}$

3. Results and Discussion - The removal of DOC, UV_{254} and color by iron oxide coated zeolite increased with increasing contact time. The first DOC concentration, UV_{254} and $Color_{436}$ obtained at the outlet with $1mLmin^{-1}$ flow rates were 1.06 mgL^{-1} (Ce/Co:0.12), 0002 and 0.002 respectively. At 2 $mLmin^{-1}$ flow rate, the first DOC concentration, UV_{254} and $Color_{436}$ were 1.44 mgL^{-1} (Ce/Co:0.17), 0.009 and 0.004. At 3 $mLmin^{-1}$ flow rate, the first DOC concentration, UV_{254} and $Color_{436}$ were 2.02 mgL^{-1} (Ce/Co:0.24), 0.014 and 0.011. The HA removal capacity at saturation obtained with 1, 2, and $3mLmin^{-1}$ flowrates are 0.093, 0.146, and $0.190mgDOCg^{-1}$, respectively. Breakthrough curves showed a sharp change after the breakpoint in each Experiment. This means that ICZ was used efficiently for HA. In this study, $1mLmin^{-1}$ flow rate corresponded to the 60% breakthrough of DOC is reached after 9 bed volumes (BV). After 20 BV, a 100% breakthrough was observed. The breakthrough of DOC was reached after 12 and 22.5 bed volumes (BV) at flow rates of 2 and $3mLmin^{-1}$ respectively.

4. Conclusions – The kinetics of DOC removal showed that the DOC adsorption by the iron oxide coated zeolite reached a plateau within 240 min. At an adsorbent dosage of 10 $g\ L^{-1}$, the DOC, UV_{254} and color removal efficiencies reached approximately 40%, 49% and 54%, respectively. Results from column experiments indicated that the DOC breakthrough where no more DOC adsorption took place (i.e., $C/C_0=1$) occurred at 30 bed volumes. ICZ is potentially suitable for applying to the adsorption of humic acid from water.

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Nutrient removal and biodiesel production by integration of freshwater algae cultivation with piggery wastewater treatment

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Abstract

Microalgae cultivation in wastewater, with the advantage of a faster uptake of nutrients such as nitrogen and phosphorus, represents one of the preferable solutions to the reduction of excessive nutrients. Meanwhile, microalgae have also been considered as one of the most promising feedstock for biodiesel production, which will not threaten the food production. Hence, an integrated approach, which combined freshwater microalgae *Chlorella zofingiensis* cultivation with piggery wastewater treatment, was investigated in the present study. The characteristics of algal growth, lipid and biodiesel production, and nutrient removal were examined by using tubular bubble column photobioreactors to cultivate *C. zofingiensis* in piggery wastewater with six dilution concentrations of 3500, 2500, 1300, 800 and 400 mg L^{-1} COD. Within 10-day cultivation, the 3500, 2500, 1300, 800 and 400 mg L^{-1} COD piggery wastewater media could respectively remove COD at 74.29%, 78.18%, 79.84%, 76.46%, 65.81% and 67.25%; TN at 78.72%, 81.03%, 82.70%, 77.81%, 70.88% and 68.96%; and TP at 85.00%, 89.23%, 98.17%, 98.62%, 99.44% and 100%. The specific growth rate and biomass productivity ranged from 0.287 to 0.492 day^{-1} and from 106.28 to 296.16 mg L^{-1} day^{-1}, respectively. The initial nutrient concentration could influence lipid accumulation which ranged from 33.91% (3500 mg L^{-1} COD medium) to 45.81% (400 mg L–1 COD medium). The lipid and biodiesel productivities ranged from 48.69 to 110.56 mg L^{-1} day^{-1} and from 11.85 to 30.14 mg L^{-1} day^{-1}, respectively. It is worthy of note that the diluted piggery wastewater with 1900 mg L^{-1} COD provided an optimal nutrient concentration for *C. zofingiensis* cultivation, where the advantageous nutrient removal and highest productivities of biomass, lipid and biodiesel were presented.

Keywords: Microalgae, *Chlorella zofingiensis*, Piggery wastewater, Nutrient removal, Biodiesel production

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EPS Producing Bacteria From An Industrial Waste Water Treatment Plant

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1. Introduction

Wastewater is produced due to many daily and industrial activities. Amount of wastewater is too high level so treatment become crucial issue. In waste water treatment dewatering and sludge settling are main problems [1]. For solution of this problem instead of using synthetic polymers, ecological and environmentally solutions must be preferred. EPS (Extracellular polymeric substances) is the one of natural polymers and play important roles in the removal of pollutants from wastewater, in bioflocculation and settling and in the dewatering of activated sludge [2]. The studies about EPS production and application in waste water treatment plants are very limited [1-5]. In this study we focused on determination new and efficient EPS producers and analyze EPS properties. Among the selected bacteria we extracted EPS and tested some properties of EPS.

2. Experimental

Waste water samples were collected from industrial waste water treatment plant. Samples were plated onto MRS and M17 agar and incubated aerobically. After incubation different and distinct colonies were selected and transferred to MRS and M17 agar plates. Then cultures were used for gram staining. Mucoid and viscous colonies were selected as EPS producer [6]. Identification of isolates was performed by sequencing the 16S rRNA gene.

For EPS production, bacteria suspension was added to glucose medium. Samples were incubated in a shaker at 150 rpm and 37°C for 3 days [1]. At the end of the 3 days to extract EPS, the medium was centrifuged for removal of bacterial cells. Then ethanol was added to supernatant and incubated at -20°C for overnight. For extraction of EPS, mixture was centrifuged. Pellet was dried at room temperature [7]. Extracted EPS was used as sample to determine the antimicrobial activity.

3. Results and Discussion

9 gram positive, 21 gram negative isolates were selected as EPS producers. 16S rRNA gene amplification was performed for 30 isolates. 3 isolates were selected for sequencing and isolates were identified as 99% *Klebsiella sp.*, 99% *Raoultella sp*. and 98% *Enterobacter sp*. All these bacteria belong to Enterobacteriaceae family and these bacteria represents dominantly in waste water. After EPS extraction *Enterobacter* and *Klebsiella* gave nearly equal amount of EPS. For antimicrobial activity test, EPS from *Klebsiella* and *Enterobacter* genus shows antimicrobial activity to *Bacillus subtilis* strain

4. Conclusions

This study investigated the EPS producing bacteria from an industrial wastewater treatment plants. Two major strains (*Enterobacter* and *Klebsiella*) were isolated from wastewater treatment plant. Both strains EPS production potential were efficient. In addition to give perspectives to use in different biotechnological areas antimicrobial activity was detected. Future studies will contribute to usage of EPS and these strains in many industrial areas.

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Effective Removal of Congo Red from Aqueous Solutions using Almond Shell

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Abstract
Dyes are widely used in industries such as textiles, rubber, paper, plastics, cosmetics, etc., to colour their products. The dyes are invariably left as the major waste in these industries. Due to their chemical structures, dyes are resistant to fading on exposure to light, water and many chemicals Batch adsorption experiments were conducted under varying conditions of particle size (10-65 mesh), contact time (5-240 min), adsorbent amont (1-10g/L) and initial dye concentration (5-50 mg/L).
Key Words: Congo red, adsorption, almond shell, isotherm, kinetic

1.Introduction - The water emerge out after used from textile industries create bad taste, offensive odour and affect the eco system. Congo red an anionic dye has been known to cause an allergic reaction and to be metabolised to benzidine, a human carcinogen. Therefore, an increased interest has been focused on removing of such dyes from the wastewater. Adsorption has demonstrated its efficiency, easy handling, availability of different adsorbents, and economic feasibility as a wastewater treatment process compared to the other purification and separation methods, [1-3].
In the present study, we investigated the adsorption of ongo red on almond shell. The effects of particle size, adsorbent amount, contact time initial dye ions concentrations on the adsorption were examined. Experimental data were then used to obtain maximum removal efficiency of congo red ions.

2. Experimental - The adsorption experiments were performed for initial congo red concentrations of 5, 10, 15, 20, 30 and 40 mg/L. The almond shell samples were sieved to obtain particle sizes of 10, 16, 20, 35, 45 and 65 mesh.

3. Results and Discussion
***3.1. Effect of particle size on the removal of congo red*-**Almond shell samples with their different particle sizes were stirred with 100 mL of 20 mg/L dye solutions for 120 min. The removal efficiencies of almond shell with respect to particle sizes are given in Fig 1, which also indicates that decreasing the particle size results in a small increase in the removal efficiency.

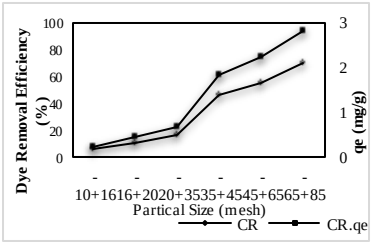

Fig. 1. Effect of particle size on congo red adsorption

4. Conclusions- The congo red removal efficiencies were examined for several concentrations ranging from 5 mg/l to 50 mg/l for the copper ion solutions and the results showed that optimum removal was achieved at initial metal concentration of 20 mg/l for almond shell. The adsorption of congo red on almond shell is explained well by the Langmuir, Freundlich and Temkin isotherm models. These results show that the removal of dyes between 70.0 and 76.5 percent is quite significant and it indicates that almond shell is a moderately good adsorbent for the removal of CR ions from wastewater.

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Crystal violet removal from aqueous solutions using clinoptilolite: kinetic and isotherm studies

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Abstract
The aim of this study is to investigate the effects of crystal violet ions from aqueous solutions using clinoptilolite. Batch studies were performed to evaluate the effects of various parameters including particle size, contact time, adsorbent amount, initial dye concentration and initial pH of the solution.
Keywords: Clinoptilolite, crystal violet, adsorption, isotherm, kinetic, model

1. Introduction - Dye molecules, even at very low concentrations in the wastewater of textile industries, are common water pollutant. Dye effluents may contain chemicals that exhibit toxic effects toward microbial populations and can be toxic and carcinogenic. In order to remove dyes from aqueous solutions, many physical, chemical and biological treatments have been used either individually or together. [1-3].
The aim of this research is to investigate for crystal violet ions on clinoptilolite under different physical and chemical conditions. For this reason, a detailed study was conducted in order to determine the influence of particle size, contact time, adsorbent amount, initial dye concentration and initial pH of the solution on adsorption chracateristic of clinoptilolite

2. Experimental Study - Adsorption experiments were performed by shaking 0.25-4.0 g of clinoptilolite samples in a 100 mL of aqueous solutions of crystal violet. The effect of pH on the crystal violet adsorption was investigated using 30 mg/L crystal violet containing solution over the pH range of 2.0-9.0. The adsorption experiments were performed for initial crystal violet concentrations of 5, 10, 15, 20, 30, 50 and 100 mg/L. The clinoptilolite samples were wet sieved to obtain particle sizes of 10, 16, 20, 35, 45 and 65 mesh.

3. Results and Discussion
3.1. Effect of particle size on the removal of crystal violet- The removal efficiencies of clinoptilolite with respect to particle sizes are given in Fig 1, which also indicates that decreasing the particle size results in a small increase in the removal efficiency. The differences in removal efficiency between the 10< x <65 mesh sizes for clinoptilolite was 79 and 89.3%.

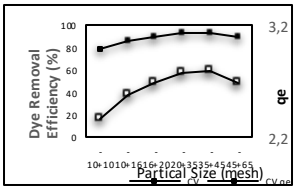

Fig. 1. Effect of particle size on CR adsorption

4. Conclusions- The aim of this study was to investigate the potential use of fly ash as a sorbent for removal of crystal violet. The adsorption process is a function of the particle size, contact time, adsorbent amount, pH and metal ion concentration. The results show that clinoptilolite was effective in removing crystal violet from aqueous solution. The maximum adsorption capacitiy of clinoptilolite was found to be 5.55 mg/g.

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Particleboards for civil construction with wastes of sugarcane bagasse and bamboo

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1. Introduction – In Brazil, the main agricultural commodity is the sugarcane due to the great production of sugar and ethanol. The objective of this work is to add value to the sugarcane bagasse by using it as a raw material for particleboard production to be employed as floor in the civil construction, together with the of bamboo leaves *Dendrocalamus giganteus*, which has characteristics of rapid growth and high renewal. Panels were produced for flooring strand boards in five different traces - 100%, 75%, 50%, 25% and 0% - bagasse relative to the total weight of the materials and supplemented with stem bamboo leaves and without then they were evaluated for physical and mechanical properties, in accordance with the standards proposed in ISO 14810-3. From the tests performed, it was concluded that the line that got the best performances was the Trace 3 (50% of each residue) in relation Static Bending, Abrasion, Janka Test, Parallel anda Perpendicular Traction.

2. Experimental - The materials employed in this research were the sugarcane bagasse, donated by Industry Tonon Bioenergia; and bamboo leaves, collected from the experimental field of UNESP; and the polyurethane resin (polyol derived from castor oil and prepolymer - isocyanate), made in Laboratory of Wood and Wooden Structures of USP in São Carlos- Brazil. To each particleboard it was used a total of 1706.88g of residue (cane and bamboo) and 204.82g of adhesive castor oil bicomponent (102.41g polyol and 102,41g prepolymer). The established amount of adhesive was 12% in relation to the total mass [3] .

3. Results and Conclusions- From Table 1, which contains all the results of mechanical tests performed in this study, it was concluded that all traces obtained values within the recommended standards in Brazil and also when necessary, by international standards (NBR 14.810-3 [1] and ANSI 208A [2]).

Table 1. Mechanical Tests.

		Parallel Traction (kgf/cm²) F1 (45 - 55 MPa)*	Perpendicular Traction (MPa) (> 0.4 MPa)*	Static Bending (MPa)		Screw Pull (N)		Abrasion	
				MOR (>18 MPa)*	MOE (> 2450MPa)**	TOP (> 800 N)*	SURFACE (> 1020 N)*	M (%)	E (%)
1	100%SC 0% B	204.61	1.15	37.05	6470.78	2029.98	2005.5	0.032	1.44

2	75% SC 25% B	176.09	1.11	34.49	6864.7	1912.3	1652.4	0.013	0.86
3	50% SC 50% B	135.56	1.04	32.93	6709.57	2093.72	1868.17	0.028	0.75
4	25% SC 75% B	118.66	0.92	28.62	5767.61	1956.40	1721.07	0.023	0.37
5	0% SC 100% B	99.03	0.88	23.8	5280.16	1824.04	1627.9	0.094	0.54

* Indices stipulated by the norm NBR 14.810-3 [2] **Indices stipulated by ANSI 208A/1999[2].

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Waste management in Universidade Estadual Paulista - Unesp Campus Bauru: Recicla Unesp

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1. Introduction – With the intensification of solid waste generation, mainly due to some aspects such as population growth and economic development, the need to search for environmentally sound alternatives for the disposal of solid waste produced, more is increasing. Concern for the preservation of the environment and a better socioeconomic condition of society has given rise to the concept of sustainable development [1-2]. The Recycles Project UNESP is a university extension project, founded in 2007, which aims to promote changes in habits and attitudes, stimulating initiatives by the academic community, aiming to improve the environmental management of the campus of Bauru UNESP by qualification and quantification of solid waste generated at the university, as well as the consumption reduction work through environmental education (Image 1). The project, initially at the Faculty of Engineering in 2014, extended to the other two colleges, and currently include the entire campus.

Image 1. transport, unloading and weighing dry recyclables (Source: Recycles UNESP 2014

2. Experimental - Initially, a literature review was conducted, checking good sustainable practices precursor universities, such as Palmas de Gran Canaria and Autónoma de Madrid – Spain. Thus, one can propose and implement an adapted version of the application of the principles of management of solid waste endowed with sustainable character. Subsequently, it evaluated the situation of solid waste on campus, to plan and organize activities, performing a diagnosis of plastic waste generated by the unit, making a quantitative analysis of the residue produced by collecting and weighing the material and yet, a survey of the types of generated waste prioritizing the reduction of consumption. Following held training and information activities, such as lectures, cultural events and awareness campaigns to highlight the importance of environmental practices to teachers, students and administrative staff, stimulating the change of culture and habits as the recycling of solid waste.

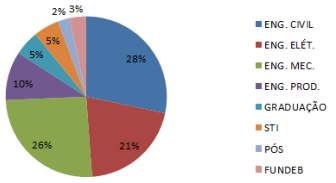

Image 2. Quantification of Solid Waste by departments in 2014. Source: Recycles UNESP

3. Results and Discussion-As a result of waste management in FEB, follows the quantification percentage of the collection held by Recicla UNESP in 2014 in each of the managed departments, image 2.

4. Conclusions - The results say the project has been successful in selective collection activities and the constant spread of environmental education, which is essential to start the principle of sustainability on campus. Each College seeks to achieve the goal, raising awareness and promoting sustainable attitudes in the academic environment, highlighting the importance of recycling and also contribute to the cleanliness inside the premises of the university campus of UNESP / Bauru, and this integrated working arrangement has benefited everyone.

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CFD Analysis of The ejector Refrigeration System: Effect of condenser pressure.

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1. Introduction – The ejector refrigeration system appears as an attractive alternative for refrigeration technologies. The main source of energy for such cooling system is the sun or waste heat. An ejector, also named jet pump, thermo-compressor, is a flow device that allows a high pressure primary fluid to accelerate and induce a low pressure secondary fluid into the primary fluid path. The efficiency of the ejector system is relatively low, compared to other fluid transport devices. However, its major advantage is a simple structure with no moving parts, and it transports a large amount of fluid with a small driving energy [1-2]. It has been shown that the performance of a refrigeration ejection system depends on the efficiency of the ejector. The performance of steam ejector can be represented by entrainment ratio defined by ratio of mass flow rate of suction to mass flow rate of motive Rm. Increasing the value of this ratio can increase the value of the coefficient of performance of the refrigeration system. The entrainment and mixing between primary and secondary streams is therefore a dominant feature which requires investigation. The aims of this research were the implementation of Computational Fluid Dynamics (CFD) to the study of supersonic ejectors, and the investigation of the flow processes that occur.

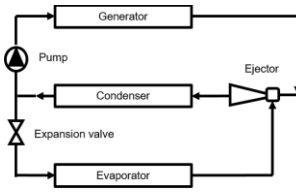

Figure 1. Schematic view of an ejector refrigeration system

2. Description of the Ejector - The ejector designed theoretically as a single phase constant pressure mixing model described by He et al. [3], the characteristics lengths and schematic of the ejector is shown in fig.2.

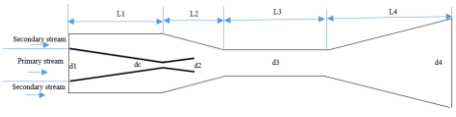

Figure 2. Schematic of ejector

3. Results and Discussion - A typical performance curve where the variation of Rm with condenser pressure is plotted (fig. 3). R134a is used as a working fluid. The key performance parameter obtained from this investigation is "critical condenser pressure". A critical condenser pressure can indicate the highest possible condenser pressure whilst Rm remains constant. Higher critical condenser pressure is more desirable for an ejector refrigeration system.

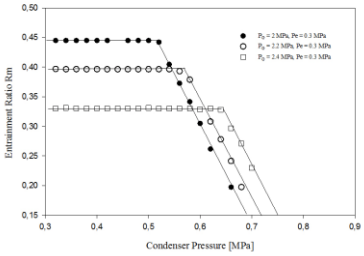

Figure 3. Rm variation with condenser pressure

4. Conclusions - The objective of this research were the implementation of Computational Fluid Dynamics (CFD) to the study of supersonic ejectors, and the investigation of the flow processes that occur. The code was to be used as a design tool to improve ejector performance.

The results show that an increase in primary pressure causes a decrease in the Rm and an increase in the critical condenser pressure.

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Nitrate Reduction in Water Using Zerovalent Iron Crosslinked Chitosan-Humic acid Nanocomposite

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1. Introduction – The application of zero-valent metal nanoparticles for environmental remediation represents one of the latest innovative technologies especially in the chemical reduction of some oxoanions in water[1-3]. The reduction of nitrate by some zevovalent nanoparticles gives rise to ammonia or nitrogen, water or hydroxyl ion[4]. Biopolymers have been used to stabilise the zerovalent metals nanoparticles which resulted in more effective nanocomposites [1,5]. The main objective of this study is to test the effectiveness of using synthesized zerovalent iron crosslinked chitosan-humic acid nanocomposite to reduce nitrate ions to nitrogen with possible adsorption onto the nanocomposite.

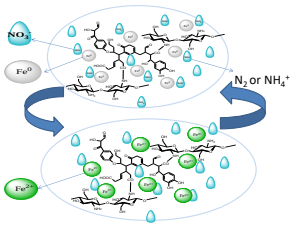

Image 1. Schematic diagram of Nitrate

2. Experimental - Humic acid(HMA) was used for intramolecular cross-linking of the Chitosan(CTS) linear chains to increase the active sites on the chitosan biopolymer (CTS-HMA) then further used as a stabilizer to synthesize zerovalent iron nanoparticles(ZvFe) by the reduction of iron (III) chloride with sodium borohydride(5) to give the ZvFe-CTS-HMA nanocomposite. Characterization of the products was carried out using Infra-red Spectroscopy, Scanning Electron Microscope. Batch experiments were conducted for the reduction of nitrate in water using different concentrations of the products in different concentrations of nitrate and at different contact time. Nitrate removal efficiency of ZvFe-CTS-HMA was further confirmed using real water samples obtained from waste and river with an initial nitrate concentration of 12 ± 0.12 ppm.

3. Results and Discussion - The characterisations showed significant morphological changes in ZvFe-CTS-HMA thereby confirming a strong bond between the crosslinked CTS-HMA and the zerovalent Iron. The result of the batch experiment showed that nitrate reduction in water was significantly higher using ZvFe-CTS-HMA than CTS-HMA at very high nitrate concentration. An increase in dosage of the nanocomposite led to a higher nitrate reduction of 100 % within 30 minutes.

4. Conclusions - The effect of nanocomposite dosage and initial level of nitrate concentration showed a pronounced effect on the reduction rate of nitrate. Batch kinetic tests indicated that the overall disappearance of nitrate may include both physical adsorption of NO_3^- onto the surface of the synthesized nanocomposite and subsequent reduction of NO_3^- to NH_4^+(g) or N_2(g) (Image 1) (4). This nontoxic and biodegradable organic and inorganic polymeric composite can be used as a new material for permeable reactive barrier walls as well as a material for ex-situ and in-situ water treatment.

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Stochastic analysis of water pipeline systems for optimal replacement strategy

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1. Introduction – Pipelines deteriorate with the lapse of time after installation; along with deterioration, leakage occurs due to cracking or partial break and eventually, the pipeline can also completely burst. Because pipe failures, leakage and burst cause enormous social and economic damage, system managers repair the leakage and replace the aging pipeline before it completely bursts. However, because frequent rehabilitation of aging pipeline increases maintenance cost, an optimal rehabilitation strategy is required to minimize life cycle cost, which is a summation of the total social cost and rehabilitation cost. In this study, we predict the probability of occurrence of leakages and burst in a pipeline, and develop an optimal replacement strategy model considering need-based repairs of leakages and replacements of burst pipes during the life time of the pipeline.

2. Method - In this study, the authors propose a methodology for estimating the replacement time to minimize the life cycle cost of the pipeline systems. It is assumed that failures in the pipeline system are classified into burst and leakage. The occurrence probabilities of leakage and burst in a pipeline were estimated using the competing deterioration hazard model(Shin 2016). The time to burst and leakage are explained by using the Weibull hazard model and exponential hazard model, respectively. The optimal maintenance model proposed in this study builds on a recursive structure, and it was estimated through the least life cycle cost approach. In order to evaluate the applicability of the proposed methodology in this study, an empirical analysis was carried out with the actual data of the pipeline system of S city, Korea.

3. Results and Discussion – The competing deterioration hazard model was estimated by a Bayesian technique based on the Metropolis–Hasting method.

Fig.1 shows the cumulative failure probability of the DCIP to burst and leakage. The leakage shows higher failure probability than burst. The total expected life cycle cost forms a convex curve over

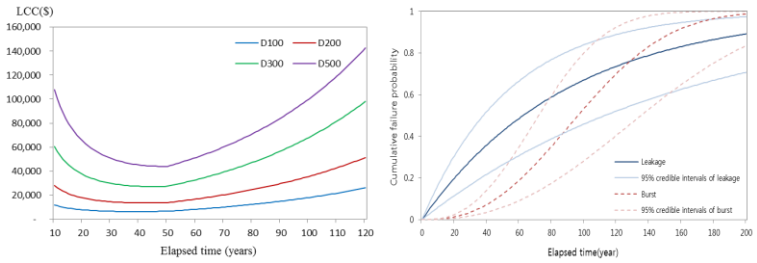

Fig.2 Expected life cycle cost comparison of pipe diameter: DCIP

time as shown in Figs. 2 and pipes of larger diameters have a high

life cycle cost and a long optimal replacement interval z. This is because larger pipes show low pipe failure probability.

4. Conclusions - The deterioration procedures of burst and leakage are forecasted by using a competing deterioration hazard model. In addition, we proposed an optimal replacement strategy model which minimizes expected life cycle cost that considers repair costs of leakages and pipeline replacement costs.

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Evolution of the physicochemical quality of urban wastewater in Bechar Oued undergoing pretreatment with local materials

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Abstract

Introduction: The Mediterranean regions are characterized by a grave hydrological imbalance during the month's summer because of the weakness of the precipitation, of the disparity of their distribution and the high temperatures. At the same time, there is a greater request of water for the irrigation as well as the domestic and industrial use.

The main objective of it modest work is to follow the physico-chemical and bacteriological evolution of domestic waste water of the city of Béchar undergoing a purge by filtration by various local supports to know the Sand and the Coal tip by reducing the nuisances which undergoes the receiving environment (Oued Béchar) and to remedy also the loss of this hydric source in recoverable materials.

Experimental: The study allowed first of all characterizing waste water urban of the Oued of Bechar which presents an environmental threat so allowing an estimation of the levels of pollution.

The characterization of the sand of dune (Beni Abbes), shows that the quartz (97 %) is the most represented mineral, the granular analysis allowed us to determine certain parameters as the coefficient of uniformity (CU) and the equivalent diameter, the observations in the electron microscope with sweeping(scanning) (MEB) and the analysis RX are realized.

Results and Discussion : The study concerned filtered waste water presents yields satisfactory and very encouraging, with a total elimination of total Coliforms, streptococci and a good dejection of the total aerobic germs in the sand-colored and sand-colored filter coal tip, a good efficiency was indicated in the sand-colored filter coal tip for the decrease of the turbidity, the values of the chemical oxygen demand DCO (145 mg / l) and the biological request in oxygen DBO5 (72 mg / l) revealed that these waters have a character less biodegradable relationship(DCO / DBO5=0.62), present a rather important conductivity (2.76 mS / cm), and contents raised(brought up) in minerals presented by chlorides and sulfates 390 and 596.1mg / l respectively, with a pH of 8.1.

The rates of allowance of organic matters in terms of the biological request in oxygen, in demand chemical in registered oxygen sound of the order of 60 %. The elimination of treats with copper sulfate and of 40 % for the sand-colored filter.

Keywords: *waste water urban, filtration, bacteriological and physico-chemical Parameters, Sand, Coal tip, Oued Béchar.*

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International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

Emissions Reduction Of Regulated and Unregulated Hydrocarbon, Gases in Gasoline bi-mode SI/HCCI Engine by TWC Converter

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1. Introduction Oxygenated hydrocarbons family are (carbonyl compounds, alcohols and organic acids). the collection of carbonyl species generated from V6 gasoline engine working in spark-ignition and homogeneous charge compression ignition modes was performed upstream and downstream of a three way catalyst converter, Qualitative and quantitative analysis of carbonyl compounds (aldehydes and ketones) in exhaust gases were preformed using 2,4 dinitrophenylhydrazine (DNPH)Homogeneous Total hydrocarbon covered wide range of unregulated compounds such as alkynes; alkenes; alkanes; and aromatics. Alkanes (paraffines) molecules contain single hydrogen-carbon bonds (e.g. ethane) and are referred as 'saturated'. Alkene (olefins) molecules contain double bonds (e.g. ethylene) 'unsaturated', and alkynes (i.e. acetylene), triple bonds unstable and reactive. Aromatic molecules typically display enhanced chemical stability (e.g. benzene, toluene) are building blocks for Poly (cyclic)-Aromatic Hydrocarbons (PAH) and are molecules containing two or more simple aromatic rings. This manuscripts presents study on a new catalytic converter design, aiming to control regulated and un regulated HC emissions under different loads and engine modes [1].

2. Experimental - Engine -The experimental work was performed on a V6 HCCI / SI mode gasoline direct injection engine The prototype three zones monolith catalyst, with optimized order of the zones, was connected to the actual engine exhaust manifold. Hydrocarbon speciation of C5 - C11 compounds was carried out using an on-line GC-MS. An 8000 series GC equipped with direct injector was connected to a Fisons MD 800 mass spectrometer, used as a detector. Carbonyls: The samples were carried out by passing the engine exhaust gas with flow rate of 1.0L/min in to 25ml midget impinger and the exhaust gas bubbled inside the DNPH solution reagent for 20 minutes, during the test the sample must be surrounding by bath of ice to prevent any vaporising of the compound species during the sampling.

3. Results and Discussion - ALKEENS : unsaturated hydrocarbon compounds (olefins) respectively presented in the engine tails in a great concentration ,with HCCI mode at engine load of 3bar , alkeenes showed a high concentration just over 600 ppm and was reduced about 50% when shifting to higher load of 4bar. Changing engine mode from HCCI to SI engine mode did not influence much the alkeen concentration , the proto type convertor showed a high conversion efficiency at high load 4bar for both engine modes. Catalyst efficiency reached over 90%.

ALKANS : paraffin saturated hydrocarbons with open – chain compound has high concentration in HCCI mode with engine load of 3bar , shifting to higher engine load 4bar has

reduced alkan concentration down to 30%, on the other hand alkanes presented with less concentration in si engine mode with the same load, the best conversion efficiency found in SI mode, folloed by HCCI mode with engine load of 3bar.

4. Conclusions- Unregulated compounds: in HCCI mode, aromatic concentration were the highestfollowed by alkans, alkenes and aldhydes. At lower load all compounds have increased regardless of engine conditions. Alkeens were influenced by changing engine load more than engine modes. Alkans compound influenced more by engine mode than engine load. Aromatic compound presented with high concentration in all engine modes and operation. Aldhydes species found to be in a low concentration in all engine conditions.

. Catalyst was more efficient in reducing the chemical compounds in higher load than lower engine load. Excellent catalyst efficiency was achieved in SI mode, all chemical compounds were eliminated.

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Enzymatic Biomonitoring of Aquatic Pollution at Jeddah Southern Red Sea Shore

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Abstract

The marine environment of the Jeddah southern red sea shore is subjected to increasing anthropogenic activities as sewage sludge draining and desalting processes. The objective of this study is to compare the quantitative responses of enzymatic biomarkers in fish from polluted area with the responses of organism from reference area. Enzymatic biomarkers as neurotoxic, antioxidant and detoxifying enzymes were evaluated in the brain and liver from *Variola louti* as a sentinel species sampled from both polluted and reference sites in the Jeddah southern red sea shore during four months January, April, July and October in 2014 and 2015. In brain of *V. louti*, the activity of acetylcholinestease (AChE) collected from reference area significantly increased 8.8 and 10.5 folds than that from polluted area in 2014 and 2015, respectively. The activities of catalase (CAT), glutathione reductase (GR) and glutathione peroxidase (GPx) and glutathione-S-transferase (GST) from liver of *V. louti* in polluted area significantly increased 1.4, 1.27 and 3, 4.5 and 4.37, 2 and 5, 4.5 folds than that from reference area in 2014 and 2015, respectively. The levels of examined enzymes are approximately similar in the four seasons detected in 2014 and 2015 indicating that the similar components of sewage were draining in red sea. In conclusion, these findings suggest the important of enzymatic biomarkers in monitoring the pollution in Jeddah red sea shore.

Keywords: *Variola louti*; Enzymatic biomarkers; Pollution; Red Sea; Jeddah

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Consumer Demand for Water Market: A Case of PET Bottled Water

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1. Introduction – The requirement of water consumption created the packed water market other than the natural water resources. This market is divided into two main varieties: PET bottled water and carboy bottled water. In the water sector, it operates both public and private sector firms. This study aimed to analyse the consumer preferences for PET bottled water.

The data of the study were obtained from the surveys conducted via face to face interviews as a sample of the Mediterranean Region. The purpose is to state the varying consumer preferences for PET bottled water like in all agri-food products. The Conjoint Analysis was used for finding the optimum PET bottled water properties which maximize the benefit of the consumer. According to the choices from the created property sets; the effectiveness and importance of price was found as 40.01%. These rates were 15.25% for having HACCP certification, 12.42% for the water source (origin), 11.70% for production type, 10.42% for taste and 10.20% for having ISO certification. The set of properties that maximize the benefit of consumer for PET bottled water was defined as the one which has a regional origin, be produced as natural spring water, tasted soft, at low price level and existing the ISO and HACCP certifications.

2. Experimental - Households' population data were obtained from Turkish Statistical Institute data; besides the data about their PET bottled water consumption preferences were collected from the face to face interviews conducted in the study area. Conjoint analysis[1] was used for the research.

Table I. Created Product Property Set for PET Bottled Water

Factor	Factor Levels
1. Origin	1. National brand; 2. Regional brand- 1; 3. Regional brand - 2
2. Production Type	1.Natural spring water; 2.Natural mineral water; 3.Processed water
3. Taste	1.Soft water; 2.Hard water
4. Price level	1. Low; 2. Moderate; 3. High

3. Results and Discussion - In the study, the optimum PET bottled water product pattern which provides maximum consumer benefit was determined by Conjoint Analysis. The factor levels were shown in Table 3. Accordingly, the main factors which could be effective on consumers' PET bottled water preferences were determined as; origin (source), production type, taste, price, ISO (Quality Management System) Certification and HACCP (Food Safety Management System) Certification.

4. Conclusions - The results obtained from this research is thought to be a guiding document for stakeholders and to shape marketing strategies and new product developments according to the consumer behaviours.

5. References

[1] M. Ness, " Multivariate Techniques in Market Research", Course of Agro-Food Marketing, 2001-2002, Zaragoza, Spain. 2002.

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AKPINAR, M.G., GUL, M., 2014. An assessment of consumer preferences on the drinking water market: today to the future, Journal of Water Supply Research and Technology-AQUA, 63, 525-531.

GUL, M., AKPINAR, M.G., 2012. An Assessment of Factors Affecting Packaged Water Consumption Decisions of the Households, International Journal of Food, Agriculture, and Environment (JFAE), 10, 252-257

AKPINAR, M.G., GUL, M., GULCAN, S., 2014. Sensitivity on Drinking Water Safety and Affecting Factors for Urban Society. International Academic Conference, "Education Culture and Society 2014, 15th – 18th, September, Wroclaw-Poland.

AKPINAR, M.G., GUL, M., GULCAN, S., 2013. Evaluation of the Factors Affecting Water Saving Attitudes of Urban Life towards the Next Century. Global Business and Technology Association's Fifteenth Annual International Conference July 2nd – 6th, 2013, Helsinki, Finland.

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Rome (Italy), 18-20 July 2016

Rainwater Harvesting and Rainwater Treatment Design for a One-Story Government Office

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1. Introduction – The main purpose of this study is to design a set of guidelines for a rainwater harvesting and rainwater treatment facility for a one-story government office. In this study, the case of the Department of Science and Technology – National Capital Region (DOST-NCR) Office at Taguig City, Philippines was considered. This study aims to design each part of a typical rainwater harvesting and treatment facility that is vital for supplementing the estimated water demand of the office. In making the design of the facility, simulations using Yield-After-Spill Algorithm were performed in order to produce a reliability curve, which will be used to identify the size of the storage facility [1]. A storage tank size for the facility and a configuration for the slow sand filter for rainwater treatment are then recommended based from the analysis of the study. [2]

2. Experimental - For the flow of the study as in Image 1, the first task was to gather available historical rainfall data of Taguig City from the Public Information Unit of Philippine Atmospheric Geophysical Astronomial Services Administration (PAGASA). After gathering this data, the demand, roof catchment area, and the data itself were processed in order to identify the proper storage size needed for the rainwater harvesting facility. The output of the process was a reliability curve exclusive for the study area. Based on this target volume, a suitable rainwater harvesting and treatment facility was designed.

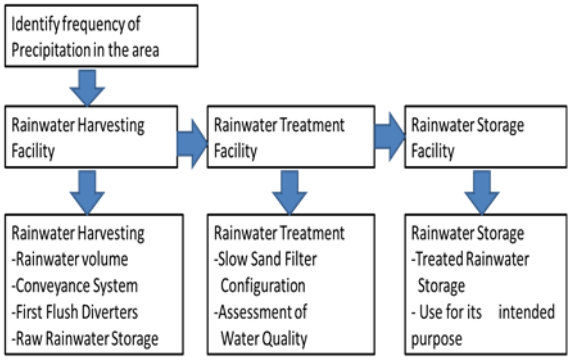

Image 1. Methodological framework of the study

3. Results and Discussion - The final configuration for the entire system as shown in Image 2 is based on the limitations in the area of DOST NCR Office, and based on the calculated water demand of the office. Depicted below is the conceptual model of the rainwater harvesting and treatment facility.The facility includes from left to right, a first flush diverter, three storage tanks, slow sand filter, and a final storage (ferrocment tank).

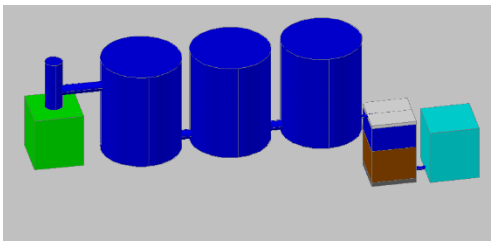

Image 2. Conceptual design of rainwater harvesting and treatment facility for DOST-NCR Office

4. Conclusions - Given the recommended reliability of 58.69%, it was recommended that 15 cu.m of storage facility be provided for the office. A solw sand filter was also designed which includes a layer of supernatant, sand, and support media. The potential of using ferrocement as a final storage was also recommended in the study.

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2013 to present **INSTITUTE OF CIVIL ENGINEERING, UNIVERSITY OF THE PHILIPPINES DILIMAN**

Masters of Science in Civil Engineering

- Proposed Thesis Topic: Policy Establishment for Urban Drainage: The Case of Greater Manila Area

2012 November **Civil Engineering Board Examination (*Professional Regulation Commission)***

- Board passer with 94.15 weighted average

2007 to 2012 **INSTITUTE OF CIVIL ENGINEERING, UNIVERSITY OF THE PHILIPPINES DILIMAN**

Bachelor of Science in Civil Engineering

- Magna Cum Laude

WORK EXPERIENCE

2012 to present **Institute of Civil Engineering University of the Philippines Diliman**

- Instructor – handles lecture and laboratory classes on engineering mechanics, fluid mechanics, mathematical methods in civil engineering, environmental engineering elective course, and disaster risk reduction and management elective.
- Primary Member – Environment and Energy Engineering Group
- Secondary Member – Water Resources and Coastal Engineering Group

2014 to present **UP ERDFI Teaching Research Grant**

- Recipient of *Beta Epsilon Teaching Research Grant*

2015 to present **DOST-NCR Office**

- **Project Leader** – Rainwater Harvester Design Guidelines for DOST NCR Office

CONFERENCES, SEMINARS, AND TRAININGS

2013 November **Sustainable Building 2013 (SB 13) – *Manila, Philippines***

- Best Poster – successfully presented a poster on rainwater harvesting entiled, "Integrating Storage Sizing and Water Treatment for Rainwater Harvesting System in the Philippines"

2014 September **International Workshop for Young Civil Engineers – Facing the Challenges of Our Future Society *Osaka, Japan***

- Attended a workshop organized by Japan Society of Civil Engineers that aims to promote close communication among international participants to discuss future roles of civil engineers in the emerging society

2015 May **International Conference on Civil and Environmental Engineering (ICOCEE Capadoccia 2015) – *Capadoccia, Turkey***

- Presented a paper on "Integrating Storage Sizing and Slow Sand Filtration for Rainwater Harvesting in the Philippines"

2015 August **Summer Training Course on Slope Land Disaster – *Taipei, Taiwan***

- Attended a training course (40 hours class + 4 hours laboratory + 2 days field work) on disaster risk reduction and management organized by Hydrotech Research Institute, National Taiwan University
- Awarded the Certificate of Excellence for an outstanding performance in the project presentation entitled, "Comparison of Landslide Mitigation

Strategies using Benefit-Cost Analysis: The Case of Brgy. Bagong Silangan, Quezon City"

2015 December **Evidence-Based Approach (EBA) Indonesia Fieldwork 2015**

- Participated in the *Indonesia Fieldwork 2015: The Practices on Water Resources Management* held in Institut Teknologi Bandung

2016 February **Management of Technology (MOT)**

- Participated in this two-week seminar at University Teknologi Malaysia (UTM)

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Self-Driven Oil-Skimmer Based on Selective-Wettability Materials

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1. Introduction – Oil spills resulting from oil exploration, transportation and storage pose great environmental risk. Oil containment booms, in-situ combustion, oil-absorption felts, dispersants, oil consuming microbes, and oil-skimmer are the main methods to clean oil spills. However, no existing methods can safely, effectively, rapidly and low-costly remove and collect oil from spills. In order to resolve the aforementioned issues, a new power-free oil-skimmer only driven by surface tension and gravity was develped based on the opponent wettability of extreme wettability porous materials to water and oil. This new method allows sustained on-site separation of oil/water mixtures without prior collection, lifting or pouring of the mixture, thus ridding the requirement of any pump or power input for removing the oil from the spill site.

2. Experimental – Superhydrophobic-superoleophilic stainless steel mesh was fabricated by chemical deposition and stearic acid modification. The oil-skimmer was consisted of the aforementioned superhydrophobic porous materials mounted in a leak-proof manner on the open end of a cylinder container.

3. Results and Discussion – Fig.1 shows the prototype device of the self-driven oil-skimmer and the collection procedure of the oil from water. Because of the affinity of the oil towards the mesh, the floating oil film wetted and spread over the mesh; the oil phase passed through the partly submerged mesh and flowed down along the inclined inner container wall and collected by gravity at the bottom, while the water phase was not transmitted through the mesh and remained outside the skimmer. The collection velocity of the skimmer is high, almost 95.4 ± 3.2% of the oil (hexadecane) can be collected from the surface of the water pool in 10 mins,

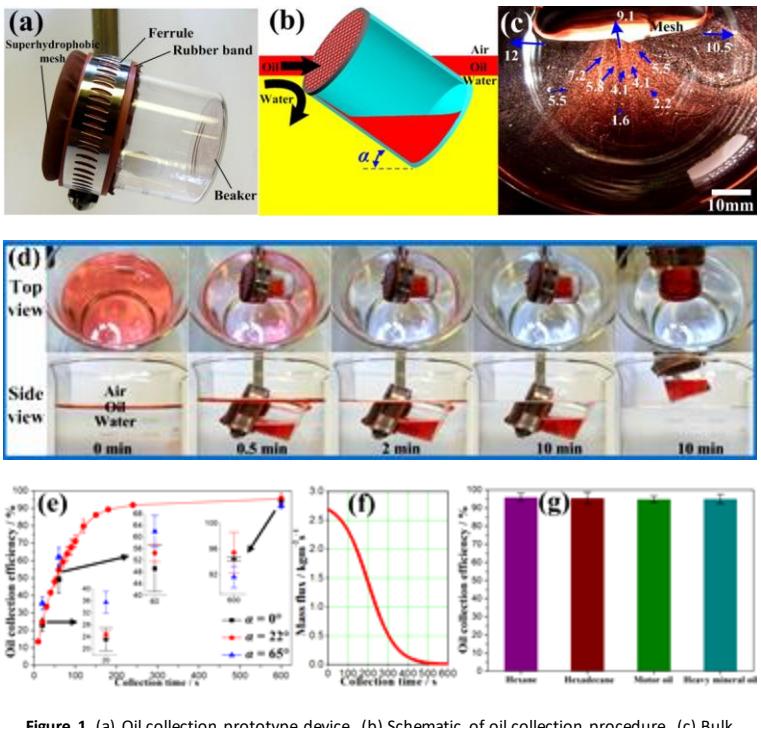

Figure 1 (a) Oil collection prototype device, (b) Schematic of oil collection procedure, (c) Bulk

leaving a clean water surface. This oil skimmer is also effective in separating oil with differenty viscosities from 0.42 cSt to 70.4 cSt with collection efficiencies better than 94%.

4. Conclusions - A new power-free oil-skimmer only driven by surface tension and gravity was develped based on the opponent wettability of extreme wettability porous materials to water and oil. The present approach achieves excellent oil collection efficiencies (above 94%) for oils with wide ranging kinematic viscosities, showing big application prospect on treating oil spills.

5. References

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International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

An Assessment of Consumer Oriented Drinking Water Supply in Urban Area: Bottled Water

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1. Introduction – The urbanization causes many problems especially in big cities. One of these problems is adequate water supply and tap water safety. After the 1990s, immigration of rural population to the big cities has improved the development of packaged water market. Bottled water demand is getting increase and preferred instead of tap water by the consumers in big cities. Modern marketing requires understanding of consumer needs and identify their needs and meet with a higher level of satisfaction than the competition. Public and private companies are operates in water market and the sectors shows a rapid development in the world. The urbanization and water safety issues are increasing demand for bottled water. The success rates of new products are 20% and 40% in the consumer market and industry market, respectively. For this reason the determination of the consumer-oriented products is important. This study focused on the bottled water (19 litres) sector constitutes an important part of the packed water market. In this context, the research was conducted to determine optimum product pattern providing the highest benefit to the consumer. In the study, conjoint analysis technique was applied as analysis method to the data. Price, origin of the water, HACCP certification, type of water (natural or mineral water), taste (soft or hard) were statistically affected factors that maximize consumer benefits in bottled water preferences as 28.04%, 21.36%, 19.07%, 13.38%, 12.11% and 6.04%, respectively.

2. Experimental - The data were obtained 965 households by face to face survey method in Adana, Antalya and Hatay provinces of the Mediterranean region of Turkey. The Conjoint Analysis [1] was used for the identified the optimum bottled water properties which maximize the benefit of the consumers.

3. Results and Discussion - The factor levels of bottled water were given in Table 1. Origin (source), production type, taste, price, ISO Certification and HACCP Certification were the factor

Table I. Conjoint Analysis Results for New Bottled Water (19 litres)

Factor/Factor Level	*Utility Estimate (Part worth value)*	*Standard error*
ORIGIN-Region 1	0.508	0.543
ORIGIN-Region 2	-1.349	0.543
ORIGIN-Region 3	*0.840*	0.498
PRODUCTION TYPE-Natural Spring Water	*0.821*	0.455
PRODUCTION TYPE-Natural Mineral Water	0.211	0.554
PRODUCTION TYPE-Processed Water	-1.032	0.554
Taste -Soft	*0.955*	0.341
Taste-Hard	-0.955	0.341
Price-Low	*1.818*	0.554
Price-Middle	0.218	0.455
Price-High	-2.036	0.554
ISO CERTIFICATION-Yes	*0.430*	0.389
ISO CERTIFICATION-No	-0.430	0.389
HACCP **CERTIFICATION**-Yes	1.413	0.389
HACCP **CERTIFICATION**-No	-1.413	0.389
Constant/Total	*4.081*	*0.407*
Pearson's R= 0.944	Significance = 0.0000	
Kendall's tau= 0.843	Significance= 0.0000	

which could be effective on consumers' bottled water preferences.

4. Conclusions – In the management of drinking water reduction of water resources in the world, an increase in environmental pollution and lack of infrastructure are discussed topics and tend to from tap water to bottled water. Consumer trends in drinking water consumption are also tended from the tap water to the bottled water. The public dimension is devoted to working for the development of tap water infrastructure and hygiene in the management of the network, the private sector is expanding the level of bottled water market under public control. In this process, consumer perceptions and preferences also plays an important role for both top water and bottled water supply and the management. As in study findings also directing consumer-oriented drinking water services will provide the resource use efficiency.

5. References

[1] M. Ness, "Multivariate Techniques in Market Research", Course of Agro-Food Marketing, 2001-2002, Zaragoza, Spain. 2002.

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GUL, M., AKPINAR, M.G., 2012. An Assessment of Factors Affecting Packaged Water Consumption Decisions of the Households, International Journal of Food, Agriculture, and Environment (JFAE), 10, 252-257

AKPINAR, M.G., GUL, M., GULCAN, S., 2013. Evaluation of the Factors Affecting Water Saving Attitudes of Urban Life towards the Next Century. Global Business and Technology Association's Fifteenth Annual International Conference July 2nd – 6th, 2013, Helsinki, Finland.

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What is the most effective use of wastes from the poultry industry, as a bioenergy resource or filler for polymer production?

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1. Introduction – With increasing popularity of poultry meat coupled with technological advances in production processes, the poultry industry is one of the largest and fastest growing in the agri-food sector worldwide [1]. The growth of the poultry industry has been accompanied by a corresponding increase in poultry waste, including litter, blood, carcass, feathers, eggshell and wastewater; inadequate management of these wastes can result in pollution of soil and water with nutrients, pathogenic micro-organisms and heavy metals [2]. Agri-environmental legislation and targets for increased use of renewable energy (along with specific incentives for energy from wastes) have led to the implementation of waste-to-energy processes in the poultry sector, such as anaerobic digestion to produce biogas, direct combustion for heat and power generation, and gasification for syngas production. Energy conversion is not, however, the only possible route for poultry waste utilisation nor for fossil fuel displacement; wastes from the poultry industry have the potential to displace petroleum by providing a source of sustainable raw materials for use in polymer production, an industry with an annual global production of 300 million tonnes. Two wastes with potential in the polymer industry are feathers and blood. In the UK ~929 million birds with an average weight of 2.2 kg are slaughtered each year [3], leading to the production of ~20.4 million tonnes each of feathers and blood (based 10% body mass yields for both wastes). The aim of this paper is to identify the most efficient routes for blood and feather utilisation in terms of petroleum displacement in the energy and polymer production sectors. The objectives are to: identify the chemical properties of blood and feathers through laboratory testing and literature review; estimate the potential for utilisation in polymer production; analyse the energy output from gasification of feathers and anaerobic digestion of blood; and compare the quantity of petroleum displaced.

2. Experimental – X-ray powder diffraction (XRD), x-ray fluorescence (XRF) and scanning electron microscopy (SEM) were used to analyse the mineral quantity and form, and to provide information on morphology, chemical composition and crystalline structure.

3. Results and Discussion - Laboratory results were supplemented with information from the literature, and the quantity of petroleum replaced in each sector was estimated using mass and energy balances based on life cycle analysis techniques.

4. Conclusions - Recommendations are made for the most effective route for blood and feather poultry waste utilisation in terms of petroleum displacement in the bioenergy and biopolymer sectors.

5. References

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Scientific CV (optional)

Dr Beatrice Smyth is a lecturer in the School of Mechanical and Aerospace Engineering, Queen's University Belfast, and is part of the Clean Energies Research Group. Her research is focused on the production and use of biomethane as a renewable fuel. Specific areas of work include analysis and optimisation of energy pathways, resource quantification and mapping, energy and carbon life cycle analyses, land use change and economic assessment. The interplay between systems is another area of interest, with topics such as the use of energy crops for wastewater treatment and the impact of alternative fuels on urban air quality currently under investigation. Prior to moving to Queen's in 2013, Beatrice worked in both the public and private sectors, mainly in energy/carbon management and in geotechnical and environmental engineering.

Dr Eoin Cunningham's IMechE accredited Masters Degree in Mechanical and Manufacturing Engineering (QUB 2000-2005, including a 13 month industrial placement with BS Tooling Ltd) provided him with extensive knowledge in a range of core engineering disciplines. Eoin's PhD (QUB 2005-2008) entitled "The Development of Bone Substitutes Based on Biomimetic Structures" was a multidisciplinary endeavour to develop manufacturing processes to replicate the unique architecture of human bone. His approach was to seek out abundant and replenishable natural sources with architectures similar to bone and attempt to replicate them. Sources included calcified algae, coral, and various marine sponges. Attaining an architecture which encourages bone ingrowth is crucial, but is by no means the sole requirement to create a successful bone substitute. Biocompatibility and mechanical stability are also essential. Post-doctoral research

projects have provided him with material processing, characterisation, product development and project management skills.

 Dr Beatrice Smyth

 Dr Eoin Cunnigham

International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

Separation of natural organic matter from nejayote by electrocoagulation using aluminium and iron electrodes

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1. Introduction – Nixtamalization is an ancient process of cooking of corn kernels in alkaline water. The cooked grains are milled to obtain dough and are used for making tortillas in Mexico. Alkaline water coming from cooking of corn, known as nejayote is a rich effluent organic matter containing high concentrations of suspended solids and in solution. At the present between 16 and 22 million m^3/year of nejayote are removed, 40% of which correspond to large production companies [1]. The nejayote is considered a highly polluting waste due to its high inorganic and organic load that produces values greater than 20000 mg O_2/L of Chemical Organic Demand (COD).

2. Experimental – The corn processing wastewater was obtained from the corn mill. Wastewater was characterized by physical-chemical parameters and UV-Vis. The electrocoagulation process was realized using three anodes of aluminium and three cathodes iron in 450 mL of nejayote. Electrocoagulation effectiveness was studied as a function of pH, treatment time and applied cell voltage. The control variable was NaCl amount (50 g/L) with constant stirring. Analysis of the quality of nejayote treated was performed by measured of Total Organic Carbon (TOC), COD, Specific Ultraviolet Absorbance (SUVA) and *Daphnia magna* toxicity tests. It was determined the kinetic of COD and COT removal and electric energy (EE) consumed to remove 1 Kg of organic matter (COD, COT), as well as sludge production versus treatment time. The composition (Energy Dispersive Spectroscopy, EDS) and morphology (Scanning Electron Microscopy, SEM) of sludge produced from electrocoagulation process was analysed.

3. Results and Discussion – The electrocoagulation process applied to crude nejayote using Al/Fe (3x3), reduce the values of COD (72.3 %), COT (59.6%) and SUVA (99.0%) with a applied cell voltage (7 V), NaCl (50.0 g/L) at pH 5 and 60 min treatment time. The toxicity tests *Daphnia magna* showed 46.6% mortality in dilution of treated nejayote (6.25% v/v), therefore the treated water is highly toxic. The apparent kinetic of COD and COT removal can be expressed as first and pseudofirst-order kinetics, respectively. The results of electric energy (EE) consumed indicate

that organic compounds (COD, COT) had different energy consumption. The maximum sludge production was 0.067 g/mL with 105 min of treatment. EDS results showed that residual sludge contains aluminium (12.8 weight%) coming from the anode electrodissolution during the electrolysis. SEM shows that the sludge is formed by compact flocs.

4. Conclusions – It was tested the effectiveness of electrocoagulation treatment for the highly concentrated organic pollutants present in nixtamalization effluents using an aluminium/iron system. Electrocoagulation treatment allows partial purification of wastewater (nejayote) of organic matter contaminants or oxidizable matter (COD) and COT, with high levels of color, turbidity and SUVA removal according to the operational optimum conditions.

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Sludge from coagulation/flocculation process of nejayote and its aplication as germination substrates in blue corn (*zea mays L.).*

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1. Introduction – Corn processing wastewater or nejayote is the result of processing of corn flour in the presence of $Ca(OH)_2$ at high temperatures which is known as nixtamalization in Mexico. A corn-processing plant with a capacity of 600 tons/day commonly generates between 1500 m^3 and 2000 m^3 of nejayote [1], therefore, a high quantity of sludge residuals, could be used as germination substrate. In the present study we evaluated the application of raw sludge (setteable solids) and residual sludge from the chemical coagulation treatment of nejayote as germination substrates for the growing native blue corn (*Zea mays)*.

2. Experimental – The coagulation/flocculation process were evaluated on nejayote. The effectiveness of natural coagulant (Sudflock P-63, alkaline aluminosilicate) and flocculant (Sumex Biofloc A-01; cationic polymer) was studied. Both the residual sludge from chemical coagulation treatment of nejayote and raw sludge obtained from filtered nejayote without treatment were used as germination substrates for planning corn. The sample of residual and raw sludge was characterized physicochemically. The variable answer was the germination percentage of planted corn between the 13th y 25th day. Five treatments consisting of different dosages of sludge were evaluated: control (C); RS25 = 75% soil + 25% raw sludge; RS50 = 50% soil + 50% raw sludge; CCS25 = 75% soil + 25% residual sludge; CCS50 =50% soil + 50% residual sludge. All the determinations were carried out in five times and the data were analyzed by a One-Way ANOVA with Bartlett's test and a Multifactor ANOVA with Tukey's range test (α = 0.05).

3. Results and Discussion – It was found that porosity, electrical conductivity, total nitrogen and calcium in CCS were higher than in RS, whereas that the values of cationic exchange capacity, organic matter, potassium, iron, manganese, zinc and C/N ratio were higher in RS than in CCS. Therefore, the germination percentage assessment on different substrates determined that, from

day 13 to 17, the percentage of seeds germinated were statistically higher in C and RS50 than in other substrates, but from the day 19 to 25, the percentage of germination reached with RS50 were greater than C. Meanwhile, for the substrates RS25 and CCS25 the percentage of seeds germinated was statistically fewer than in other substrates.

4. Conclusions – The RS and CCS substrates are promoters of germination of native blue corn when are using as germination substrates. The germination percentages using RS depended on the composition in the substrate, being better with RS50 since the germination percentage was 93.8±1.9% compared to RS25 (72.5±7.2%). The germination percentage using CCS25 and CCS50 substrates were 62.5 ± 9.4% and 82.5 ± 5.0%, respectively.

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Beetosan – from Bees to chitosan

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1. Introduction

Medicine, veterinary medicine, pharmacy and environmental protection are only some of the areas in which chitosan is used. The amount of these branches increases, and therefore it becomes important to look for new sources of this organic compound. Chitosan on an industrial scale is obtained by deacetylation of chitin – a polysaccharide that is the essential component constituting the exoskeleton of crustaceans. However, obtaining this polysaccharide from these animals is expensive, and therefore alternative sources are sought. What is important, apart from above-mentioned crustaceans insects such as bees are also a good source of this material. Therefore, within the framework of this research a multi-step synthesis of chitosan in which the raw material were naturally died honeybees is presented. The starting material were dead bees, which have not survived the winter period and the accompanying bad weather conditions. This material is an unnecessary waste. Thus, synthesis suggested in this abstract is preferred for the sake of the use of unnecessary waste with simultaneous obtaining polysaccharide that is used in many areas [1-3].

2. Experimental

Dried bees were extracted with ethanol in order to get rid of waxes from their bodies. Then the material was treated with hydrochloric acid (getting rid of mineral salts) and sodium hydroxide (deproteinization). Such prepared bees were subsequently treated with hydrogen peroxide for the removal of melanin (a natural dye). Insects devoid of waxes, proteins, mineral salts and dyes were then subjected to deacylation process in order to obtain the final product – chitosan.

Image 1. A raw material for obtaining chitosan.

The chemical structure of the material after various stages was monitored using FT-IR spectroscopy and X-ray diffraction.

3. Results and Discussion

On the basis of the research parameters of individual stages of processing bees were selected in such a way that the loss of a raw material was as low as possible. Moreover, based on FT-IR spectroscopy and X-ray diffraction it was found that the chemical structure of the resulting material was similar to the structure of commercial chitosan.

4. Conclusions

Naturally died honeybees are equally good and useful source of obtaining chitosan as compared to the crustaceans. However, a multi-stage chemical treatment is required as well as the selection of appropriate parameters of conducting individual stages.

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Self-healing hydrogels based on A6ACA

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1. Introduction

Self-healing materials are a group of compounds with unique properties, which are used in many fields. These materials are characterized by an ability to regenerate and re-create the chemical bonds at the place where the material has been interrupted. The regeneration process requires the creation of appropriate conditions (eg. temperature and pH), which will be conducive to the formation of the respective bonds. What is more, self-healing is a reversible and cyclical process, that can be controlled by modifying the physical parameters (eg. changing of pH of the solution in which self-healing takes place).

Such materials include hydrogels based on acryloyl-6-aminocaproic acid (A6ACA). On the one hand the above-mentioned polymers after placing in a solution having a pH $\leq$ 3 combine to form a continuous and compact structure. This is likely a consequence of the formation of hydrogen bonding between the carboxyl group and the amide. On the other hand healed hydrogels after immersion in a solution of pH> 9 separate from each other [1-3].

2. Experimental

In order to obtain above-mentioned materials A6ACA was dissolved in 1M solution of NaOH. Subsequently, an appropriate amount of the crosslinking agent (poly(ethylene glycol) diacrylate; PEGDA 700) and a photoinitiator (2-hydroxy-2-methylpropiophenone) were added, and the whole mixture was subjected to UV radiation for 1-2 min. The resulting hydrogels were dried at room temperature. Furthermore, their ability to self-healing was determined by cutting them out and immersion in a solution of low and high pH.

3. Results and Discussion

Fragments of the synthesized material immersed in the solution at low pH healed and formed a compact structure. The resulting structure when introduced into an alkaline solution divided again into two separate pieces. The procedure described above was repeated several times and it was found that the material retained a capacity of self-healing.

Image 1. Separated pieces of obtained material.

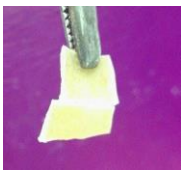

Image 2. Healed hydrogels.

4. Conclusions

Innovative self-healing materials are becoming increasingly popular. In order to obtain materials with such characteristics it is necessary to select an appropriate reagents and conditions under which the self-healing occurs. In the course of the research hydrogels based on acryloyl-6-aminocaproic acid (A6ACA) were obtained. These polymers have tended to self-healing in the low pH environment.

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Effect of nitrogen application management on water use efficiency of rainfed wheat in west of Iran

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1. Introduction - Soil available water and nitrogen are limiting factors that restrict the production of wheat in dry-lands of Iran. According to the statistics, 63% of the agricultural area in Iran under wheat cultivation is faced drought stress during the growing season because 90% of these lands are in areas with rainfall of less than 500 mm. Since water is major limiting factor for agriculture production in Iran, improving WUE is vital for reach the increasing food people. Nitrogen deficiency is the most common nutrient deficiency in small grains. In arid and semi-arid areas, the lack of organic matter in the soil as a natural source of nitrogen and drought stress are the main obstacle to absorb nitrogen and nitrogen stress after drought stress is the most important limiting factor in the production of wheat [2].The objective of this study was evaluation the effects of nitrogen on yield and water use efficiency in rainfed wheat.

2. Experimental - Field experiment was conducted in the west of Iran, 47°, 29′ E and 35°, 9′ N, on Fluventic Xerochrepts fine loamy Carbonatic Thermic which is representative of local rainfed condition at Dry-Land Agricultural Research Station of Qamloo in Kurdistan province, Iran. The study carried out within two successive season growing years 2012 - 13 and 2013 - 14. Experiment was designed as a randomized complete block design as split-plots test using three blocks. Three timing and splitting of nitrogen as main-plots were including T_1- Total in the fall, T2- 2/3 of in the fall +2/3 in the spring and T3- 1/2 in the fall + 1/2 in the spring. Five rates of nitrogen, including 0, 30, 60, 90 and 120 $kg.ha^{-1}$ of urea were used as the sub-plots. The Water Use Efficiency ($kg.mm^{-1}.ha^{-1}$), WUE, of rain was calculated by using French and Schultz (1984) method [2]. Nitrogen Agronomic Efficiency ($kg.ha^{-1}$), NAE, for each sub-plot was calculated by Huggins and Pan (1993) Method.

3. Result and Discussion - Result shows that the effect of year on biological yield and harvest index (HI) was significant at the level of 1% and 5% probability respectively. However it was insignificant on other traits. Apart from HI ($p < 0.01$) the effect of the nitrogen timing was insignificant on other traits. The effect of nitrogen rate on biological, grain and straw yields, TSW, HI and NAE and WUE of rain were significant at the level of 1%. Apart from HI ($p < 0.05$), interaction effect of the year in timing of nitrogen was insignificant in entire traits. The interaction effect of year in nitrogen rate was insignificant for the studied traits. The interaction effect of timing in nitrogen rate was significant on biological, grain and straw yields, HI and NAE and WUE of rain at 1% level. However it was insignificant on the TSW. The interaction effect of year in timing, nitrogen rate was significant on grain and straw yields ($p < 1\%$) and in NAE ($p < 5\%$). However it was insignificant in biological yield, TSW, HI and WUE of rain.

4. Conclusions – Nitrogen fertilizer increased the efficiency of rain water use, nitrogen agronomic efficiency and in wheat. Applying 60 $kg.ha^{-1}$ nitrogen in the fall (without splitting) with the highest yield, efficiency of nitrogen and water use was the best treatment.

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Brief Scientific CV

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Master Thesis Advising: *5 M.Sc Students*

Publications: *10 scientific paper in Persian*
Papers Presented in the National Scientific and Professional Congregations: *56 paper*
Extensional Bulletins and Technical Notes: *6*
Final Reports of the Completed Projects: *15*

Research Activities: *15 Research Project (National and Local)*
Research Interests: *Soil Fertility and Management and Soil and Water Pollution*
Awards (Honorary Degrees): *Distinguished researchers nominate*

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2. *The appreciate letter was awarded by governor of Kurdistan. (2000).*
3. *The appreciate letter was awarded by head of University of Kurdistan and governor of Kurdistan Province. (2004).*

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Development of a New Dyeing Process to PES/CO Fabric

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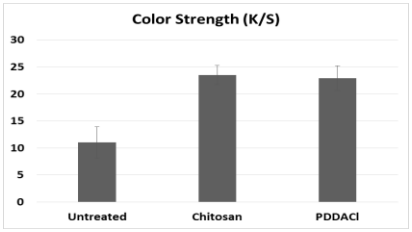
1. Introduction – The attractiveness of the application of new fibrous materials and functionalities has not stopped growing in recent years. Currently, various techniques and products have been used in order to modify the surface of textiles to create materials with new properties, and there are numerous scientific works that show this reality [1-4]. The continuous search for new solutions has created great opportunities to add value to traditional textile substrates, through the increment of different functionalities, by the development of new fibres [2] structures [3], finishes [4] or even by surface modification by use of physical or chemical processes. Despite its undeniable importance, the textile industry is known for being extremely polluting, mainly due to chemical processes in the finishing processes (bleaching, dyeing, printing, among others), which generate higher wastewater rate. Therefore, it is essential to finding solutions that causes the reduction of pollution load or even the cost with energy and chemical products of the above cited textile processes. One reason for the high rate of effluent is the enormous finishing processes and the low dye absorption into the fibres. Thus, modifications of fibrous substrates to decrease the time and temperature of procedures or even to increase the dyebath exhaustion is extremely important and reasonable. In this paper, polyester/cotton (PES/CO) plain fabric was functionalized with the application of two polyelectrolyte with the objective to dye the substrate using only one type of anionic dye and lower temperature process than the conventional one.

2. Experimental - A plain weave fabric (50%CO+50%PES) with 98 g/m^2 was used in this study. The poly diallyldimethylammonium chloride (PDDACl) and Chitosan were applied as polyelectrolytes and the acid Telon Red 2%owf as dye. The functionalization with different parameters (time, temperature and concentration) and the dyeing processes were performed by use of BMA-B MATHIS equipment with automatic heating system. Chemical analysis of the fabric before and after treatment with polyelectrolytes was performed by XPS and FTIR techniques. The PES/CO samples after the dyeing process were evaluated in the spectrophotometer KONICA MINOTA, Model CM – 2600D. The washing fastness of the samples were performed according to Norm ISO 105 C06 - N°. A1S.



3. Results and Conclusions - The chemical and physical effects of the previously treated PES/CO substrate with Chitosan and PDDACl contributed to the best results obtained in the dyebath exhaustion and color strength (K/S) using only one type of dye with the temperature of 70ºC. The results of washing fastness of the samples functionalized were considered excellent with values of 4 and 4/5 to the PES/CO-chitosan and PES/CO-PDDACL respectively. These promising results imply the possibility of obtaining unique and solid colors to PES/CO samples using a faster dyeing process, (one bath) and lower temperature than conventional one (130ºC).

Fig.1 - K/S results obtained for the dyed samples

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Removal of Diazinon Pesticide from Pesticide-Contaminated Water by Adsorption Using Bentonite: Kinetics, Equilibrium and Thermodynamic Studies

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Abstract

The present paper focuses on the possibility of utilization of bentonite as an adsorbent for removal of diazinon, an organophosphorous pesticide from pesticide-contaminated water.Adsorption of diazinon, from pesticide-contaminated water was studied by adsorption on acid-treated bentonite. The effect of initial pesticide concentration, contact time, initial pH,and adsorbent dosage were studied. The equilibrium adsorption results were complied with Langmuir isotherm model and its maximum monolayer adsorption capacity was 5.667 mg/g for diazinon. Thermodynamics studies revealed the spontaneous and exothermic nature of thesorption process. Adsorption kinetics studies indicated that the pseudo- second-order model yielded the best fit for the kinetic data. An intraparticle diffusion model suggested that the intra-particle diffusion was not the only rate-controlling step.

Keywords: Diazinon, Bentonite, Adsorption, Kinetic, Isotherm, Thermodynamic.

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Water use efficiency of urban households

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1. Introduction – Water exerts a vital significance on the sustainability of social life and economic development. Human-related water use can be classified into (i) potable water, (ii) running water, (iii) industrial or commercial use like irrigation water, water for fire extinguish and (iv) purposes for fishing, swimming or sea transportation [1]. Being unable to replace water, scarcity of water and speculations that the world shall face several water crises in the long run make countries more conscious towards water potential and wise water use. Thus, they have been paying a considerable focus on several practices for water supply and water demand management. To what extent households use water for personal care and household needs consciously, that constitutes 97% of daily water use per capita, has been gaining importance in global level. While average daily per capita water use differ in developed and developing countries, water use habits and water saving issues bear plenty similarities. This study aims at demonstrating water use and saving behaviours and attitudes of households in urban settings through a sample case study. The results show that 25.3% of households maintain practices in order to reuse and save water. It has been found that 66.7% of waste water is used at toilet, 17.3% in plant watering and 16% in cleaning balconies or similar parts of the house. The tap water is mainly used for cooking, laundry, personal care as well as for garden irrigation (66.2%) and car washing (57.7%). The data obtained demonstrate that marketing activities and policies that shall improve conscious tap water use in households are of vital significance.

2. Experimental - The material of the study involves the data obtained from 965 face-to-face surveys conducted in households of urban settings in Mediterranean Region of Turkey. Besides, several relevant international literature have been benefited. Basic descriptive statistics have been used to analyse and evaluate the consumer data. The study has also investigated knowledge level of households regarding tap water resources as well as their water use habits and water saving tendencies.

3. Results and Discussion - Table 1 indicates usage areas of tap water of households. As can be inferred from the table, the use areas widely differ. In 90.5% of the households interviewed the

Table I. Tap Water Usage Areas

		Usage Status---Yes	Usage Status------ No	Total
Cooking	N	873	92	965
	%	90.5	9.5	100.0
Tea, coffee making		831	134	965
		86.1	13.9	100.0
Shower, laundry, toilet		947	18	965
		98.1	1.9	100.0
Personal care (shaving, tooth brushing, washing hands and face, etc.)		952	13	965
		98.7	1.3	100.0
House cleaning		947	18	965
		98.1	1.9	100.0
Rug-carpet washing		883	82	965
		91.5	8.5	100.0
Plant watering		851	114	965
		88.2	11.8	100.0
Garden irrigation		639	326	965
		66.2	33.8	100.0
Car washing		557	408	965
		57.7	42.3	100.0
Stairs-doorstep cleaning		781	184	965
		80.9	19.1	100.0
Balcony cleaning		887	78	965
		91.9	8.1	100.0

tap water is used for cooking and 86.1% for tea-coffee making. High ratio of using tap water for doorstep cleaning, garden irrigation and car washing demonstrates that people use tap water for waste purposes and that they need to be more conscious. Thus, 66.2% of households use tap water for garden irrigation while 57.7% use it for car washing.

4. Conclusions – Tap water management stands out as an important area of development in public level. In water supply, the sufficiency of water resources, infrastructure, environmental pollution, etc. are important while they are sufficient water supply, water quality and hygiene and perceptions, attitudes and behaviours of people towards water use in water demand management. Formation of sense of conscious water use is regarded as a shared responsibility in this respect. The microdata play a significant role in developing effective and efficient policies regarding the issue. The variations observed from country to country might also appear within the country due to geographical, demographical, economical and psychological factors. All in all, it has been found that developing appropriate marketing and policy components catering for the needs of target groups are of great importance.

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1. Agricultural economics
2. Production economics
3. Farm management
4. Agricultural marketing

Related publication to congress

GUL, M., AKPINAR, M.G., 2012. An Assessment of Factors Affecting Packaged Water Consumption Decisions of the Households, International Journal of Food, Agriculture, and Environment (JFAE), 10, 252-257

AKPINAR, M.G., GUL, M., GULCAN, S., 2013. Evaluation of the Factors Affecting Water Saving Attitudes of Urban Life towards the Next Century. Global Business and Technology Association's Fifteenth Annual International Conference July 2nd – 6th, 2013, Helsinki, Finland.

AKPINAR, M.G., GUL, M., 2014. An assessment of consumer preferences on the drinking water market: today to the future, Journal of Water Supply Research and Technology-AQUA, 63, 525-531.

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International Congress on Water, Waste and Energy Management
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Evaluating the trend of changes in groundwater quality parameters (Case Study: Jiroft plain)

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Abstract
In recent decades, population growth and development of agriculture, has led to indiscriminate use increase of groundwater resources and exacerbate the decline in the quality of groundwater in the most parts of the country. Thus, given the importance of this research to study the spatial and temporal changes trend in parameters of calcium, magnesium, pH, chloride, sodium and sulfate of groundwater in Jiroft discussed. For this purpose, the data of 40 wells, that had been measured by Regional Water Authority of Kerman province and qualitative analysis had been done on them, were used in 2002-2012. In this regard, after normalizing the data, the accuracy of different geo-statistical methods including the kriging and inverse distance weighted methods was evaluated, then map of the spatial changes zoning in the groundwater quality parameters was prepared in ArcGIS9.3 using the best method of interpolation. The results showed that the amount of calcium, pH and chlorine has increased in the water and magnesium and sodium sulfate has declined. But the quality of groundwater resources in Jiroft plain in 2012 compared with 2002, has generally decreased and based on changes trend, groundwater quality is reduced toward South and West that existence gypsumand halite formations in the South and West parts of study area can be its main cause.

Keyword: Modeling, Jiroft plain, groundwater, spatial changes, interpolation.

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Mapping of Solar Energy Potential in Indonesia for Energy Security in the Pacific Region

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1. Introduction – The objectives of this study is to mapping the potential of solar energy potential in Indonesia for energy security in the Pacific region. Indonesia is the largest island country located in the Pacific region that is needed to maintain energy security as one of the issue. Energy security is defined as the association between national security and the availability of natural resources for energy consumption. The utilisation of solar energy source can be one of the alternatives to increase the energy security.

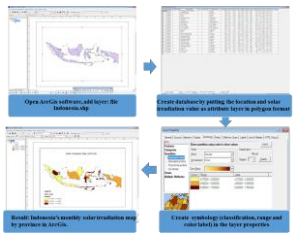

Figure 1

2. Method - The method used on this study is to develop the database of solar energy potential in GIS platform then overlay the potential energy produced by utilyzing the technical solar energy potential. The procedure are described in the Figure 1.

3. Results and Discussion - The results are presented as the mapping of solar energy potential (Figure 2) produced by province in Indonesia to show the potential energy tapping by PV technology selected. The value of solar irradiation by province are obtained from nasa website (www.eosweb.larc.nasa.gov/sse) by putting the latitude and longitude of the capital city of provinces. The potential of energy PV technology (in Kwh) are calculated solar radiation value into efficiency of PV system and efficiency of solar cell with consideration of the PV area installed.

4. Conclusions - The mapping of solar energy potential indicates the role of solar energy potential for energy security in thePacific region. It is recommended for decision maker such as the government and other stakeholders to develop projects on photovoltaics systems. The Indonesia's energy policy for improving the green and sustainable energy technology must be put in action. The future work will focus on the technical design and economic analysis of PV systems implementation for Indonesia.

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Scientific CV (optional)

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Carbon dioxide sequestration as $CaCO_3$ using industrial wastes

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Since the industrial revolution, large quantities of CO_2 have been emitted into the atmosphere. Carbon dioxide discharged from combustion processes is now believed responsible for global warming and an increase in the earth's average temperature. Many studies have introduced new technologies for CO_2 capture; however, the quest for feasible capture technologies continues. To this end, CO_2 mineralization technology presents innovative model system for trapping CO_2 from emission sources. Mineral carbonation is expected to offer an environmentally safe and permanent CO_2 disposal method. In this study, we utilize waste such as steelmaking slag, fly ash or waste concrete as the alkaline-earth metal sources. This study examines a carbon dioxide capture and utilization technology in which absorbed CO_2 is precipitated in the presence of the amine solvent to obtain a $CaCO_3$ precipitate with a polymorphic crystal composition that depend on the pH, temperature, or mole ratio of the reactants in the reaction mixture.

Each pH experiment was conducted with a mole ratio of 1:1 at 25°C. A saturated CO_2 solution was added to a Ca^{2+} extracted from waste and Tris–HCl buffer, at pH 8.5, 9.0, 9.5, or 10.0. After 2h, the precipitated $CaCO_3$ was quantified by the IC method, and the crystal phases were identified and quantified by XRD. The crystal phase compositions varied with the pH, and a mixture of $CaCO_3$ phases, including calcite and vaterite, was obtained. The ratio of the $CaCO_3$ phases (vaterite/calcite) varied with the pH. The phase ratios in the precipitated $CaCO_3$ at pH 8.5, 9.0, 9.5, or 10 were 1.49, 2.24, 4.13, and 7.62 . A mole ratio of 0.25:1 or less (Ca^{2+} : CO_3^{2-}) favored the formation of pure vaterite crystals because the surface calcium ions attracted a layer of carbonate ions, which were oriented to facilitate vaterite structure formation. In the carbonate plane, the surface carbonate groups were rotated to lie flat on the surface and form porous spherical particles. Because the calcium concentration was higher than the carbonate concentration ($[Ca^{2+}] > [CO_3^{2-}]$), pure calcite formed at mole ratios of 3:1 or greater (Ca^{2+} : CO_3^{2-}). The temperature dependence of the calcium carbonate precipitate crystal phases was measured for a mole ratio of 1:1 over 120 min, and the temperature was varied over the range 15-75°C. The aragonite and calcite phases dominated at 75°C. All three $CaCO_3$ crystalline polymorphs were obtained at intermediate temperatures (45–60°C). Higher temperatures disfavored the formation

of the most soluble crystalline vaterite phase, whereas the major crystal phase at 40°C was calcite, 86%.

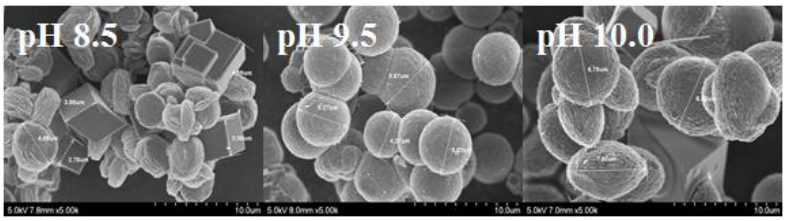

Image 1. SEM images of $CaCO_3$ with different pH.

$CaCO_3$ forms in three polymorphs by absorbed CO_2 during post-combustion process that could potentially be optimized as a carbon dioxide capture and utilization (CCU) technology to replace the established CCS technologies.

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NEW ALTERNATIVE FOR PHYSICOCHEMICAL RECYCLING SYSTEM FOR RECOVERY OF ORIGINAL COMPONENTS FROM MULTILAYER POSTCONSUMER PACKAGING.

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1. Introduction –

The main objective of this project is to develop a new system for the recovery of aluminum, polyethylene and cellulose that make up these packages. Through a process of separation that allows for recycling of aluminum and polymer contained in that type of packaging.

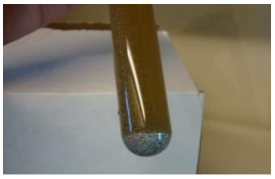

Image 1. Separation of Aluminum

Our project consolidated a new technology, of variable and simple components which can increase the recycling of multilayer packaging for obtaining their original materials, and to allow recycling companies in Mexico, to have a cost-effective alternative of separation of aluminum and polyethylene; economically viable and that does not require processes and/or equipment of high investment costs and / or operation that limit the widespread use of this new technology.

2. Experimental - The experimental phase mainly consisted in laboratory performance of Formulations and Processes, confirming the technical feasibility of using techniques electrochemistry, use of recycling oils, organic co-solvents 100% reusable, and new zeolites membranes to purify the final components, Among other variables, for recovery of components multilayer packaging.

3. Results and Discussion - The main result of our development was a unique system for recycling multilayer packaging and the recovery of polyethylene and aluminum through a process of separation with minimal energy and raw materials use, recovering 100 % of the aluminum and polyethylene in the initial material, with a profitable process and without use of pyrolysis process,

obtaining a very high level process of recovery of aluminum and polyethylene, low cost, high profitability and standard operating conditions.

4. Conclusions - The growing social awareness of recycling, reuse, sustainability and generally everything that reduce the environmental impact resulting from our current lifestyle is crucial for companies and developers seek solutions to reduce such impact. Being the main entry barrier of solutions for recycling in Mexico the low profitability in many of the developments generated, we have created solutions with a focus in favor of the environment and society as a whole.

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Calotropis Procera fiber: an effective bioadsorbent for oil removal in seawater

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1. Introduction – Although Crude Oil is a product of great economic and energy importance, the oil affects in marine and coastal ecosystems are significant and aggressive [1]. For remediation of environmental damage caused by oil spills into the sea, several methods are used. The choice of method to be used is strongly linked to the type of affected and exposed ecosystem, it may be through containment booms, sorbents, skimmers, dispersants, absorbents, in situ burning, bioremediators, vacuum pumping and coagulants/flocculants and others [2,3]. The aim of this study was to characterize and analyze the behavior of *Calotropis Procera* (CP) fiber as crude oil bioadsorbent within the marine environment.

2. Experimental – Light crude oil with an API gravity of 33 degrees and 0.86 g/cm^3 density was used. The seawater was obtained on the Mãe Luiza beach, coastal area of Natal, Brazil. CP fibers were provided by the Federal Institute of Pernambuco, Campus Sertão-Petrolina and the Brazilian Agricultural Research Corporation, Pernambuco, PE, Brazil. The adsorption experiments were performed in a solution of water/oil for periods of 30 and 60 seconds. After the established time, the samples were removed from the solution, dried and weighed. The content of oils and greases were analyzed by extraction method via Soxhlet using oil and greases extractor TECNAL brand, model TE 044, greenhouse NOVA ETICA, model 402-SDE, analytical balance MARTE, model AX2000, and a filtration system funnel Buchner and Kitasato.

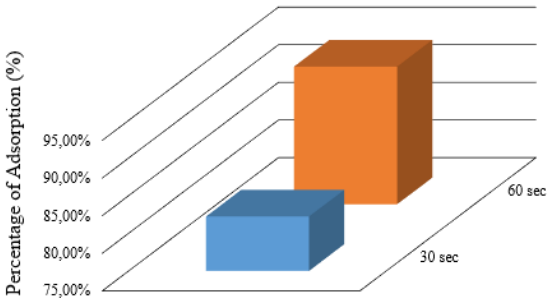

Fig. 1 - Adsorption of crude oil by Calotropis Procera

3. Results and Discussion – The samples subjected to the adsorption test had an average oil retention around 93.29% for 60 seconds period and 82.23% at 30 seconds Fig. 1. The results of oil and grease content of the effluent submitted the adsorption of CP for 60 seconds achieved an average of less than 20 mg/L, within the limits established by the Brazilian resolution of the

National Council for the Environment (CONAMA) and US Environmental Protection Agency (EPA).

4. Conclusions – The CP fiber was considered efficient and feasible in the removal of hydrocarbons in the marine environment, with a significant rate of adsorption, being hydrophobic, oleophilic and biodegradable, and it is available in abundance in the semi-arid vegetation regions of Brazil, contributing to the preservation and environmental sustainability.

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Turning Water Pollutants into Energy

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Abstract-Solid and liquid wastes including soluble and biodegradable organic materials create serious environmental problems when disposed into environment in an uncontrolled manner, but they can be valued as an energy source if decomposed in a controlled anaerobic chamber. Wastewaters from slaughterhouses and cheese factories fall into this category and it is difficult to treat these liquid effluents in a conventional wastewater treatment process due to their high organic loadings and requirements to long hydraulic retention times and large reactor volumes. In this study biogas production potential of cattle manure, cheese whey and blood and treatability of blood and cheese whey were investigated comparatively. Biogas production rates of 0.63, 0.72 and 0.64 l min^{-1}. m^{-3} were obtained from the digestion of manure, co-digestion of manure-cheese whey and manure-blood, respectively, at 35±2 °C. A 54% reduction in volatile solid materials (VSM) and a 52% reduction in phosphorus (PO_4^{3-}) were observed in 30 days of digestion of manure (Fig. 1). The amount of total nitrogen (Tot-N) decreased 10% in 30 days of digestion but ammonium-nitrogen (Am-N) increased 46% at the same duration of time. Manure, during co-digestion, buffered and inoculated the cheese whey and blood, and converted them to the energy source. An average COD removal of 52% or 34% is also possible during co-digestion of cheese whey or blood with manure (Table 1).

Table 1. Variation of some physical and chemical parameters during anaerobic co-digestion of whey with manure.

Parameter	Influent conc. mg l^{-1}	Efluent conc. mg l^{-1}	Removal efficiency %
Solid material, TS	98977	83140	16
Volatile solid material, VSM	64285	35357	45
COD	35426	17004	52
Am-N	185	191	-3
Total N	230.8	166.1	28
Phosphate	215.4	144.5	33

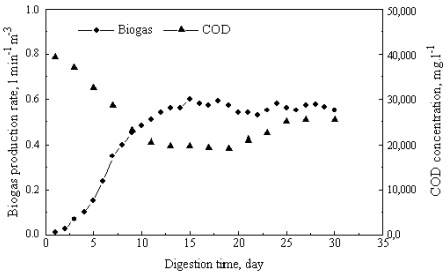

Figure 1. Variation of biogas production rate, its methane content and COD concentration during co-digestion of blood with manure.

Dr. Ozturk was born in Trabzon, TURKEY, in 1966. He received the B.Sc. and MSc degrees in Environmental Engineering from Ondokuz Mayis University, Samsun, Turkey, in 1987 and in1991, respectively, and the Ph.D. degree in Chemical and Gas Engineering from the University of Salford, Manchester, England, in 1997.

Since 1997 he is a lecturer and researcher in Environmental Engineering Department at Ondokuz Mayis University, Samsun, Turkey. His current research interests include membrane technology, membrane gas separation, and renewable energy.

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Estimate drinking water and water crisis evaluation under drought condition in Sanandaj city, Iran

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Abstract

For stakeholders the most important issues is drinking water safety. The way out of rural drinking water safety issue is one of the important ways for the improvement of water resource utilization efficiency. In Sanandaj city, Kurdistan, Iran surface water is the main supply for drinking which is highly relies on annual precipitation. The Gheshlagh dam with a 225 MCM reservoir capacity was constructed to store and balance the water during dry and wet periods. Very low precipitation and drought severity in last few years caused a steep decline in surface water sources from the rivers to Gheshlagh dam and consequently the drinking water shortage in Sanandaj city. The crisis in 2015 raised so that put the Sanandaj to red alert. The regional and national officials and organizations urged to consider short-term and long-term plans to resolve the issues. In this research the managements to overcome this crisis were evaluated and the drinking water for Sanandaj city by 2030 was determined. The share of different consumption components of water use per capita were calculated using common standards and present consumption data reported by authorities. The water consumption and population in 2015 were considered to calculate those in 2030. Using the recorded data in last decades the population growth rate was found as 3.4%, and considered to determine the population in 2030. Considering persistent population growth rate the Sanandaj population will increase from 373,987 in 2012 to 725,775 in 2030. Furthermore, it was found that the drinking water per capita will increased from 294 l/day to 380 l/day. Consequently the annual drinking water consumption will increase from 40 MCM to 100 MCM during 2012 to 2030. In case of water management, although provisional plans prevent the city from water crisis, however managing the reservoir by reducing the consumption of the agricultural sector can be a better solution. In addition, the link of drinking water to mega structures such as new dams and huge pump stations to transfer water between basins is associated with large uncertainties. The results of this research quantified the needs for drinking water and can be used by decision makers to fill the gap between water supply and demands under drought condition.

Keyword: Drinking water, Extreme event, Drought, Sanandaj

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Conversion of sugars to added value products with heterogeneous tin based catalysts

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1. Introduction – High global demand for energy and chemicals and uncertainty about currently used fossil fuels have produced a growing interest to obtain different products from biomass, that in many cases comes from waste products. Regarding biomass, carbohydrates, and specially sugars, are excellent candidates to undergo transformations to get high value added products because of their low price and wide availability.

Lactic acid and its derivatives have a wide range of applications in several industrial fields, as food industry, textile industry and the pharmaceutical and biomedical industry [1]. The industrial production of lactic acid is mainly based on the fermentation of vegetal feedstocks. This biotechnological process needs long reaction times and a precise control of reactor conditions. Furthermore, fermentation produces a large amount of waste products. These problems can be solved by means of inorganic heterogeneous catalysts [2]. The aim of this work is to carry out the catalytic conversion of sugars to methyl lactate using nanostructured porous catalysts.

2. Experimental – Catalytic tests were carried out in a batch reactor at temperatures ranging from 160 to 220 ºC and with reaction times between 20 and 72 h. The reaction was performed by mixing a given amount of sugar, such as glucose, fructose, sucrose and cellulose, containing 1,25 mmol of monosaccharide, with 8 g of methanol and 160 mg of catalyst. Naphthalene was used as internal standard.

3. Results and Discussion – Different porous solids have been synthesised and tested as catalysts for this reaction, including delaminated titanosilicates UZAR-S1 and UZAR-S2 materials, siliceous mesoporous materials and metal organic frameworks (MOFs). From all these materials, mesoporous Sn-MCM-41 [3] and Zn based ZIF-8 [4] have shown the highest yield of methyl lactate from glucose and sucrose respectively.

4. Conclusions – Several nanostructured porous materials have been successfully applied as catalysts for the transformation of sugars to methyl lactate. Then, we can conclude that heterogeneous catalysis represents a feasible alternative to improve the production of lactic acid derivatives and other processes.

Acknowledgements – Financial support from the Spanish Ministry of Economy and Competitiveness (MAT2013-40556-R) and the European Social Fund (ESF) through the Aragón Government (DGA, T05) is gratefully acknowledged.

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[4] Murillo, B., Zornoza, B., de la Iglesia, O., Téllez, C., Coronas, J.; J. Catal. 334 (2016) 60-67.

Scientific CV (optional)

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His research activity is developed at the Aragon Institute of Nanoscience (INA) within the group of "catalysis, molecular separation and reactor engineering group" (CREG). His research is focused in the preparation, characterization of nanoporous materials (zeolites, mesoporous materials, MOFs, etc.) as powders and films, and their application in liquid and gas separations, membrane reactors, adsorption and catalysis.

He is co-author of 19 articles in JCR journals, one book chapter, one academic book entitled "Environmental Technologies" and 3 congress proceedings with ISBN. He is also co-author of 39 communications to national and international conferences.

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Urban Water Management Network of Household Expectations

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1. Introduction – Access to clean potable water is a basic issue in global level while it is also one of the articles of human rights. Potable water is defined as the water provided by an institution or an entity for purposes of human consumption, preparing beverages and food as well as cleaning the stuff used to prepare food and beverages [1]. Personal and household consumption constitutes 15% of total water consumption while only 3% is for potable water. The demand for water increases as the population and economical activities grow in that water consumption increases more than the population growth depending on the increase in level of life standards. However, the water pollution and decrease in water levels in the dams due to global warming as well as the low quality of potable water brings up the issue of running water sufficiency and safety. The production and distribution services of potable water are mainly maintained by city municipalities while it might differ from one country to another. Studies regarding potable water gains more importance in an environment where water supply and demand management is maintained in the spotlight of supply of safe and clean potable water. This study measures consumer satisfaction level and expectations regarding potable city water quality and services based on the cross-sectional data collected from urban settings. The results suggest that 71.4% of households use city water as their potable water and define the quality of potable city water as average quality. In five level-likert scale, the color and turbidity qualities of water have been ranked quite high while conductivity, taste and odor of the water have received lower rankings of satisfaction. Lack of pre-informing of water cuts, insufficient maintenance and repair services and unsatisfactory responses to the consumer complaints have been listed the main problems encountered in city water services. In customer expectations evaluation, improving the quality of potable water, water pricing and safety issues have been found the most immediate items.

2. Experimental – Primary data have been used as the study material. The study has been conducted in Turkey. The interview data obtained from 965 households from urban settings through face-to-face interviews have been analyzed via SPSS software. The five level-likert scale has been used to evaluate the customer satisfaction for city water services.

3. Results and Discussion – The study outcomes involve the profile of the household members used in the study, evaluations regarding city water quality and other variables, market-oriented approach and expectations regarding city water services.

Table 1 Evaluation of City Water (tap water) based on several criteria

	*Average**	*Standard Deviation*
Water quality	3.21	0.926
Water amount (water duress)	3.68	0.902
Water permanency	3.73	0.936
Water price	2.61	1.098
Water safety	3.09	0.936
Municipality services regarding water	3.20	0.975
Satisfaction level	3.26	0.923

**Five level-likert scale (1:Very bad.....5:very good)*

4. Conclusions – City water services are of a significant issue in public and social levels. While setting the strategies and policies in order to enhance the production and distribution services of water, the demands and expectations of target consumers are to be considered. Thus, developing services catering for the expectations of the consumers shall also allow efficient use of scarce resources. The results of the study indicate that water quality and safety in potable city water production and distribution services are the primary development areas.

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Related publication to congress

AKPINAR, M.G., GUL, M., 2014. An assessment of consumer preferences on the drinking water market: today to the future, Journal of Water Supply Research and Technology-AQUA, 63, 525-531.

GUL, M., AKPINAR, M.G., 2012. An Assessment of Factors Affecting Packaged Water Consumption Decisions of the Households, International Journal of Food, Agriculture, and Environment (JFAE), 10, 252-257

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Characterization of the temporal variability of drought in the watershed of Oued Seybouse –Algeria

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1. Introduction:

The aim of this study is to highlight the elements that characterize climate variability in the northeastern region of Algeria (Seybouse basin). the studies were characterized the evolution of recent climate through the two main parameters, temperatures and precipitation, and drought study revealing indices in time series at different time steps between 1970 and 2011. The spatial and temporal variability of the parameter. For the establishment of future climate change projections and the impact of this change on our natural resources.

2. Experimental:

This work adopts the indices of drought in watershed Seybouse, we are interested in changes in precipitation (P), temperature (T) and from data collected by the basin agency in various stations climate For the period 1970-2011, made the analysis incorporated the following steps:

- changing series of precipitation and temperatures measured in different stations during that period.
- Estimation of meteorological drought indices and analysis of climate dynamics.
- Spatial characterization of precipitation (rainfall indices Mapping)

3. Results and Discussion:

Interannual variability of rainfall stations for the period 1970-1995 the consistency of deficit years we notice .The annual precipitation has increased the période1995-2011.

The analysis of temperature trends over the 1972-2011 periods indicates a remarkable increase in temperature.

The report of the Standardized Precipitation Index (SPI). These indices have allowed us to show that the hydraulic basin Seybouse experienced dry spells 1970-1995

Mapping of the average values of the index over different periods between dry and wet years 19970-1995 years 1995 2011

4. Conclusions:

From these analyzes, which were displayed in the various stations within the perimeter of Seybouse basin, we concluded that a series of dry period of 2 to 5 years, the drought and considered a repetitive phenomenon in years of 1970-1994, but in the wet period 1995-2011en observe a small increase in temperature and precipitation volume.

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Pharmaceutical pollutant removal from water by Aluminum pillared clay

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1. Introduction The aim of this work is to explore the removal of a pharmaceutical pollutant, from aqueous solution. Pharmaceutical pollutants are a group of emerging contaminants that contain different groups of human medicinal compounds that are widely used all over the globe and causing an environmental problem **[1, 2]**. In this work, the removal of diclofenac potassium by the use of aluminum -pillared clays as adsorbents, in comparison with their starting material (a natural clay mineral) was studied. Modifying clay minerals via pillaring currently constitutes an important and broad field of materials and surface science research. Pillared clays are complex microporous systems, having enormous potential for application in adsorption process. Introducing inorganic pillars, in addition to improving clay mineral strength and stability, increases microporosity and provides greater surface area on the solid, thereby facilitating pollutant's adsorption **[3].** This study improves diclofenac potassium removal by an adsorption process, using modified clays instead of the natural clay mineral. The pillared clays were synthesized from a natural clay mineral from Algeria, by using Aluminum oligocation. The pillared samples showed a considerable increase in their adsorption capacity in comparison to the natural clay mineral. This effect can be related to the textural and structural changes produced during the pillaring process.
Batch adsorption experiments were carried out for solutions of diclofenac potassium in the concentrations range 50–1,000 mg/l Experiments were performed with adsorbent and diclofenac potassium solutions. An optimization of adsorption parameters was studied (effect of contact time, adsorbate/adsorbent relationship and effect of the initial concentration of diclofenac potassium solution) Consequently, Aluminum-pillared clays could be the new material to be used in treatment of different effluent.

Keywords: Diclofenac potassium; Pharmaceutical pollutant; Adsorption; Clay; Bentonite; Aluminum pillared clay

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Synthesis of magnetic nanoparticles for the treatment of wastewater

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Keywords: Magnetic Particles; pollutants; pesticides; water treatment

Abstract :

In the past few years, the magnetic nanoparticles (MNP) have a growing interest due to their ability to react in response to an external magnetic field [1.2]

Nanoparticles was particularly interesting because of its non-toxicity, chemical and thermal stability [3];

The Synthesis of magnetic particles has by many researchers, and we will see in this work the magnetic particles functionalized with adequate grouped and their use for the removal of various pollutants including dyes and pesticides; Synthesis of magnetic nanoparticles through technical co-precipitation [4] using magnets; protected by a silica shell for avoiding the oxidation of us particles, characterization of these particles thus

by IR spectrum, functionalized with a group that makes the complex with the pollutant (NP_polluant), and the choice will be governed by chelate type of pollutant treating

The magnetic part can be recovered by a simple, one using a magnet external

3. Results and Discussion

I realized zeta potential measurements and thermogravimetric analysis products. TEM data show that the magnetic particles are spherical size of average size of 10 nm

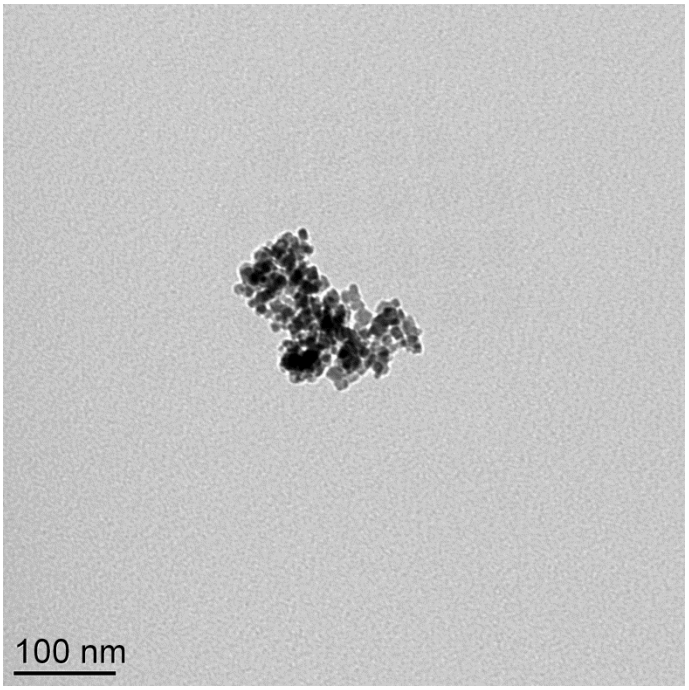

Figure 1.MET picture synthesized magnetic particles

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[4] Samar Layek1,*, Anjana Pandey2, Ashutosh Pandey3 and H.C. Verma1

Scientific CV (optional)

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Biosorption Performance of Powdered Waste Sludge for Removal of Textile Industry Wastewater: Equilibrium and Kinetic Modeling

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1. Introduction – Growing concerns in developing countries about the environment have resulted in the development of new environmental technologies, new materials, and new ways to reduce and to minimize wastes [1]. A high level of worldwide production and extensive use of dyes generate substantial volumes of coloured wastewaters. Industrial effluents treatment is becoming an obligation in many developing countries both environmentally and for water re-use. Another important waste produced by contemporary society in abundant quantity is industrial and municipal sewage sludge, which calls out for efficient and environmentally friendly approaches to its valorisation [2]. Rather than simply disposing of the sludge, considered use of this waste material seems to be a promising way of turning it into a resource. One application that has received increasing attention is the utilization of sewage sludge as a low cost alternative adsorbent for the removal of pollutants from wastewater [3]. The aim of the present work was to develop an effective and inexpensive technology for removing dyes from aqueous solution using powdered waste sludge (PWS). Congo Red (CR) was chosen as a dye model.

2. Experimental - The biosorption experiments were carried out in batch reactor by suspending a certain quantity of powdered sludge in a dye solution for the desired concentration and pH. The samples were taken from the thermo-regulated shaker at predetermined time intervals. Every sample was centrifuged prior to analysis. The concentration of CR was measured by means of UV–Vis spectrophotometer. The effects of operation variables, such as pH of the solution, adsorbent amount, initial CR concentration and agitation speed were investigated using batch adsorption technique. Sorption kinetics, isotherms and thermodynamic parameters were conducted.

3. Results and Discussion - The results showed that the retention capacity of the mud increases with the increase of the sorbent quantity, the temperature, the CR concentration, as well as the agitation speed. The best sorption amounts were obtained at pH 6. The parameters of both kinetic and equilibrium modelling showed that the kinetic data were accurately described by the pseudo-second-order model. The equilibrium data were analyzed using five isotherms models, Langmuir, Freundlich, Redlich-Peterson, Temkin, and Elovich models. Results showed a good fit with Redlich-Peterson and Langmuir models suggesting monolayer coverage of dye molecules onto the biosorbent surface and adsorption active sites of quite similar affinities toward the experimental textile pollutant. The thermodynamic parameters such as Gibbs free energy change ΔG_0, standard enthalpy ΔH_0, and standard entropy ΔS_0 indicated that Congo Red adsorption onto powdered sludge was endothermic, spontaneous, involving a chemical bonding.

4. Conclusions - This study identified sewage sludge – at its raw state and without any physical or chemical activation – as a suitable low cost adsorbent to be used for removal of CR dye from

aqueous solution. The very rapid adsorption and high uptake capacity for CR (up to 90% of CR removal rate in less than 3minutes) make the PWS a quite interesting alternative to more costly materials such as activated carbons. More technical and experimental optimisations and treatments should be realized to improve the adsorption capacity of sewage sludge. Studies on theses topics are in progress.

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Scientific CV (optional)

Borhane Mahjoub is an Assistant Professor in Environmental Chemistry at High Agronomic Institute of Chatt-Meriem (University of Sousse, Tunisia). He is a Researcher and Lecturer in the Department of Horticultural Engineering and Environment, and the Head of the Laboratory of Chemistry. He is member of the "Bio-Chemistry and Environmental Toxicology" Research Unit. His research topics concern Environmental Chemistry and Monitoring.

Borhane Mahjoub was a coordinator of the DAAD funded project "*EMPOWER Tunisia – Emerging Pollutants in Water and Wastewater in Tunisia*" and he is also an active member in other euro-mediterranean projects (XNEM-TEMPUS, SOWAEUMED, GAMAOUN, …).

Borhane Mahjoub published several papers in peer-reviewed international journals, one chapter in a book on Phytoremediation (*Royal Society of Chemistry*), 3 textbooks and holds one patent. He is an Associate of Editor of Sustainable Chemistry and Pharmacy Journal, *Elsevier*, and member of the editorial boards of the International Journal of Environment and Waste Management (IJEWM), the International Journal of Environmental Engineering (IJEE), *Inderscience*, and the International Journal of Environmental Engineering Science (IJEES), *Serials Publications*.

He is a consultant in Environmental issues to the Governorate decision makers of Sousse (Tunisia).

Keywords about areas of expertise: Wastewater treatment processes, Behaviour and fate of contaminants in Soils and Waters, Solid waste valorisation, Phytoremediation, Sustainable chemistry.

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Water, Iron and Liver

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ABSTRACT

Background: Several diseases have been caused by contamination of surface and groundwater.

Aim: The aim of the present work is to investigate the impact of iron overload in drinking water on liver pathology.

Materials and Methods: Samples of drinking water, blood and true cut liver biopsies were taken from selected inhabitants, who attended in some Dakahlia governorate hospitals. Those inhabitants (16 patients) from Mit-ghamr and Aga districts were suffering from liver disorders (had hepatitis C) and 4 patients had chronic cholecystitis from Mansoura district as control cases. Measurement of iron level in water samples was carried out by the use of an atomic absorption spectrophotometer, analyzed for serum iron level with a micro lab 200 spectrophotometer.

Results: The mean value of iron in surface water is lower than the permissible limit of Egyptian ministry of health (EMH) and World health organization (WHO). However, the mean value of iron in groundwater samples is higher than that permissible limit and than those of surface drinking water. Comparison between iron level in drinking water and human blood samples shows positive relationship. The control group depended on drinking surface water and had normal liver function tests, whereas the patient group that depended on drinking groundwater had abnormal values in liver function tests. These data suggest that the polluted iron drinking water is the reason for the liver disorder of the patients. Siderosis was apparent among those patients drinking polluted iron water in comparison to control cases. The siderosis appears to be responsible for resistance to treatment of HCV and progression of fibrosis.

Conclusion; The accumulation of iron in liver leads to fibrosis. Iron depletion therapy could interfere with fibrosis development and possibly reduce the risk of hepatocellular carcinoma (HCC).

Keywords; Water, Iron, Liver

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Three Dimensional-Ni based High Performance Flexible Wire Supercapacitors

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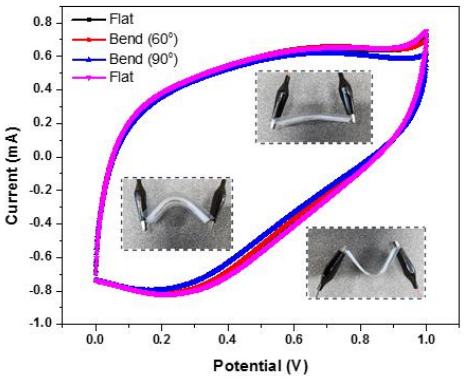
1. Introduction – Flexible supercapacitors have received much attention for next-generation energy storage due to their remarkable features, including their light weight, stability, portability, safety, flexibility, and eco-friendliness [1-3]. In order to reduce their size and increase compatibility, fiber and cable-type flexible supercapacitors have been developed. However, most reported fiber supercapacitors have been based on metal wire current collectors with smooth surfaces, low surface area, and low porosity, which produces large contact resistance between the active materials and the current collector substrate, which leads to low performance. Herein, we introduce a three-dimensional (3D) current collector, a 3D porous nickel (3D-Ni) architecture on a Ni-wire substrate, for constructing next generation flexible fiber supercapacitors.

2. Results and Discussion - The 3D-Ni was prepared by electrodeposition under the presence of hydrogen bubble templates, and possesses highly porous dendritic walls with many electroactive sites connected by highly conductive networks and short diffusion path lengths. This allows for easy transport of ions/electrons, leading to more efficient contact between the electrolyte ions and electroactive sites for faradaic energy storage, and thus results in high charge/discharge rates even at high-current densities. In addition to good flexibility, this binder and conductive additive-free 3D-Ni/Ni-wire allows for high mechanical strength, low cost, and ease of fabrication. NiCo2O4 electroactive materials were grown onto a 3D-Ni/Ni-wire current collector using the electrodeposition method, and the combination provided better electronic conductivity, natural abundancy, low cost, environmental friendliness and higher electrochemical activity than those of nickel oxide and cobalt oxide. The as-prepared three-dimensional porous flower-like NiCo2O4 on 3D-Ni/Ni-wire (3D-NiCO2O4/Ni) exhibited the outstanding volumetric capacitance of 35.2 F cm-3 with good rate capability (97.7% at 20 mA). Further, the planar-integrated fiber supercapacitor



exhibited excellent cycling stability (100% retention even after 5000 cycles) and flexibility with an energy density of 2.8 Wh Kg-1 and a power density of 27.77 W Kg-1.

3. Conclusions – We successfully fabricated a flexible solid-state fiber supercapacitor by the planar integration of 3D-NiCo2O4/3D-Ni electrodes. The fiber electrode delivered the high volumetric capacitance of 29.7 F cm-3 at 2.5 mA and it retained 28.9 F cm-3 at 20 mA, which suggests an excellent rate capability in a three electrode system. These promising results demonstrate that flexible fiber supercapacitors have great potential for embedding in flexible electronics, such as portable and wearable devices, and self-powered devices.

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The Overview Of Turkish Cadastral System

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1. Introduction – Cadastre; a measure based on the boundaries of a country or of data concerning ownership of the region arranged public inventory [1]. First Turkish cadastral work began with private property law, adopted in 1858 during the Ottoman Empire. However, the Ottoman Empire has been working on for quite ownership and land operation was not performed until 1912 and no map work in this period. It has started to literally surveying activities in the Ottoman Empire in 1912. But it could not continue with the interruption of the First World War. The compulsory cadastre works began in 1934 to solving the unregistered real estate problem in Turkey. The base cadastral maps were produced with cadastral law. The responsible instution for producing cadastral maps is General Directorate of Land Registry and Cadastre (GDLRC) on the time both Ottoman Empire and Turkish republic. During 169 years, a lot of cadastral maps were produced using different laws, different technology, etc. The deformation occurs on these maps inevitability in course of time. Also, these cadastral maps had got a lot of errors formed from various sources. There are the 636.630 cadastral maps in the GDLRC archives produced with different coordinate system, scale, production and measurement methods. Some of these cadastral maps are not produced digitally. The big task of GDLRC has been the digitizing of these maps in recent years. In this study the cadastral system has been described in Turkey and the condition of current legislative maps has been demonstrated according to different characteristic.

2. Application – The classification of cadastral maps can be made according to the map scale. It is seen at the 66.91 % of cadastral maps have been produced with 1/1000 and 1/5000 scale. The same classification can be realized according to coordinate system, base type, measurement or calculation method. While the 50.19 % of cadastral maps were produced on ED-50 coordinate system, the 17.86 % were produced on ITRF coordinate system. The same classification can be used according to base type. 43.36 % of cadastral maps have been produced with astrolo base while 56.64 % of have been produced with different base.

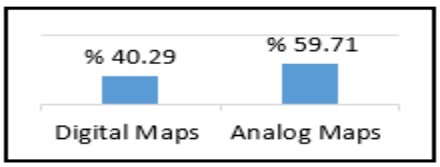

Image 1: Rate of total cadastre maps

3. Results and Discussion – The 60 % of the cadastral map was not produced digitally. The cadastral maps have to be digitally depending on modern conditions. The best digitizing method make the real measurements but obtaining the real measurements is very difficult. In this case, the coordinate transformation methods are realized between the scanned map view and real coordinate systems for digitizing maps. These coordinate transformation methods are based the common point. The common points coordinates are known mentioned two coordinate system.

The Affine coordinate transformation is used for digitizing maps. The details of affine 2D coordinate transformation can be found in [2].

4. Conclusions – Digitizing is a big problem for Turkish cadastral system. The affine coordinate transformation is recommended for digitizing the cadastral map according to [3]. The accuracy of cadastral map digitization is directly related to the selected common points coordinates and numbers.

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Purification of bilge water by physical processing

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1. Introduction - Generally, bilge waters can be briefly defined as saline and greasy wastewaters. The oil and grease are mixed with the sea water, which affects many marine species. Bilge water is a complex mixture of various compounds such as solvents, surfactants, fuel, lubricating oils and hydraulic oils. It is resulted mainly by the leakage from the machinery and fresh water wash downs, which are allowed to drain to the lowest inner part of the ship's hull [1]. There are several physicochemical methods used for bilge water treatment such.As biodegradation [2] electrochemical and electro-coagulation/flotation [3].The research herein presented discusses adsorption as a method to treat bilge water and eggshells was studied as adsorbent. The influence of operating parameters as contact time and adsorbent dose (0, 2 - 2g/l) on the removal efficiency of Chemical oxygen demand (COD), conductivity and turbidity was analyzed.

2. Experimental - The bilge wastewater used for this study was supplied by Harbour Bouharoune. The characteristics of wastewater can be seen in Table 1. Batch kinetic adsorption studies were conducted in a temperature-controlled stirrer using 100mL of adsorbate solution. The samples at different time intervals (1–90 min) were taken and at the end of each agitation period, the mixtures were centrifuged for 20min at 5000rpm. COD analyses were performed using HI839800 reactor.

Table 1. The characteristics of synthetic bilge water

Parameters	Concentration
pH	7.66
Conductivity, mS/cm	31.1
Turbidity, NTU	35.5
COD, mg/L	985

3. Results and Discussion - Chemical oxygen demand removal increased from 26.7% to 68.7% as the adsorbent dose increased from 0.2 to 2 g. The kinetics of adsorption by activated carbon were fast, reaching 55 % of the total adsorption capacity in ten minutes (T= 20°C, pH =7.66, m=2g/L). It was found that the turbidity removal efficiency decreased and 95% were achieved at the end of 90 min reaction.

4. Conclusions – The adsorption process was found to be effective for the purification of bilge water and pseudo-second-order kinetic model was fitted for COD removal.

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DMSO contaminated industrial waste water recycling by distillation

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1. Introduction – Clean water protection is one of the major priorities of environmental actions in the world. Also in Hungary reservation of potable, unpolluted water base is essential to the inhabitants and agriculture of the country, the most hazardous chemical contaminants (elements or compounds) in the drinking water are the followings: arsenic, ammonia, boron, manganese. [1]

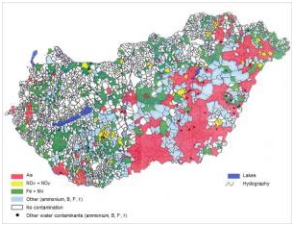

Image 1. The most hazardous contaminants in the drinking water in ..

In the project called "DMSO contaminated industrial waste water recycling by distillation" the factory of the Project Promoters S-Metalltech 98 Ltd. produces arsenic, phosphorus, iodine and fluorine removal adsorber for drinking and technological waters. During the production process 1m^3 high DMSO (dimethyl sulfoxide) content hazardous waste water is produced daily, which needs to be collected and transferred to the incineration plant to be burned. The transferred DMSO need to be replaced with fresh solvent in the production process.

Beside 20 w/w% DMSO the waste water contains:

- Soluble polymer – ethylene-vinyl alcohol copolymer (EVOH)
- Minerals such as cerium-hydroxide

The aims of the project are to reduce the volume of the hazardous waste water and to reuse the recovered solvent and water in the production process.

3. Results and Discussion - Within the framework of the project we planned to study the followings:

- identify the components of waste water with qualitative and quantitative analysis methods
- separate the different types (water, solvent /DMSO/ and other components) with distillation and analyze the efficiency of the separations in laboratory level and also during the manufacturing process

- prepare sustainability analysis based on technical performance, life-cycle analysis, CAPEX and OPEX in laboratory level and also during the manufacturing process

Table I. Main relevant characteristics of the waste water which we planned to analyse

Main relevant characteristics of the waste water	pH	NO_3^- mg/l	SO_4^{2-} mg/l	KOI_{kr} mgO_2/l	TOC mg/l	loss on ignition (total minerals) mg/l	Ce µg/l
	4,77	11 000	<25	53 300	79 000	1 710	553 000

4. Conclusions - In our ongoing project we executed the preliminary measurements and due to these results we found the two-step vacuum distillation as the best solution. Now we are testing the efficiency of the separations in laboratory level and we started the life-cycle analysis and CAPEX, OPEX calculations. We expected the following results at the end of the project: according to preliminary estimates the amount of hazardous waste water could be reduced from 265,2 ton/year to 5,5 ton/year, so with 98 %; furthermore the amount of water used in the manufacturing process could be reduced approximately with 27 %.

5. References

[1] the measurements and results carried out by National Institute of Environmental Health Sciences

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Environmental Management Practices in Hospitals: Challenges and Enhancing Factors

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Abstract

Introduction - Paradoxically, healthcare facilities primarily hospitals pose a potentially significant threat to the environment and consequently to public health as they fulfill their responsibility towards patients' care. This study aims to assess the perception of stakeholders in hospitals with regards to the environmental impacts of their activities and the current environmental standards of the Lebanese Accreditation system. It also aims to investigate the challenges and the enhancing factors for implementing environmental management practices.
Methodology - In-depth interviews were conducted with concerned stakeholders from 18 public and private hospitals with different sizes selected from the 6 Mohafazas/districts in Lebanon. Thematic analysis was employed to thoroughly examine and evaluate the transcripts comprehensively, following the set objectives of the research.
Results and Discussion - Findings revealed that the majority of the stakeholders were unsatisfied with environmental standards because they were not clear, not enforceable, not applicable, and/or required improvement. Given that the environmental standards are not mandatory for accreditation, stakeholders perceived environmental impacts not significant. Generally, the main challenges hindering the implementation of environmental management practices in hospitals are primarily employee resistance, lack of financial resources and qualified personnel, lack of awareness, lack of treatment methods and lack of support from the government. The enhancing factors that were recommended by the stakeholders revolve around financial support, training programs, rewarding system and standard improvement. Seemingly, not mandating environmental standards for accreditation has in some way affected environmental performance in hospitals. Hence, it is time for the healthcare facilities to recognize their environmental responsibilities to reduce the environmental impacts of their operations.

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Photocatalytic degradation of methyl orange by GaN-based materials with InGaN/GaN multiple quantum wells

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1. Introduction –Energy and environmental issues is a major challenge of mankind. In order to create a better living environment and realize the sustainable development of human, people have made many explorations. There are many semiconductor photocatalytic applications about solving the energy and environmental problems. However, previous studies have focused on TiO_2, which works only under irradiation of UV light. Thus it's not efficient to use TiO_2 as photocatalytic materials. In our studies, we used GaN-based materials with InGaN/GaN multiple quantum wells doped by 20% In composition in InGaN layer as photocatalytic electrode, which works under irradiation of visible light and has a broader spectral response range. We studied the photoelectric catalytic properties of InGaN/GaN-MQW materials in photocatalytic degradation of methyl orange (MO).

2. Experimental – The hexagonal GaN-based films with InGaN/GaN multiple quantum wells were growed on Al_2O_3 sapphire substrate by Metal Organic Chemical Vapor Deposition (MOCVD) on a c-face sapphire substrate. The structure of the materials are shown as image 1.

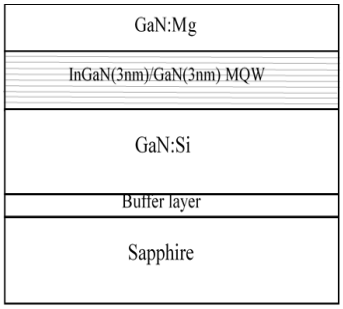

Image 1. The structure of GaN-based materials with InGaN/GaN multiple quantum wells.

The GaN/sapphire structure was bonded onto Graphite substrates using conductive resin adhesive. Then the sapphire substrate was carried off by laser lift-off technology, which is shown as image 2. KrF excimer laser was directed through the transparent sapphire to remove the sapphire substrate. The laser was operated at 248 nm with a pulse duration of 20 ns and an energy density of 600 mJ/cm^2.

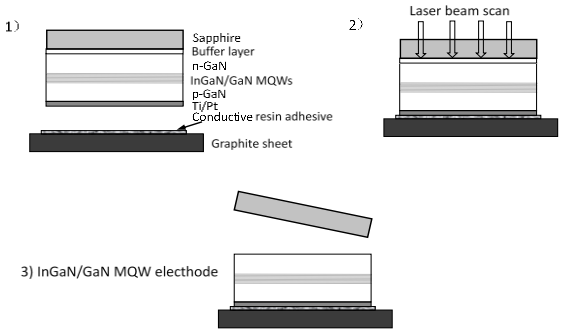

Image 2. The sapphire substrate was carried off by laser lift-off technology.

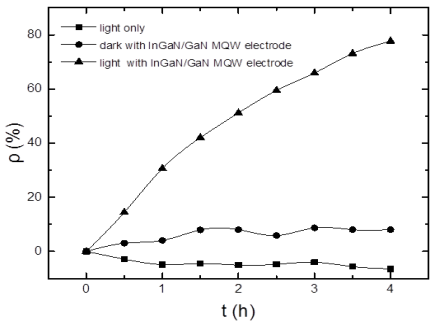

Image 3. The effect of photocatalytic degradation rate of methyl orange under simulated sunlight.

3. Results and Discussion –We test the electrical properties of the GaN-based electrode with InGaN/GaN MQWs in the photoelectrochemical cells (PEC) system. Under irradiation of simulated sunlight, the electrode's open circuit voltage and short circuit current has increased significantly in contrast to that in the dark. For one of the electrodes, the open circuit voltage increased from 56.5mV to 521.9mV, short circuit current increased from 0.0057mA to 0.072mA. The maximum surface output power density increased significantly, which increased from 0.56 mW/m^2 to 64.98mW/m^2. We studied the photocatalytic properties of the GaN-based electrode with InGaN/GaN MQWs on the degradation of methyl orange in the PEC system. After four hours' photocatalytic degradation, 77.7% of MO was degraded in the PEC system with the photocatalytic electrode. The apparent first-order rate constant is $6.25\times10^{-4}\cdot min^{-1}$. Image 3 showed the degradation rate of methyl orange by GaN-based electrode with InGaN/GaN MQWs.

4. Conclusions –GaN-based materials have a broad spectral response range by adjusting In component. Photocatalytic electrode of the GaN-based materials with InGaN/GaN MQWs can work under irradiation of sunlight. The photocatalytic properties of the GaN-based electrode with InGaN/GaN MQWs on the degradation of methyl orange in the PEC system shows that GaN-based materials have great potential in wastewater degradation.

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Scientific CV (optional)

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Biogas Production From Waste Residues And The Role Of Microorganisms Involved In The Process

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1. **Introduction –** Biogas is primarily composed of methane (CH_4) and carbon dioxide (CO_2) [1]. Complex organic compounds can be converted to CH_4 via the interaction of the hydrolytic, acidogenic, acetogenic and methanogenic microorganisms. These groups of bacteria work synergistically to achieve maximum biogas production and consequently high CH_4 concentrations [2]. The composition of the gas depends not only on the substrate's characteristics but also the consortium microorganisms present in the biogas digester.

2. **Experimental –** All substrates and **se**eding material were characterised and quantified by chemical composition including the Total and Volatile solids. A mini digester experimental set up was constructed according to German Standard VDI 4630 document guidelines [1] and the biogas potential of each substrate like bran, hominy chop, paper pulp, swine, sheep, chicken and cow manure was investigated for 21 or 30 days at 37 °C. The performance of the process was evaluated by measuring the volume (eudiometer tube) of the biogas produced and the efficacy of hydrolysis and acetogenesis was evaluated by analysis of product formation from each step, using Spectrophotometry and HPLC respectively. The biogas composition was determined using GC with BID. The microbial diversity of the inoculum was assessed by both DGGE and targeted 16S rRNA metagenome sequencing on the Illumina MiSeq platform. The four different functional groups of bacteria were selected using specific enrichment media. Counts of viable cells from the enumerated media were carried out using DAPI staining. Gram Staining was performed to visualize the morphology of the cells.

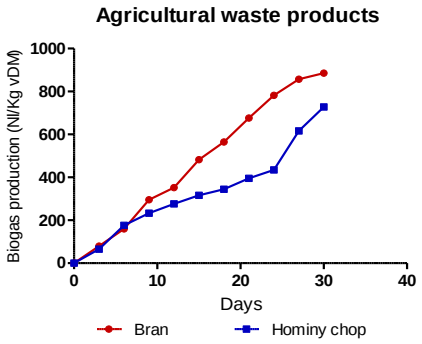

Fig 4: Biogas production from bran and hominy chop

3. **Results and Discussion** – The highest biogas production (Figure 1) was achieved with the bran substrate (885 Nl/kg vDM) 75.55% CH_4, followed by hominy chop (727 Nl/kg vDM) 68.17% CH_4. The gas production from liquid paper pulp (722.1 Nl/kg vDM) 47.73% CH_4 and dry paper pulp (143.5 Nl/kg vDM) 53.4% CH_4. Swine manure produced (400 Nl/kg vDM) 60% CH_4 and cow manure (350 Nl/kg vDM) 57% CH_4. The 16S rRNA metagenome sequencing indicated the dominance of proteobacteria, bacteroidetes and firmicutes in the inoculum, however, the presence of methanogenic archaea was also detected. The DGGE profile showed varying populations for each enrichment contributing to all four stages of biogas production.

4. **Conclusions –** Various organic substrates were tested for biogas potential. The highest methane production was reached with the bran substrate followed by other agricultural waste material, while the manure samples yielded lower but sufficient gas to exploit for heating. Selection and control of each step of the biogas process might enhance the synergistic flow to control methane production. Monitoring populations associated with each step and controlling their metabolic access to substrates might improve biogas composition as well as yield.

5. **References available from the authors.**

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Constructive Design of Bioremediation Strategy based on Bio-composites

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1. Introduction – Kazakhstan as a rapidly developing country is facing unprecedented environmental and economic challenges. Discharge of contaminant-rich wastes from agricultural, domestic and industrial sources has led to adverse effects on terrestrial and aqueous ecosystems. Discovery, improvement and application of various microbes and their products to transform, remove and inactivate pollutants promotes the efficiency of the environment protection. Bioremediation uses different active species of microorganisms alone or in combination with sorbent/carrier, which can greatly maintain the viability, proliferation and implementation of the biological objects. Compared to "conventional" sorbents, the bio-composite sorbents are cheaper, eco-friendly and reusable alternative for the remediation of various pollutants, especially hydrocarbons, heavy metals and pesticides from wastewater. This is now under intensive investigations focusing on effective pollutant removal, different biosorption mechanisms and modeling, modification and immobilization of biocatalysts, the construction of novel bio-composites, their assessment, potential application and relevance for any particular purpose (Image 1) [1].

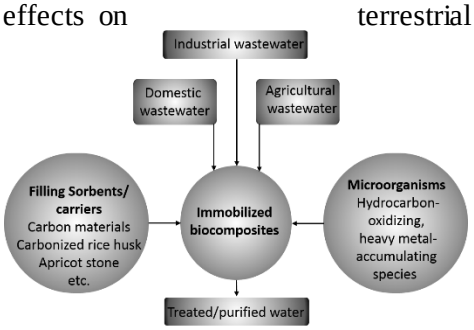

Image 1. Model of the bio-composite construction design

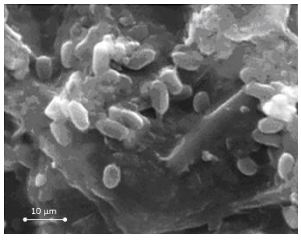

Image 2. Electron microphotograph of the heterogeneous bio-composite

2. Experimental - Due to their potential properties, nanostructured carbon materials, including carbonized rice husk and grape stones can be used as sorbent/carrier for separation and extraction of toxic compounds and elements. The new cost-effective and environmantal sustainable bio-composite based on microbial cells immobilized on carbonized materials has been successively designed and developed. Electron microscopy images showed that active microbial cells can attach, proliferate and migrate inside the porous network of the sorbent (Image 2). Our extensive experiments

using bio-composites are conducted in a municipal wastwater treatment plant in Almaty, Kazakhstan.

3. Results and Discussion - The obtained heregenous bio-composite specifically adsorbed up to 94,5% heavy metals and other inorganic constituents from solutions. For remediation of petroleum-polluted water, we are presently developing a bio-composite on the basis of carbonized sorbents and a microbial consortium composed of indiginous strains of *Pseudomonas spp*. and other microbial cells with high *hydrocarbon-oxidizing potential*. First pilot results were obtained in the field experiments on petroleum-polluted water from the "Zhanazhol" oil sludge, West Kazakhstan.

4. Conclusions - The created bio-composite possess distinguished pollutant-binding and degrading properties accompanied by particular microbial species or strains used. This new set of knowledge could significantly support design and development of new heterogenous immobilized bio-catalysts with high specifity and activity.

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Screening of Microorganisms Effective To Increase Oil Recovery in the Kazakhstan Oil Fields

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1. Introduction – Kazakhstan is one of the largest oil reserve areas in the world. However, the efficiency of oil recovery from reservoirs with implementing modern technologies and methods in all oil-producing countries to date is not high, resulting in an average oil recovery in different countries and regions between 25-40%. In Kazakhstan, the figures are even lower, because the majority of oil deposits in the region refers to the highly viscous, i.e., hard-to recover [1].

In this regard, the urgent need nowadays is to develop novel technologies and emerging strategies for enhanced oil recovery. It requires looking for cost-effective, reliable and practical ways to liquefaction of the lower pools of oil wells. One such area is biotechnology, which is based on the use of special strains of microorganisms capable of utilizing heavy hydrocarbon oil fraction and producing biosurfactants, reducing surface tension of reservoir oil, thus providing increased access hydrocarbons in microbial cells for subsequent microbial oxidation. It was established that bacterial oxidation of hydrocarbon formation is accompanied by the formation of volatile acids, alcohols, and gases, together with the biosurfactants, which contribute to displace the reservoir oil [2].

2. Results and Discussion We have selected oil-oxidizing and active biosurfactant-producing bacteria among microorganisms isolated from the sludge deposits in Western Kazakhstan. Thirty-three oil-destructor strains of microorganisms were screened, of which fourteen showed the index of the emulsification of oil above 50%. These strains were used in experiments to create a biotechnological method for increasing oil recovery from oil reservoirs.

3. Conclusions - The results indicate that the hydrocarbon-oxidizing microorganisms, possessing a wide spectrum of biological action, may serve as a basis for development effective ways to improve the recovery of oil.

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Water Use Efficiency (WUE) of two olive tree cultivars (*Olea europaea* L.) in Tunisia

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Abstract

Despite the immense potential for olive production, Tunisia is known as an underprivileged country in water resources and water scarcity is evident in certain regions. This work aims to assess the water use efficiency of two young olive tree cultivars for oil-production Koroneiki, a promising Greek cultivar, and Chemlali, the best local cultivar, under water restriction conditions. Three water treatments were applied: T100% (control treatment: Daily irrigation at 100% of Available Water Content (AWC)), T50% (Daily irrigation at 50% of AWC) and T0% (Without watering). For that, measurements of eco-physiological and biomass parameters were made during 35 days under green-house conditions. Then, intrinsic, extrinsic and plant Water Use Efficiency (WUE) were determined through Photosynthesis (A)/stomatal conductance (gs), Photosynthesis/transpiration (E) and biomass/water consumed ratios respectively. The intrinsic WUE of Koroneiki, expressed as the ratio A/gs, shows no significant difference between T100% and T50% plants throughout the experiment. However, for Chemlali plants, T50% presents a better intrinsic WUE than T100% plants. A significant difference is maintained between T100% and T50% during the experiment period. Koroneiki WUE ranged between 83 to 98 µmol CO_2 m^{-2} s^{-1} compared to Chemlali WUE that ranged between 80 and 135 µmol CO_2 m^{-2} s^{-1} for T50% treatment. This result indicates that Chemlali plants valorizes better low quantities of water (T50%) rather than high quantities (T100%). A significant difference between Koroneiki and Chemlali plants for the two water treatments was shown, 35 days after applying water treatments. The extrinsic WUE of Koroneiki, expressed as the ratio A/E, shows that at T50% treatment the plants present better WUE than T100% with an average value of 5.66 µmol CO2 m^{-2} s^{-1}. No significant difference between the two water treatments was observed starting from the 21st day after applying water treatments. For Chemlali cultivar, plants at T50% were more efficient than T100% ones, and no significant difference was observed between the two water treatments throughout the experiment, except the last day. It should be noted that at T50% Chemlali WUE average value was 6.36 µmol CO_2 m^{-2} s^{-1}. The plant WUE of Koroneiki treated at 50% decreased

(42%) significantly up 35 days after the start of the applying water treatments in comparison to T100%. However, an increase of 20% in Plant WUE for Chemlali T50% was detected comparatively with T100%. WUE was improved under a certain range of water supply, but this was cultivar dependent. For Koroneiki, the intrinsic WUE increased when gs values were between 0.16 and 0.22 mol H_2O m^{-2} s^{-1}. WUE of Chemlali increased, when gs values were between 0.11 and 0.22 mol H_2O m^{-2} s^{-1}. The number of grams of fruit dry matter per kilogram of consumed water in T100% and T50% treatments were respectively 3.75, 2.18 for Koroneiki and 5.67, 7.07g/l for Chemlali. These results showed that a water restriction of 50% FC did not affect the photosynthesis and biomass. In this case, for Meski cultivar grown in Tunisia, we can manage water better by limiting water applied to 50% FC especially when we know that Tunisia belongs to the semi-arid bioclimatic stage where water resources are limited.

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Photocatalytic performance of cotton coated with SiO_2-TiO_2-HY: Emphasis on the calcination role

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1. Introduction - This work aims to investigate the optical and photocatalytic properties of cotton textiles functionalized with SiO_2-TiO_2-HY composites. The photocatalytic activity of the samples was tested via the degradation of rhodamine B (RhB) under similar solar irradiation. This dye is a pollutant that can be quite found in the effluents of textile industry and therefore, its degradation is an objective to be achieved.

2. Experimental - The sol-gel method was used to prepare silica/ titanium sols, which were mixed with HY zeolite (Si/Al=2.50, Aldrich). Tetraethoxysilane (TEOS) and tetra-isopropoxide (TTIP) were employed as precursors for SiO_2 and TiO_2, respectively. The powder HY zeolite was calcined at 500 °C during 8 h in a dry air stream prior to use. The SiO_2-TiO_2-HY composites were prepared and calcined at 500 and 600 °C, which for a matter of better understanding they are coded as STH-5 and STH-6, respectively. X-ray diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR) were used to perform structural characterizations. The cotton substrates were functionalized by a combination of methods based on the previous works [1,2]. The UV-vis diffuse reflectance spectrum was used to determine the optical bandgap energy (E_g) of the coated textiles. At the beginning, some studies related with the adsorption of RhB on the samples were carried out. Then, the photocatalytic activity of coated samples was evaluated based on the ratio of $(C_0\text{-}C)/C_0$ (photocatalytic efficiency, η) calculated from the absorbance measurements. At last, the functionalized textiles were washed in a 2.0 gL^{-1} ECE detergent solution at 70 ºC during 1.5 h and subjected to another round of photocatalytic essays to evaluate the catalyst's fixation degree on the fibres.

3. Results and Discussion - FTIR analysis confirmed the presence of Si-O-Ti stable bounds and the region between 570 and 600 cm^{-1} was used to calculate framework Si/Al ratios in the composites. The STH-6 composite showed a large increase in Si/Al ratio (dealumination) suggesting that the calcination at 600 °C affects the zeolite structure. These results were also confirmed by XRD studies. This feature can be influenced RhB photodegradation rate after 3 h of irradiation (Table I). The functionalized samples showed fairly high photocatalytic efficiencies, even after being subjected to a severe washing process (45-55%).

Table I. Si/Al ratio, efficiency and bandgap.

Sample	Si/Al	η (%)	E_g (eV)
STH*	2.42	55	3.55
STH 500	2.83	61	3.25
STH 600	3.23	50	3.43

*** As-prepared.**

4. Conclusions - Photocatalytic fabrics have been produced by functionalization with STH composites on cotton textiles. The STH composites were subjected to a calcination process to study the influence of this parameter on the structural, optical and photocatalytic properties. The FTIR and XRD results showed that the HY zeolite present in the calcined composites has changed its framework Si/Al ratio. Finally, the degradation rates of RhB under similar solar irradiation are in agreement with the bandgap energy values.

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Recovery of a severely fouled RO membrane from a seawater desalination plant by means of dynamic cleaning procedures

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1. Introduction – RO membrane cleaning is an integral part of the desalination process, since it is necessary to keep the process performance and ensure the membranes durability. When the quality of the produced water does not meet the required specifications, the membrane is retired from the process and becomes waste. Currently, standard cleaning procedures attending the membrane manufacturer are applied in desalination plants. However, adapting the cleaning procedure specifically to each membrane-fouling system is recommended due to the complexity of the fouling phenomenon and its consequences on the membranes [1]. The aim of this work is to test and select specific cleaning procedures which are suitable for a severely fouled RO membrane retired from a desalination plant, so that they allow an efficient cleaning and prolong the membrane lifetime.

2. Experimental – Firstly, membrane fouling characterization was carried out by means of scanning electron microscopy coupled with X-ray emission (SEM-EDX), atomic force microscopy (AFM) and Fourier transformed infrared spectroscopy (FTIR). Taking these results as a reference, the most suitable cleaning agents were selected [2-3] and 24 dynamic cleaning tests in pilot plant were performed, testing 4 agents (NaOH, EDTA, citric acid and SDS), 3 concentrations and 2 different temperatures (25 and 40 ºC). Cleaning efficiency was determined through the recovery percentage and the final values of permeate flux (J_P) and salt rejection index (SRI), as well as SEM-EDX and AFM analysis of the cleaned membrane.

3. Results and Discussion - Membrane fouling characterization indicated predominance of inorganic and colloidal fouling (silica, aluminium and iron silicates), highly heterogeneous distribution on the surface and a reduction of the surface roughness as a consequence of the deposited foulants. Attending the obtained results, the maximum recovery of J_P (54.60%) was achieved by cleaning with citric acid 0.01% at 25ºC, although it only reached an SRI recovery of 1.23%. The maximum SRI recovery (6.28%), however, was achieved with EDTA 1% at 25ºC, reaching also an acceptable J_P recovery (9.92%). In absolute terms of permselectivity values of the cleaned membrane, citric acid 0.05% at 40ºC was the cleaning agent that obtained best results, reaching J_P up to 0.43 $L/m^2 \cdot h \cdot bar$ and SRI up to 98.20% (only 1% lower than the value considered acceptable for the seawater RO treatment). Therefore EDTA 1% at 25ºC and citric acid 0.05% at 40ºC were chosen as the best cleaning solutions considering they allowed to obtain the best results of J_P and SRI. Surface characterization after cleaning showed that EDTA 1% at 25ºC cleaning

procedure reduced the percentage presence of silicon, aluminium and iron approximately by half, whereas citric acid 0.05% at 40ºC reached a 40% lower reduction of silicon and aluminium and 13% lower reduction of iron than that one achieved by EDTA 1% at 25ºC.

4. Conclusions - Dynamic chemical cleaning of the RO membrane used in this work allowed to recover partially its permeability and selectivity, enabling a prolongation of its lifetime. Citric acid 0.05% at 40ºC procedure was selected because it maximized the final values of J_P and SRI. EDTA 1% at 25ºC procedure was selected because it maximized the percentage recovery of these properties.

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Hydrogels based on Beetosan containing gold nanoparticles

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1. Introduction

From the point of view of medicine and pharmacy the most important are materials, which characterize high biocompatibility and non-toxicity. Chitosan based hydrogels belong to this group of compounds. In carried out syntheses it was applied Beetosan – chitosan originated from naturally died honeybees. Introduction of gold nanoparticles into polymeric matrix allow to improve antibacterial properties and increase the solubility of drugs and to enhance their stability. Due to obtained materials, after more specialized research, can be potentially used as wound dressings [1-3].

2. Experimental

The main aim of this investigation was preparation of Beetosan based hydrogels containing different amounts of nanogold (0-5 ml of 250 ppm) and selection of appropriate parameters of crosslinking reaction. Synthesized hydrogels were modified with nanogold using crosslinking agent such as diacrylate poly(ethylene glycol) (PEGDA, M_n=700) and 2-hydroxy-2-methylpropiophenone as photoinitiator. The radical polymerization and crosslinking reactions were conducted under UV radiation.

The attained hydrogel materials were studied for swelling behavior in distilled water, Ringer's solution and simulated body fluids (SBF). The swelling ability in various fluids was determined 1h and 48h after immersion. Moreover, for all samples incubation investigations in distilled water, Ringer's solution and simulated body fluids (SBF) were conducted. Moreover, surface morphology of naturally died honeybees and received hydrogels was evaluated applying SEM.

3. Results and Discussion

On the basis of the obtained results we can conclude that the most important is selection appropriate amounts of gold nanoparticles (3 ml of 250 ppm). Because of the introdution of 5 ml of additives reduce porosity of attained hydrogels materials. Moreover, the carried out physicochemical properties confirmed that obtained hydrogels modified with nanogold are very stable in simulated body fluids.

4. Conclusions

In this studies preparation of Beetosan based hydrogels modified with different amount of nanogold was presented. These reactions were carried out under UV radation. In the future the biological activity of these promising materials should be in detail studied and verified using experiments on cell lines or pathogens.

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Pharmaceutical pollutant removal from water by Aluminum pillared clay

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1. Introduction Pharmaceutical pollutants are a group of emerging contaminants that contain different groups of human medicinal compounds that are widely used all over the globe and causing an environmental problem **[1, 2]**. This study improves diclofenac potassium removal from water by an adsorption process, using modified clays instead of the natural clay mineral **[3]**. The pillared samples showed a considerable increase in their adsorption capacity in comparison to the natural clay. This effect can be related to the textural and structural changes produced during the pillaring process. Consequently, Aluminum-pillared clays could be the new material to be used in treatment of different effluent.

Keywords: Diclofenac potassium; Pharmaceutical pollutant; Adsorption; Clay; Bentonite; Aluminum pillared clay

2. Experimental - Batch adsorption experiments were carried out for solutions of diclofenac potassium in the concentrations range 50–1,000 mg/l Experiments were performed with adsorbents (natural and pillared clay) and diclofenac potassium solutions. An optimization of adsorption parameters was studied (effect of contact time, adsorbate/adsorbent relationship and effect of the initial concentration of diclofenac solution). The equilibrium concentration of diclofenac was then obtained spectrophotometrically.

$$q_t = (C_0 - C_e) \times V/m \qquad (1)$$

Where, qt: amount of diclofenac /of adsorbent (mg/g), Co: Initial concentration of diclofenac (mg/l), Ce: residual equilibrium concentration (mg/l), V: volume of solution (l), m: weight of adsorbent (g).

3. Results and Discussion -

3.1. Optimization of Contact time, Maximum adsorption of diclofenac onto natural bentonite and aluminum -pillared bentonite was observed at 150 min (the equilibrium time).

3.2. Influence of the initial concentration of diclofenac potassium: the elimination of diclofenac occurred very quickly with increasing concentration of diclofenac potassium.

3.3. Effect of adsorbent: It can be said that by increasing the mass of adsorbent, the surface area of the adsorbent increases, thus ensuring a better elimination of diclofenac potassium.

3.4. Adsorption isotherm studies: The fit of the data for diclofenac adsorption onto natural and aluminum-pillared bentonite suggests that the Langmuir model gave better fitting than Freundlich model.

4. Conclusion In this study, a natural clay mineral from Algeria was successfully pillared using aluminum oligocations. The diclofenac adsorption studies for the different adsorbents showed a considerable increase in the adsorption capacity of the aluminum-pillared clay compared to the natural material. This is due to the high affinity between adsorbate and adsorbent.

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Arsenic Removal by Modified Solar Oxidation - Zero Valent Iron, as a Sustainable Option for Household Use

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1. Introduction - Sources of natural water containing arsenic (As) concentrations above that maximum contaminant level (MCL) (10µg/L) have been found in some Costa Rican villages. Therefore, it is necessary an alternative and sustainable home solution [1]. This work shows an emergent technology, modified Solar Oxidation and Removal of Arsenic (SORAS), with commercial steel wool as a source of zerovalent iron (ZVI) and solar radiation as catalyst, (image1). SORAS removes As by adsorption and co-precipitation as iron oxides/hidroxides [2] This study was developed in laboratory trials using different conditions such as: time of solar irradiation, initial As concentration, total ZVI, pH, color, temperature and turbidity. This solution affords simple, low cost operation process and equipment.

Image 1. Modified SORAS test with

2. Experimental - One litre of spiked water (200 µg/L) containing 0,2 - 0,6 g of steel wool was exposed to the sun. Sampling was done after 1, 2, 4 and 6 h of solar exposure. After that time, samples were filtrated by 0,45 µm Sartorius filter membranes, then stored in PET bottles at 4 °C with 50% HNO_3 and analyzed for arsenic content using the standard method [3] with Perkin Elmer AAnalyst 800 apparatus.

3. Results and Discussion - With initial ZVI dose of 300 mg/L, total As was reduced from 200 µg/L to below MCL within four hours of solar radiation of 1,0 W/m^2 (Image 2). Similar results were reached with a ZVI dose of 200 mg/L and six hours of solar exposure of 0,7 W/m^2. This shows that with a lower ZVI dose and longer exposure time not only MCL of As was achieved, but also total Iron concentration was below its own MCL (0,3 mg/L). The average solar radiation of Bagaces, is within 1,0 W/m^2, reaching to 2,0 W/m^2, therefore, it is expected that the system will show good performance under these conditions.

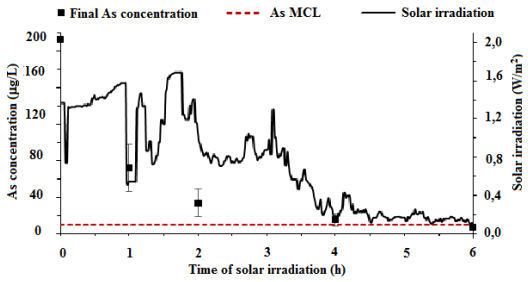

Image 2. Arsenic removal from contaminated water by modified

4. Conclusions - The modified SORAS achieves the reduction of As concentration below the MCL. With longer exposure, besides As removal, also total Iron concentration holds below limit. Modified SORAS has an efficacy for removal of As up to 90% resulting in a low cost system a solution for household use.

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The Production of Animal Feed with High Protein Content based on Agro-Wastes

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1. Introduction – Currently, due to the high costs of raw materials and energy for the production of traditional fodder proteins in livestock sector are not efficient and cost-effective. Therefore, the scope of specific and suitable plant based substrates for the biosynthesis of fodder yeast technology is considered applicable as a source of renewable raw materials and carbohydrates. It involves not only traditional crops but also by-products or wastes formed during or after their processing. In this case, an alternative microbial protein-production systems for animal feed can be provided and at the same time the problems related to the reuse/recycling of agricultural waste and environment protection can be effectively solved. Metabolic potential of microorganisms particularly yeasts to produce fodder proteins and other nutrients can eliminate the deficiency of protein in the feed of livestock [1-3].

The aim of the study is to develop a yeast consortium with high protein accumulation activity based on solid-state fermentation using crop residues and agricultural wastes for the enrichment and fortification of feed products for farm animals.

2. Experimental - In order to achieve the goal, the biomass accumulation activity of yeast cultures isolated by us, including *Yarrowia lipolytica A1, Cryptococcus uzbekistanensis I1, Pichia fermentans TD1, Candida inconspicua TD6 and Kluyveromyces marxianus TD7* was determined using such plant materials, like wheat straw, cotton husks, wheat bran and safflower as the source of substrates. Construction of yeast associations were performed on various co-cultivation substrates.

3. Results and Discussion - The results have shown that the intensity of biomass accumulation of mixed yeast cultures increased on wheat straw and wheat bran, after 6-7 days of cultivation the number of yeasts reached $7{,}84 \times 10^{10}$ cells/ml. Relatively high results showed a consortium of *Yarrowia lipolytica A1* and *Cryptococcus uzbekistanensis I1* grown in a medium enriched only with wheat bran. The intensity of protein production by yeast cultures was examined according to Bradford method. All yeast cultures demonstrated the highest intensity of the protein formation in wheat bran substrate. A relatively high protein formation rate observed in the culture *Cryptococcus uzbekistanensis I1* and *Yarrowia lipolytica A1*, i.e. the protein concentrations were 158-160 μg/ml and 141-150 μg/ml respectively. The nutritional value of the feed mixture containing *Yarrowia lipolytica A1* and *Cryptococcus uzbekistanensis I1* grown in wheat bran

demonstrated high potential, notably protein mass fraction was 3,0±0,3%, fat mass fraction 1,0 ± 0,1%, mass fraction of carbohydrates 5,33 ± 0,53%, mass fraction of moisture 89,67 ± 8,9 and energy value was 42,32/177 kcal/kJ.

4. Conclusions - Based on obtained yeast cultures grown on plant biomass substrates exhibited a high nutritional and energy value of feed additives. The results of the analysis may be provided to improve the quality of feed additives enriched with yeast cultures.

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Scientific CV

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Important Research areas related to Agricultural/Microbiological Biotechnology, Green/Environmental Biotechnology, Waste Management.


EXIT
ASTEWATER BASED ON MICROALGAE STRAIN -
FATTY ACIDS, PROMISING FOR BIODIESEL
Heterogeneous Nanobioc
Zhubanova A.A., Abdiev
Synthesis of Carbonized Sorbents:
Abstract:
Structure of Carbonized Sorbents:
Sorption
Acknowl

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Perspectives of Using Carbonized Sorbents on the basis of Secondary Raw Materials

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1. Introduction – Adsorption characteristics of carbon sorbents from plant raw materials are being widely applied in environmental purification and bioremediation. Activated carbons are used in petroleum processing, pollutant and odor removal, extraction of hazard elements, etc. Currently most studies are focusing on nanostructured carbon sorbents and nanotubes [1-2].

2. Experimental - A novel sorbent, amorphous nanostructured carbon obtained at our university upon high temperature (within range of 600–900°C in argon flow) carbonization process.

3. Results and Discussion - Obtained nanostructured sorbents based on plant materials and agricultural wastes have extended network porous structure, including macro-, meso- and micropores, which are suitable for the adsorption of a wide range of molecules and microbial cells. Adsorption properties of these materials can also be explained on the basis of various chemical groups on their surface (analyzed by infrared spectroscopy). These groups mostly formed by controlled oxidation of nanostructured surface and categorized as phenolic, carboxyl, carbonyl, lactone, ester and other groups. Various physio-, chemo- and biological variables prescribe adsorption properties of carbonized sorbents in respect of microorganisms. The different chemical groups on the surface of microbial cells (phosphate, amine, carboxyl, carbonyl, hydroxyl) demonstrate hydrophilic or hydrophobic properties and even produce extracellular polymers, such as glycoproteins, teichoic acids, polysaccharides and etc. These multiple functional groups specify formation of covalent bonds between the surfaces of microorganisms and the nanostructured materials (Image 1). These diverse interactions make

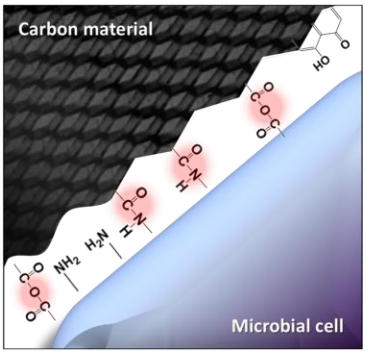

Image 1. Covalent bonds formation between the urfaces of the carbonized materials and microbial cells

possible and constrain the immobilization process in order to achieve the highest performance and ultimate versatility of the bio-based carbon materials for various applications [3].

4. Conclusions - The obtained plant-derived carbon sorbents are very efficient and reliable because of their extraordinarily surface area, pore structure and poly-functional groups which are greatly effective for microbial adhesion. This complex system known as immobilized biocatalysts would cover applications including wastewater treatment, contaminated air purification, animal feed formulations and fortification, single-cell protein production and many others.

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Urban planning in the environment of reservoirs as a pollutant. Analysis and evaluation of the case of Proserpina (Mérida, Spain).

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Introduction – There are many technical solutions in order to avoid or reduce the impact on water quality that urbanised areas close to the reservoir cause to it. The choice of the most effective and reasonable solution requires the prior analysis and evaluation of the actual situation of each area. In the Proserpina reservoir environment, declared in 2006 "Intercommunity Sensitive Area of Spain", an urban area devoid of a sanitation network has developed. The detailed study of its situation could become an example of the before mentioned. To evaluate the weight exerted by the urban pressure on this area, the knowledge of urban plans, cadastral information, multi-temporal study of aerial photos and cartographies and field work has been necessary, generating a database of urban development that has allowed us to know in detail the evolution (Image 1), characteristics and type of use of each plot.

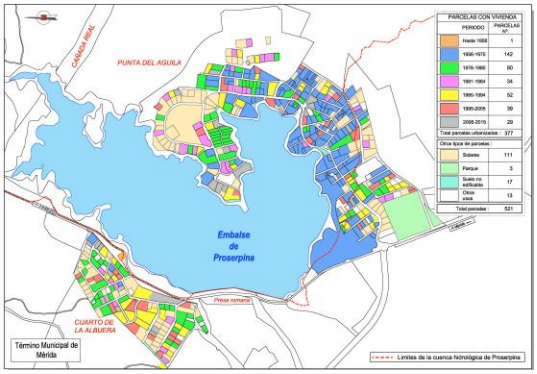

Image 1. Evolution of construction in the Proserpina reservoir environment (1956-2015)

The main aspects of urban planning origin, contaminating the reservoir have been contemplated: infiltration of leachates, tractors of urban rainwater, uncontrolled releases of waste.

Results and Discussion - The area placed in the interior slope to the reservoir is the one mainly which affects the quality of its waters. It becomes necessary, therefore, to separate it from the rest. In this sector, bearing in mind the period of construction of every housing, 24,2 % of them use blind well, 66,4 % septic tanks and 9,4 % biological purification stations of entire oxidation. The population is estimated between approximately 116 residents in winter and 861 in summer. The area is residential, and therefore lacking in pollutant industries. The calculation of the entire pollutant load of the waste water produced in this interior urban area to the Proserpina basin belongs to 999 equivalent inhabitants.
The evacuation and treatment of the waste water of the area is the most important corrective

measurement in the area. A comparative study has taken place between two possible solutions. On the one hand, the execution of a network of sanitation of separative type that leads the black waters towards a Waste Water Treatment Plant, to construct streamwise from the dam; on the other hand, the use of biological purification stations total oxidation in the proper area.

Conclusions – Contemplating the correct dimension of the problem, and after comparing the possible solutions, the conclusion is that the most suitable measure to be applied in the urban area of Proserpina is the widespread use of biological purification total oxidation. This measure not only complies with current legislation, but it also causes a smaller environmental impact and lower costs of execution (75% below the sewage network).

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Drying analysis of grinding powder from cork industry

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1. Introduction – In a global context where waste production increases continuously, revaluation of these wastes plays an important role from an economic and environmental point of view. Accordingly, the use of wastes as fuels takes part in sustainable strategies.

Cork industry is not unfamiliar with this problem, being the aim of study by several authors. Gil [1] carried out a physical and energy characterization for different kinds of cork powders. Nunes *et al.* [2] pelletized cork wastes with different particle sizes, obtaining results that were similar to wood waste pelletization. Mediavilla *et al.* [3] assessed pelletizing possibilities for vine shoot, cork wastes and their combination, analysing their physical properties and combustion behaviour in a stove.

Majority wastes in cork industry —grinding powder and granulometric separation powder— are produced in powder factories. Grinding powder are obtained after grinding cork sheets, whereas granulometric separation powder is generated from density selection. Some cork industries already use these wastes for thermal energy use, even though there are considerable differences between both wastes (particle size, density, ash, etc.). While granulometric separation powder is obtained at moisture levels between 10 and 15 % (wb), grinding powder surpass 40 % (wb), which implies lower yields for combustion. Thus, pelletizing these wastes in the same facilities where they are obtained might imply considerable advantages, related to reduction costs when it comes to storage and maintenance, as well as obtaining a uniform fuel (at form and structure levels) that allows a precise control of combustion process [4]. Concerning grinding powder, and due to their ideal particle size, drying is the only pre-treatment to carry out, and its analysis is the aim of the present research work.

2. Materials and methods – The samples were obtained from different cork industries located in San Vicente de Alcántara (Badajoz, Spain). Initial moisture was assessed by using a precision balance and a drying oven (UNE-EN 14774-2 norm). The drying tests were carried out with a convective dryer (Gunt, CE130), consisting of four removable stainless steel trays, drying pipe, air flow control (through a fan and electric resistances) and a digital balance (for monitoring weight loss). The tests were done for different temperatures and drying air flows, ending when a certain moisture level (15 %, wb) was obtained, whose value was chosen according to previous experiences.

3. Results and Discussion – Drying is a basic step for waste revaluation. The most inexpensive process is not necessarily the most profitable. Lower energy costs imply longer drying processes and the impossibility to obtain a suitable fuel for cork industries. That is the reason why an energy study for the different processes is advisable. The use of exothermic processes would reduce the energy cost of the process (gas from combustion in boilers for boiling cork sheets).

4. Conclusions - The cost of drying, as a pre-treatment, might be assessed with high confidence levels. For further works, different temperature and drying air flow levels will be studied, in order to minimize drying times and optimize energy costs for drying process.

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Performance of a pellet boiler: analysis of the influence of excess air

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1. Introduction – The recent publicacion the EN ISO 17225 norm [5] enables woody pellet (and other kind of pellets) commercialization for domestic and industrial use, has meant an increase in the number of biomass wastes that might be used for these purposes. Pelletizing industry has started to look for new products, such as wastes from forestry development, agriculture, agroindustrial facilities or their combination. These wastes are potential to be used as biofuels, even though they present some properties that make combustion process and operating and maintenance conditions of the thermal equipments difficult, making a recalibration of these equipments necessary. In view of these circumstances, the analysis of the behaviour of these biofuels is vital as a previous stage for their possible commercialization [6-7]. There are several research works that go more deeply into this subject. Verma *et al.* [8-9] analysed the yield of a boiler with woody pellets and other wastes, paying attention to the importance of low ash content in order to avoid *slagging and fouling*. Carvalho *et al.* [10] analysed pellet combustion in agricultural wastes, such as straw, maize, wheat bran, vineyard pruning and hay, in a 15-kw boiler. Thus, new research works are necessary to focus on the feasibility of densified products for combustion.

2. Materials and methods – The tests were carried out in a plant composed of a Domusa Bioclass 9 multifuel boiler, with 9,4 kWmaximum power and provided with a 300-litre auxiliary tank, hydraulic circuit made of copper pipes, an air heater (BTU, AB 122/4), an 8-liter expansion vessel and a 100-liter buffer tank Cordivari. The above-mentioned plant has an intelligent electronic system based on KNX protocol, that monitors and interprets the performance of the main elements in the boiler. In order to measure air flow from the fan, a PCE-151 tachometer was used.

3. Results and Discussion – The fan is controlled by the electronics of the boiler, modulating it depending on combustion parameters from its own sensors. In practice, it is impossible to obtain homogeneous blend between the fuel and the comburent agent. This fact forces to use higher amounts of air than necessary. Highly excessive air causes higher loss because of combustion gases, whereas low excessive air causes loss due to unburned products. Moreover, in small scale boilers there is no feedback, that is, air entrance is not modified depending on combustion gases, with air flow being preset by the manufacturer and not being valid for all kinds of pellets.

4. Conclusions – The use of this system will allow the comparison and assessment for different working regimes, depending on the kind of feeding, fuel and use. In the same way, it will provide information about the elements to be adjusted in order to optimize the combustion process, with the aim of extending its use to less conventional biofuels.

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Removal of reactive dyes from single and binary mixture by cross-linked magnetic biosorbent

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1.Introduction - Dyes are one of the most important hazardous materials found in industrial effluents. [1,2]. Also, dyes can cause allergy, dermatitis, skin irritation and also provoke cancer and mutation in humans [3]. The methods of dye removal from industrial effluents include adsorption, oxidation, coagulation, flocculation, chemical degradation and biological treatment which fall under the broad classification of physical or chemical methods [4]. In recent years, there has been increased interest in the use of magnetic assisted separation technique which is an alternative to centrifugation or filtration separation methods based on the use of magnetic nanoparticles [5].

2.Experimental – Glutaraldehyde cross-link Magnetic Chitosan Nanoparticles **(**GMCNs) preparation is described in our previous study [6]. The GMCNs was studied to determine the adsorption capacity of the RB5 and MY dyes. This process was conducted by adding 2.5mL of each kind of the nanoparticles (10 mg/mL) into a 50mL of dye solution, then adjusting to pH 3.0 using HCl or NaOH solutions while stirring at 30 ◦C for 24 h. The kinetics of the competition adsorption of the mixture solution A (initial concentration of RB5 0.67 mM and MY 0.67 mM) of the RB5 and MY dyes on the GMCNs was studied with a pH of 3.0 and a temperature of 30 ◦C. Also mixture solutions were studied at different concentrations.

3.Results and Discussion - The adsorption capacities of the RB5 and MY dyes on the GMCNs increased from 0.05 to 1.2 mmol/g and from 0.03 to 0.58 mmol/g, respectively, as the initial pH of the solution decreased from 10.0 to 3.0. The initial adsorption rate of the RB5 dye on the GMCNs nanoparticles in mixture solution A was faster than that of the MY dye. The adsorption capacity of each dye was determined in the mixture solution A and B A (initial concentration of RB5 0.67 mM and MY 1.33 mM). The adsorption capacity of the RB5 dye was found 0.46 mmol/g, whereas that of the MY dye appeared to be only 0.24 mmol/g.

4.Conclusions -This study investigated the equilibrium and the dynamics of the adsorption of two anionic dyes on the chemically cross-linked chitosan beads. The cross-linked chitosan beads had high adsorption capacities to remove the anionic dyes, whose maximum monolayer adsorption capacity is 620 mg g-1 for dye MY and 2549 mg g-1 for dye RB5 at pH 3, 30 ^{0}C. The equilibrium isotherm agrees very well with the Langmuir equation. The second-order kinetic model fits well with the dynamical adsorption behavior of a single dye for RB5 and MY. At the same time the second-order kinetic model fits well for mixture solutions.

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Cross-linked magnetic biosorbent for removal of phenolic compounds from water

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1. Introduction – The pollution of ground and underground water by phenolic compounds is a very important environmental problem. Phenol and phenol derivatives are major pollutants because of their high toxicity even at low concentrations [1]. Among the many methods available for removing phenols and its derivatives from aqueous solutions namely: chemical precipitation, ion exchange, coagulation, solvent extraction and membrane processes, adsorption has been shown to be an economically feasible alternative [2]. Chitosan has drawn more attention due to its low cost, non-toxicity, antimicrobial properties and high adsorption potential. Some agents such as glutaraldehyde, ethylene glycol diglycidyl ether and epichlorohydrin have been used to crosslink chitosan to reinforce its chemical stability. In addition, reactive functional groups and magnetic properties were introduced into the crosslinking of chitosan, to further improve the adsorption capacity and accelerate the process of solid–liquid separation [3].

2. Experimental – Glutaraldehyde cross-link magnetic chitosan nanocomposites (GMCNCs) successfully synthesized by the modifiedreduction precipitation method, making use of low temperatures and the inexpensive cross-linking reagent glutaraldehyde through the method suggested by Tural et al. [4]. The uptake of phenol, 2-chlorophenol and 4-chlorophenol from aqueous solutions using glutaraldehyde cross-link magnetic chitosan nanocomposites (GMCNCs) at room temperature. The GMCNCs was studied to determine the adsorption capacity of phenol, 2-chlorophenol and 4-chlorophenol. The adsorption processes were carried out by adding 50 mg GMCNCs into 50 mL of 50 mg L^{-} phenol, 2-chlorophenol and 4-chlorophenol solution at pH 7 with a shaking of 200 rpm for 30 min at 30 °C.

3. Results and Discussion - GMCNCs were characterized by several techniques such as fourier transform infrared spectroscopy, vibrating sample magnetometer, transmission electronmicroscopy, scanning electron microscopy and dynamic light scattering analyses. Adsorption characteristics of phenolic compounds from aqueous solution on to magnetic chitosan have been studied and results indicated that the adsorption capacities were affected by initial pH values, initial concentration of phenolic compounds, contact time and dosage of GMCNCs. Adsorptions by the adsorbents under investigation follow the Freundlich, Langmuir and Dubinnin-Radushkevich isotherm models. **In the meantime** kinetics parameters of the process were estimated.

4. Conclusions - In this study, the GMCNCs were proposed as a adsorbent for magnetic separation of phenol, 2-chlorophenol and 4-chlorophenol from aqueous solutions and investigated the equilibrium and the dynamics of the adsorption. The adsorption capacity of phenolic compounds onto the MCNs was depend on pH, contact time, the initial phenolic compounds concentration and adsorbent dose. High adsorption capacities were obtained in the pH range of 6.0-7.0 to remove the phenolic compounds. The adsorption capacity increased with increase in initial phenolic compounds concentration. The adsorption of adsorbates followed with the pseudo-second-order reaction, and equilibrium experiments were well fitted the Freundlich isotherm model.

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Comparative boron removal performance of magnetic nano-sorbent with n-methyl d-glucamine via "click chemistry" and direct coupling

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1-Introduction – Water contamination by boron cause serious environmental problems. The World Health Organization (WHO) recommended that the level of maximum limiting boron concentration in drinking water to 2.4 mg/L [1] In the literature, many different technologies used for separation and recovery of boron. The size of the sorbent particles which are these technologies are used, needed to be minimized [2]. Therefore, developing alternative techniques and the applications of magnetic technology has received considerable attention in recent years. Magnetic assisted separation technique having smaller particles, fast kinetic and optimum retention capacity. [3] In the present work, silica-coated magnetic nanoparticles chemically modified with N-methyl-D-glucamine (NMDG) which is selective for boron synthesized via "click chemistry" and direct coupling.

2. Experimental – Fe_3O_4 magnetics nanoparticles were prepared by co-precipitation of ferric and ferrous salts and silica-coated magnetic nanoparticles were synthesized by sol–gel method [4,5]. Then silica-coated magnetic nanoparticles chemically modified with NMDG by normal coupling (sorbent-1) and click chemistry (sorbent-2) [6,7]. The comparison of sorbents sorption capacity was performed by applying artificial prepared aqueous solution of boron and sea water samples. The influence of different parameters on the sorption capacity, magnetic sorbent dosage, pH, contact time, type and amount of stripping solution evaluated by using the magnetic sorbent.

3. Results and Discussion – The characterization of the magnetic products was investigated by X-ray diffraction, scanning electron microscope, transmission electron microscope, dynamic light scattering, thermogravimetric analysis, Fourier transform infrared spectrophotometer and vibrating sample magnetometer. The adsorption data for boron was analyzed by fitting the Langmuir, Freundlich and Dubinin–Radushkevich adsorption isotherms. The pseudo-first-order and pseudo-second-order kinetic models were used to fit the experimental data.

4. Conclusions - Magnetic sorbents have applied successfully for the removal of boron from natural and artificial water. The sorbents are compared in terms of boron removal, at each stage, Sorbent-2 of sorption capacity has been found to be superior by Sorbent-1. The experimental data were well described by the Langmuir isotherms and the pseudo-second-order kinetic model. This study has provided us with advantages which are being simple, speedy, and workable, without the need of filtration or centrifugation steps, opportunity to work with a large volume of sample, being economical, superiority in terms of green chemistry.

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Removal of hazardous azo dye from aqueous solution by cross-linked magnetic biosorbent; equilibrium and kinetic studies

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1. Introduction – Over 100,000 commercially available dyes exist and more than 7×105 tonnes per year are produced annually [1,2]. Due to their good solubility, reactive dyes are common water pollutants and they may frequently be found in trace quantities in industrial wastewater. The presence of very small amounts of dyes in water (less than 1 ppm for some dyes) is highly visible and undesirable [3,4]. Conventional methods for the removal of dyes in effluents include physical, chemical, and biological processes [5]. In recent years, there has been increased interest in the use of magnetic assisted separation technique which is an alternative to centrifugation or filtration separation methods based on the use of magnetic nanoparticles [6].

2. Experimental - Glutaraldehyde cross-link Magnetic Chitosan Nanoparticles **(**GMCNs) preparation is described in our previous study [7]. The uptake of Reactive Black 5 (RB5) from aqueous solutions using glutaraldehyde cross-linked magnetic chitosan nanoparticles (GMCNs) at 25◦C. The GMCNs exhibited significantly higher adsorption capacities of the RB5 from aqueous solutions. The GMCNs was studied to determine the adsorption capacity of the RB5. This process was conducted by adding 2.5mL of each kind of the nanoparticles (10 mg/mL) into a 50mL of dye solution, then adjusting to pH 3.0 using HCl or NaOH solutions while stirring at 30 ◦C for 24 h.

3. Results and Discussion - The characterization of the GMCNs was performed by fourier transform infrared spectroscopy, transmission electronmicroscopy, scanning electron microscopy, dynamic light scattering, and vibrating sample magnetometry analyses. Adsorption characteristics of the RB5 from aqueous solution on to GMCNs have been studied and results indicated that the adsorption capacities were affected by initial pH values, initial dye concentrations, contact time and adsorbent dose. Adsorptions by the adsorbents under investigation follow the Freundlich, Langmuir and Dubinnin-Radushkevich isotherm models. Meanwhile kinetics parameters of the process were estimated.

4. Conclusions - This study investigated the equilibrium and the dynamics of the adsorption of anionic dye RB5 on the chemically cross-linked chitosan beads. It indicates that GMCNs have high adsorption capacity even at low equilibrium dye concentrations. However, the removal efficiencies of the RB5 decreased from 84% to 58%, as the initial RB5 concentration increased from 66 to 275 mg/L. The adsorption of RB5 followed with the pseudo-second-order reaction, and equilibrium experiments were well fitted the Langmuir isotherm model.

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Advanced valorisation of cork wastewater by multi-stage membrane processes

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1. Introduction – Cork is a versatile product that has different uses of which the most important one is the production of wine cork stoppers. The cork industrial process includes a stage in which cork planks are immersed in boiling water during one hour in order to improve their physic-chemical characteristics. Cork boiling wastewater (CBW) is a black liquor containing a high chemical oxygen demand (COD) due to the polyphenols content in the range of 4,5–5,5 g/L and 0.6–0.9 g/L , respectively. Due to the toxicological properties of these effluents and the high volumes produced (140 to 1,200 L ton^{-1}cork) (1) they must be treated before its discharge into public courses by sophisticated treatment processes, some of which are based on NF or combined UF-NF membranes but there are problems with the "fouling". This study proposes a sequential combination of MF-UF-NF in order to avoid membrane fouling and improve the purification of CBWs. On the other hand, specific phenolic compounds are separated in each stage and can be recovered as useful by-products

2. Experimental –

CBW was treated by a sequential system of six membranes (2MF-3UF-1NF), being the permeate from each membrane the feed of the next one. COD, TOC, total phenolic compounds (TP) and specific polyphenols were analysed in both, permeates and concentrates. Table 1 shows the properties of each membrane.

Membrane	*Material*	*Pore size, µm*	*MWCO, Da*	Retention, $MgSO_4$, %	*pH*
11 µm (MF)	nylon	11			
JX(MF)	PVDF	0,3			2-11
MW(UF)	Ultrafilic		100000		1-10
PW (UF)	PES		20000		2-11
PT (UF)	PES		5000		2-11
HL (NF)	TF		150-300	98	3-9

Table 1. Properties of MF, UF and NF membranes used for this study

3. Results and Discussion –

Membrane	COD (mg/L)			TOC (mg/L)		
	Feed	Permeate	Concentrate	Feed	Permeate	Concentrate
11 µm	4450	4450	4475	1833	1823	1863
JX(MF)	4450	3015	5150	1823	1059	3225
MW(UF)	3015	1295	4770	1059	489	2105
PW (UF)	1295	915	1920	489	379	912
PT (UF)	915	745	1340	379	264	593
HL (NF)	745	167	870	264	54	571

Table 2. COD and TOC results achieved during the treatment

Samples	Concentrations mg/L							
	TP	GA	PA	VA	SA	ESC	CON	EA
CBW	889,9	18,95	11,427	3,313	2,983	2,032	0,825	11,32
Concentrate 11 µm	908,04	21,094	9,713	3,912	4,093	2,06	0,828	16,977
Permeate 11 µm	877,94	21,446	8,013	3,393	3,298	2,045	0,825	10,994
Concentrate JX	1460,1	19,693	7,008	4,67	4,248	2,913	1,168	35,678
Permeate JX	484,43	18,667	7,737	3,052	1,914	1,149	0,47	5,549
Concentrate MW	1085,04	20,04	8,363	4,467	4,093	1,958	0,804	9,167
Permeate MW	210,5	12,972	1,486	2,143	1,435	0,719	0,275	1,025
Concentrate PW	383,91	17,123	5,899	2,086	2,035	0,975	0,34	0,867
Permeate PW	102,42	8,736	0,85	1,449	1,024	0,424	0,196	0,326
Concentrate PT	424,28	17,724	3,2	1,859	1,901	0,859	0,293	n.d.
Permeate PT	83,27	10,877	9,147	1,444	4,093	0,417	0,192	n.d.
Concentrate HL	194,82	12,621	9,689	1,887	1,285	0,722	0,301	n.d.
Permeate HL	n.d.	0,27	0,205	0,407	n.d.	n.d.	n.d.	n.d.

Table 3.Concentrations of phenolic compounds during the treatment
***TP** total phenolic compounds, **GA** gallic acid, **PA** protocatechuic acid, **VA** vanillic acid, **SA** salicylic acid, **ESC** esculetin, **CON** coniferaldehyde, **EA** ellagic acid*

Removals of 96% for COD, 86,60% for TOC and nearly 100% for TP were achieved. Most of the organic matter is present in colloidal form, because MF stage showed reductions of 32% for COD, 42% for TOC and 45% for TP. Specific phenolic compounds were separated and concentrated.

4. Conclusions – This proposed multi-stage membrane process based on a Modular Operating Scheme MF-UF-NF showed good results in CBW treatment. The design of this system minimized membrane fouling, achieved good purification results and permitted recovery of useful phenolic compounds.

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Investigating the biotechnological potential of filamentous algae from extreme environments

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1. Introduction

It is known the potential of algae for biosorption of metals and for metals bioreduction. This work focuses on the study of biosorption and/or bioreduction capacities of two filamentous algae collected in extreme environments. One alga, identified as a *Mougeotia* sp., was collected in acidic water (pH 2 to 3) rich in sulphate and metals (Al, Cu, Fe and Zn) from mine ponds located at Mina de São Domingos, a deserted open-pit mine in the municipality of Mertola, in the Alentejo region, in Portugal. The other alga is an *Ulva* sp. collected in highly salty marine water (80 $^{0}/_{00}$ salinity) from a small water channel beside salt ponds in Ria Formosa, in the municipality of Faro, in the Algarve region, in Portugal.

2. Experimental

For the biosorption experiments, the alga *Mougeotia* sp. (collected in the metals contaminated mine water) was used. For the bioreduction experiments, this same alga and also the *Ulva* sp. (collected in highly salty marine water) were used. Both algae were washed, dried and grinded. For the biosorption experiments metals solutions of Fe(III), Cu(II), Pb(II), Mn(II), Cd(II), Zn(II) were prepared in deionised water with pH adjusted to 3 and to pH 5 with HNO_3 while Fe(II) and Sn(II) solutions were prepared just in pH 2 and pH 0.06, respectively, to ensure total dissolution. For the bioreduction experiments, the metal solutions were made from Ag(I), Au(III), Pt(IV) and Pd(II) in 5% HNO_3 (pH~0.25). To test the adsorption capacity of *Mougeotia* sp. the algal powder was mixed with the metal solutions and the metal concentration was monitored during 24 hours of mixing by means of flame atomic absorption spectroscopy (FAAS). In the bioreduction assay the metals solutions and extracts, obtained by autoclaving algae powder suspended in water, were mixed for 24 hours. Here metals removal was also monitored by FAAS and the formed precipitates were studied by X-ray diffraction analysis.

3. Results and Discussion

In the biosorption experiments results suggest leaching of metals from the algae into solutions for metals present in the mine ponds where the algae was collected. Washing the metals present on the algal filaments was a challenge apparently not fully achieved. On the contrary, promising results were obtained for Sn(II) at pH 0.06, Pb(II) at both pH tested (3 and 5) and Cd(II) at pH 5, with 100, 68, 73 and 85 % removals respectively.

For the bioreduction experiments, precipitates were formed for Ag(I), Au(III) and Pd(II) with *Ulva* sp. extract and for Pd(II) with *Mougeotia* sp. extract. XRD showed formation of metallic gold particles with the *Ulva* sp. extract and metallic paladium particles with the *Mougeotia* sp. extract. AgCl particles were formed with the Ag(I) solution with *Ulva* sp. extract, probably due to a putative high concentration of Cl ions in it coming from the extremely salty water where this alga was collected.

4. Conclusions

The results show the high potential of *Mougeotia* sp. for removing some metals by adsorption, but also show difficulties in removing metals previously adsorbed to its filaments, which can be a disadvantage for the reutilization of this alga in successive adsorption cycles.

The formation of metallic particles of gold and Paladium, with *Ulva* sp. and *Mougeotia* sp. extracts respectively, suggest the presence of reducing agents for these elements on these algae, paving the way for further studies aiming their identification and/or for industrial applications.

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Comparisons of the iodoorganic compounds formation with Mn-oxide in iodide- and iodate-containing water

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1. Introduction – Iodoorganic compounds by-produced in disinfection have been demonstrated to be extremely genotoxic and cytotoxic [1]. With variety valence manganese element and porosity, Mn-oxides could act as an oxidant or catalyst in natural environments and govern the formation, mobility and toxicity of many pollutant compounds [2]. Both iodide (I^-) and iodate (IO_3^-) were observed in hydrosphere and pedosphere. However, the effect of source species of inorganic iodine on the iodoorganic compounds was still unclear.

2. Experimental – Iodide (or iodate) and NOM extracted from local river sediments were dosed into the Mn-oxides suspension. The total iodoorganic compounds were analyzed using an activated carbon adsorption process (TX03, Mitsubishi) and the adsorbed activated carbon was subjected to pyrolysis using an automatic quick furnace (Mitubishi).

3. Results and Discussion – Fig. 1 (a) and (b) respectively show the results of iodine speciation after I^- or IO_3^- as iodine source reacted with NOM in MnO_2 suspension. Six species of iodine were observed in the resulted solution, including I^-, I_2, IO_3^-, adsorbed form on MnO_2 and complex form with NOM. As shown in the middle bar of Fig. 1(a), the remained I^- was higher in the MnO_2 suspension with NOM addition than without NOM system (right hand bar of Fig. 1(a)) and the formation of I_2 was quite the reverse, indicating NOM could compete with I^- for the oxidation site of MnO_2 surface. Notably, no IO_3^- formed in the MnO_2 suspension

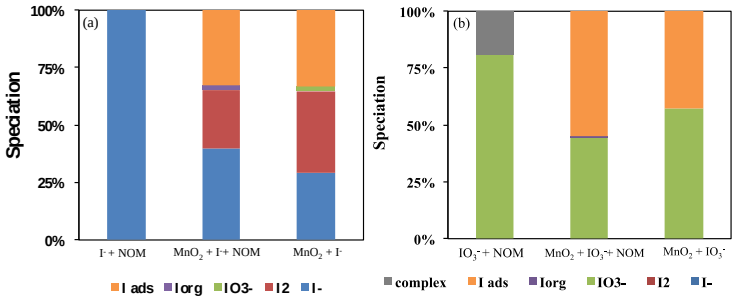

Fig. 1 The iodine speciation after I^- or IO_3^- as iodine source reacted with NOM in MnO_2 suspension.

with NOM system, indicating that the pathway from I^- to IO_3^- was interrupted when the NOM participate the reaction of I^- and Mn-oxides. Surprisingly, a detectable quantity of iodoorganic compounds was also determined in the system of IO_3^- with the presence of NOM and Mn-oxide. The trace iodide in the result solution and the relative low concentration of dissolved Mn^{2+} ions in this case may interpret the Mn-oxides catalyzed the IO_3^- reduction to iodoorganic compounds by NOM.

4. Conclusions – Both I^- and IO_3^-, prevalent inorganic source of iodine, could transform to toxic iodoorganic compounds in natural system with NOM and Mn-oxide. I- was oxidized by Mn-oxide while IO_3^- was reduced by NOM under the catalyst of Mn-oxide.

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Selection of relevant microorganisms for the biodegradation of organic micropollutants, using an hybrid membrane bioreactor

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1. Introduction – Due to the recalcitrance of some organic micropollutants regarding current conventional wastewater treatment systems, the removal of these compounds from wastewaters has become an environmental concern. Even though removal of micropollutants is compound- and process-specific, their biodegradation could be an interesting and low cost alternative. That is why the selection of efficient microorganisms able to break down selected micropollutants is needed in order to design and refine an additional biological process to current wastewater treatment plants.

2. Experimental - In that context, batch degradation experiments were first performed on two pharmaceutical compounds, diclofenac and carbamazepine, and a pesticide: diuron (n=3). These micropollutants are defined as priority substances by the EU Water Framework Directive 2013/39/EU. Each Erlenmeyer flask contained isolated strains, or selected white rot fungi (WRF) inoculated in a nutrient medium. Uninoculated controls, as well as controls killed using sodium azide added to the medium, were also performed under identical conditions in order to assess contamination or sorption effects, respectively. The removal efficiency of diclofenac, carbamazepine, and diuron, initially added at 1 $mg.L^{-1}$ was evaluated by LC-MS QqToF analysis.

3. Results and Discussion - After three days of degradation during batch experiments, a complete removal of diclofenac was observed, mainly due to biodegradation pathway. Removal of diuron and carbamazepine was more than 50% and 30%, respectively (Image 1). A mixed culture of isolated and acclimatized bacteria was also tested in the same operating conditions to evaluate their potential synergy, but no significant improvement regarding the efficiency of the strains has been observed.

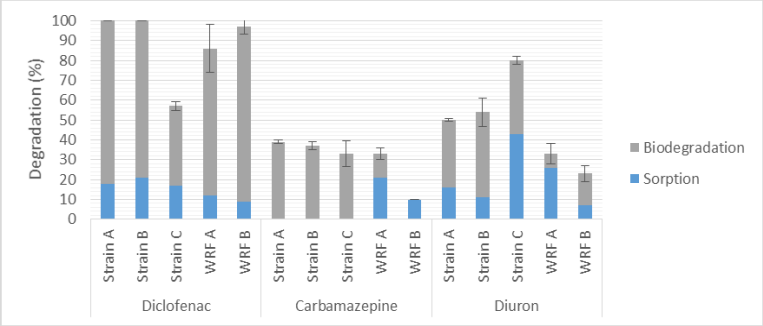

Image 1: Degradation of diclofenac, carbamazepine and diuron after 3 days, using different microorganisms (n=3)

4. Conclusions – Finally, the results showed significant biodegradation rates and thus, highlighted the ability of few strains to break down recalcitrant micropollutants. Once the optimized conditions found, selected relevant microorganisms will be acclimatized in a hybrid membrane bioreactor combining fixed-bed and free cultures. Then, the degradation of selected micropollutants will be evaluated on continuous flow using optimal operating conditions.

Scientific CV :

I graduated from ENSIL (École Nationale Supérieur d'Ingénieurs de Limoges, a French engineering school) with an engineering degree in Water & Environment speciality and from Limoges University with a research Master degree in quality and wastewater treatment. I am presently a Ph.D. student under a CIFRE (Industrial Convention of Formation by Research) contract, working on the biodegradation of organic micropollutants at LCE (Laboratoire Chimie de l'Environnement, France), M2P2 (Laboratoire Mécanique, Modélisation and Procédés Propores, France). My supervisors are Dr I. Seyssiecq and Pr. P. Doumenq.

The goal of my research project, funded by Seakalia, is to find a complementary process in wastewater treatments used nowadays in wastewater treatment plants, in order to remove persistent and emergent organic micropollutants. I have recently submitted a review, entitled "*From the conventional wastewater treatment to hybrid processes, the evaluation of organic micropollutant biodegradation: A review*", in Water Research. I presented a poster, entitled "*Degradation of organic micropollutants by innovative biological processes*" during the 10th European Congress of chemical engineering (ECCE10) which took place in Nice (France) from 27 September to 1st October 2015. Furthermore, I have been selected to participate to the Leading edge summer course "Management of micropollutants in the urban water cycle", which be organised from July 4 to July 8 2016, in Narbonne (France).

International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

Optimization-based planning of the lignocellulosic wastes utilization system for energy supply to the transport sector

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1. Introduction

Bioethanol has been recognized as a substitute of transportation fuels because ethanol-blended gasoline is compatible with the conventional vehicles and the corresponding infrastructure [1]. It has also a positive effect on the environment protection including climate change and can improve energy security by reducing the dependence on imported energy. For that reason, we present a new optimization model to design the bioethanol supply chain that utilizes the lignocellulosic wastes, such as agricultural and forest residues. We also conduct different practical strategies, e.g., various blend ratios of bioethanol and gasoline, to evaluate the economics and feasibility of the bioethanol supply system. With the proposed approach, we can provide useful information to policy-makers and stakeholders in energy business such as a bioethanol production company.

2. Optimization model

The goal of the proposed optimization model is to identify i) type and quantity of biomass as a feedstock and ii) the number, type, size and location of the technologies and storage systems that are required to produce and supply bioethanol under different blending strategies of bioethanol and conventional liquid fuels. The model is formulated using mixed integer linear programming (MILP) techniques. The objective function is to minimize the total supply cost (*TSC*) of the bioethanol supply system, which is subjected to the systematic and practical constraints as shown in Figure 1.

$$\underset{x,y}{\text{Minimize}}\ \text{TSC}\ \{\text{Total supply cost}\}$$

$$\left.\begin{array}{l} f(x,y)=0 \\ g(x,y)\le 0 \end{array}\right\} \begin{array}{l} \text{Liquid fuel demand satisfaction} \\ \text{Mass balance} \\ \text{Facility \& biomass types selection} \\ \text{Facility capacity} \\ \text{The location of facility} \\ \text{The land use} \end{array}$$

$$x \in \mathbb{R}^n,\ \ y \in \mathbb{N}^m$$

Fig. 1. The structure of optimization model

3. Results and discussion

We apply the optimization model to the bioethanol supply problem of Jeju Island, South Korea. As a result, the TSC of the strategies is ranged from 552 to 588 M$ per year, and the unit supply cost of the ethanol blended fuel is in the range of 0.81 - 0.87$ per litre which is the modest cost when we consider the regional chracteristics of the island (e.g., isolated from main land).

4. Conclusions

We identified that the bioethanol supply system prefers to utilize the woody residue due to its relative low processing cost via gasification technology. Thus, the strategy with ethanol content below 20% (E20 policy) is suitable for Jeju Island, because the woody residue available for ethanol production is insufficient for the strategy with ethanol content beyond 20%.

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The effect of zeolite, chemical fertilizer and compost on yield of cress, nutrient composition and soil properties

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1. Introduction – Aluminosilicate minerals such as zeolites have been extensively used for soil remediation, land erodibility control, soil properties improvement and nitrogen use efficiency. Different composts derived from agricultural by-products such as olive stone or olive leaves, grape and tobacco wastes which are abundant in Mediterranean countries, have been successfully applied to ameliorate soil physical and chemical properties [1,2]. A combination of compost from olive leaves, zeolite and chemical fertilization was used to cress plants so as to examine the soil physicochemical parameters and plant yield.

2. Experimental - A soil pot experiment was conducted with cress plants *(Lepidium sativum)* in a plastic greenhouse without heating at the farm of the Soil Science Department of Athens (Institute of Soil and Water Resources, ELGO «Demeter»). Plastic pots of 4 L in volume were used. The soil was obtained from the surface layer (0-30 cm) of the farm, ground and sieved to less than 2 mm. Two types of soils were used, i.e. light (sandy loam) and heavy (sandy clay) soil and were mixed with chemical fertilization, such as Complet 12-12-17-2 Mg, (F) or not (F0), compost from olive leaves at 0% v./v. (C0) or 10% v./v. (C10) and zeolite at 0% (Z0), 2% (Z2) and 5% (Z5) w./w. The growth period last from April to June 2014. Different soil parameters were measured such as pH, electrical conductivity, organic matter, electrical conductivity, macronutrients such as N, P, K, Ca, Mg, and trace elements Fe, Zn, Mn, Cu indicating the influence of zeolite, compost and chemical fertilization to soil and plant tissues.

3. Results and Discussion – According to soil samples, soil moisture is higher to "light" textured soil (0.5-1.3%) compared to "heavy" textured soil (1-2%) for all treatments. Moisture increases gradually up to 2% in the treatment where soil contains 10% of compost, 5% of zeolite and no chemical fertilization for both soils. Soil pH is almost stable around 7.0 for heavy soil and 6.4 for light soil. The values of electrical conductivity and salinity are higher for both soils, which contained chemical fertilization compared to soils with no chemical fertilization. Soil organic matter presents values between 2.0 to 8.0% for light soil and 2.0 to 12% for heavy soil. Light soil appears high levels of trace elements such as available Fe and Cu and low levels for available Zn and Mn while heavy soil presented high values of available Mn. Exchangeable Ca and Mg presents similar behaviour while Na and K ions are higher to treatments where zeolite presents the highest percentage (5%). Both soils contain sufficient concentration of P and low concentrations of total N. Plant samples have shown sufficient concentrations of total N and P

and high concentrations of K, Ca and Mg for plants cultivated to both soils. Available Fe values are higher to heavy soil compared to light soil in contrast to the concentrations of available Zn and Cu.

4. Conclusions

a) The addition of zeolite increases the concentrations of Na and K to cress plants and soil.

b) Chemical fertilization influences the values of electrical conductivity and salinity to both soils.

c) pH is stable and organic matter reaches around 3 to 5% for both soils.

d) The presence of compost and zeolite with no chemical fertilization increases the concentration of trace elements to both soils.

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The effect of soil amendments in Cr(VI) polluted soils cultivated with celery

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1. Introduction – Heavy metals are used in a variety of industrial activities. Industrial effluents containing heavy metals such as Pb, Cr, Cu and Ni are the main sources of water and soil contamination [1]. Common methods for the removal of heavy metals from wastewaters and soils are chemical precipitation, ion exchange, reverse osmosis, solvent extraction and adsorption. The last method is low cost with high efficiency of metal removal and environmental friendly [2]. The present paper examines the addition of zeolite and modified zeolite with HDTMA-Br in soils polluted with Cr(VI), which were cultivated with celery (*Apium graveolens*).

2. Experimental – A soil pot experiment was conducted with celery plants, (*Apium graveolens*), in a plastic greenhouse without heating at the farm of the University of Thessaly in the central Greece. Plastic pots of 2 L in volume were used. The soil was obtained from the surface layer (0-30 cm) of the farm, ground and sieved to less than 2 mm. Two types of soils were used: sandy loam and silty loam. The ratio of soil/adsorbent was 200/1 g/g. Celery seeds were sown directly in pot soil on October 10th, 2013. Cr(VI) in the form of CrO_3, was added to the soil at three different doses of 10 mg Cr(VI)/kg soil 15, 20, and 22 days after sowing. Fertilization (Entec 26-0-0+13S) took place on October 23th, 2013. The experiment repeated three times. The determination of Cr(III), Cr(VI) and total chromium in soil, the upper and ground part of celery followed.

3. Results and Discussion – Results have shown that after 4 months, the Cr(VI) reduction percentages were equal to 88.2% for the soil polluted with Cr(VI) (S), 74.4% for the soil polluted with Cr(VI), which contained zeolite (SZ), and 84.1% for the soil polluted with Cr(VI), which contained modified zeolite (SMZ) in sandy loam soil. As far as silty loam soil was concerned, the respective reduction percentages were equal to 73.5, 62.1 and 69.0%. The addition of Cr(VI) to sandy loam soil increased the amount of Cr(III) but the increase was not significant to all cases while the addition of Cr(VI) to silty loam soil increased significantly Cr(III) in soil with zeolite (SZ) and modified zeolite (SMZ) in comparison with soil without the addition of Cr(VI). The addition of Cr(VI) in the two soils did not increase significantly the total chromium in soils. The analysis of the upper part of celery plants, which were cultivated to polluted with Cr(VI) sandy loam soil, has shown 43.7% decrease of Cr(VI) concentration in plant tissues developed in soil with zeolite (SZ) and 84.0% in soil with modified zeolite (SMZ). The analysis of the upper part of celery plants, which were cultivated to polluted with Cr(VI) silty loam soil, has shown significant decrease of Cr(VI) concentration in plant tissues developed in soil with modified zeolite (SMZ) in comparison with those which developed in soil with zeolite (SZ) or without soil amendment (S).

4. Conclusions

-The addition of zeolite and modified zeolite in soils did not reduce the amount of Cr(VI) in soil but metal ions are probably adsorbed by the amendments

- The addition of Cr(VI) in the two soils did not increase significantly the total chromium in soils.

-Cr(VI) concentration decreased significantly to the upper part of celery with the addition of soil amendments especially modified zeolite

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Obtaining of hydroxyapatite from natural source

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1. Introduction

Hydroxyapatite (HAp), as a inorganic compound naturally present in human bone, is one of the most important materials used in bone regeneration. This material has a high degree of biocompatibility, exhibits osteoconductive behavior and can create chemical bonding with surrounding tissue. Due to the rise in the number of patient which require bone replacement it is necessary to create biocompatible material with sufficient mechanical strength. Transformation of waste generated from agricultural process into material used in medicine is an attractive alternative to traditional method of biomaterials production [1-3].

2. Experimental

The main aim of this investigation was the production of calcium phosphate from agriculture waste material such as chicken eggshells which contain approx. 94% of calcium carbonate. This compound during calcination convert to calcium oxide that can be used to produce hydroxyapatite.

HAp production were divided into few stages. Firstly, collected eggshells were heating for 3 h in temperature range from 800°C to 1200°C in chamber furnace. In this study the synthesis of hydroxyapatite was carried out by reacting calcium precursor – calcium oxide from eggshells with phosphoric acid at ambient temperature, under alkaline conditions. Subsequently, obtained mixtures were aged for 24 and next filtered and dried. The last step included physical characterization of obtained powders.

The phase identification of the final products were confirmed by X-ray diffraction and FT-IR spectroscopy. Scanning electron microscopy (SEM) was applied to determined morphology and particles size of obtained powders. Moreover, the amount of phosphorus and calcium were evaluated too.

3. Results and Discussion

HAp has been succesfully produced by reaction of calcined eggshells and phosphoric acid in presence of ammonia water. The study proved that the only one phase, such as hydroxyapatite was present in the all samples.

4. Conclusions

In this studies synthesis of calcium phosphates from chicken eggshells was presented. The result of this investigation confirm presence of hydroxyapatite in obtained powders. This materials can be a promising materials concerning medical and dental applications.

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The microengineers in macroaggregates

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1. Introduction – The macroaggregate habitats, such as marine snow or activated sludge, are known from all the aquatic ecosystems. Recent findings show that protozoans may be regarded as ecosystem engineers in such systems. The aim of the study was to estimate the effect of crawling ciliate, *Aspidisca cicada* (Protista) on the flock structure, and accordingly on the population growth rate of *Lecane inermis* rotifer, in the context of activated sludge system.

2. Experimental - Experimental treatments of *A. cicada* (A), *L. inermis* (L), *A. cicada* and *L. inermis* (AL) and control (C) were cultured for 1.5 months (four replicates per treatment). Every 3-4 days the cultures were sampled for (i) calculating *A. cicada* and *L. inermis* densities, and (ii) analyzing the floc structure.

3. Results and Discussion - *A. cicada* reached 1000 indiv./ml in A treatment and disappeared from the AL treatment after two weeks, achieving the highest number of 315 indiv./ml on 7th day. *L. inermis* proliferated at higher rate in AL treatment than in L treatment ($p<0.001$), achieving the maximal number of 45000 indiv./ml. The parameters of floc structure showed an intermediate pattern for AL treatment in comparison with A (highest values) and L (lowest values) treatments. These differences are significant in case of floc size ($p<0.001$) and tend to differ in case of floc compactness ($p=0.06$).

The presence of *A. cicada* considerably improved the population growth of L. inermis through changes in floc structure. Despite the early disappearance of A. cicada from the system, the floc structure remained under its influence to the experiment closure. These data suggest that *A. cicada* may be regarded as an influential engineer in the floc ecosystem. These results shed light on the processes taking place in macroaggregate system by indicating the strong relationship in this complicated, dynamic habitat.

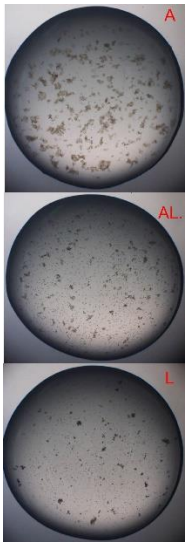

Fig. 1. Floc structure in different treatment groups

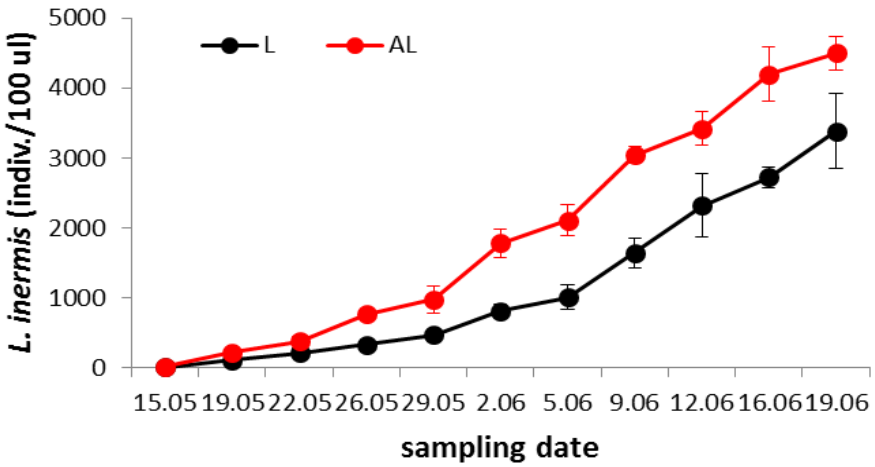

Fig. 2. *Lecane inermis* individuals density in experimental groups. Mean±SD

4. Conclusions - The presence of *A. cicada* considerably improved the population growth of *L. inermis* through changes in floc structure.

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Fluorescence-based bioassay for the analysis and assessment of water quality

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1. Introduction – Biomonitoring based on chlorophyll fluorescence (CF) shows promising application in environmental biotechnology. This bioassay is used as a practical and potential indicator of biotic and abiotic factors, including pollutants/toxicants. The method is simple, inexpensive and accurate; it is suitable to apply in both laboratory and field-based environments. It is also important that it not only provides reliable information about toxicity, but also provides an opportunity to understand the consequences. CF bioassay, as a method of aquatic toxicology, commonly used to regulate environmental pollution and protect natural resources [1]. Measurement ratio of CF intensity at saturating photosynthesis the exciting light (Fm) and conditions that do not cause changes in the state of the photosynthetic apparatus (Fo), allows to determine the effectiveness of the primary processes of photosynthesis, which is equal to (Fm-Fo)/Fm = Fv/Fm. The effectiveness of the primary photosynthesis processes (Fv/Fm) represents dimensionless energy of photosynthesis characteristics. The intensity of the fluorescence from Fo with high correlation coefficient corresponds to the total content of the light-harvesting pigments of photosynthetic apparatus, and thus correlates with the abundance of microalgae [2]. In this study, the biological assessment of water toxicity from artesian well of Atyrau region, Kazakhstan (Image 1) using CF of microalgae *Chlamydomonas reinhardii* was conducted.

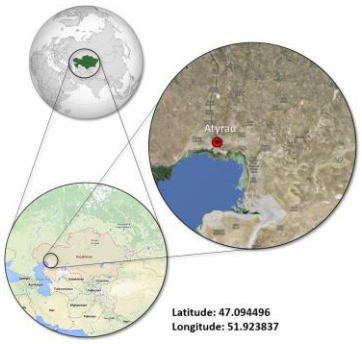

Image 1. Location of water sample collection

2. Experimental - *Chlamydomonas reinhardii* culture was grown in Tris-acetate-phosphate medium, pH 7,0 at 25°C and light intensity of the fluorescent lamps at 30 μE/m^{2}sec. Measurements of CF of microalgae was carried out on a pulse fluorometer.

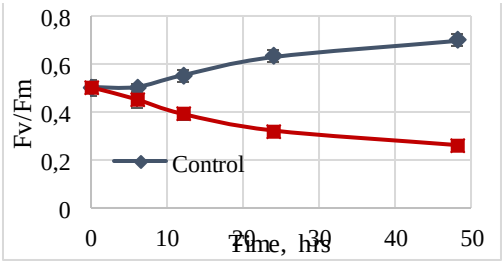

Image 2. Changes in fluorescence parameters of *Chlamydomonas reinhardii* in the artesian water

3. Results and Discussion - The analysis showed that during 2 days incubation of the microalgae there was a slight reduction in the fluorescence velocity. Artesian water has significant toxic effects on the growth and photosynthetic activity (Fv/Fm) of *Chlamydomonas reinhardii* (Image 2).

4. Discussion – The toxicity bioassay revealed moderate contamination of artesian well of Atyrau region, which indicates that the water is not

potable and safe to consume. The results obtained using this bioassay by microalgae' photosynthetic activity are promising approach for monitoring and assessment of water quality. Due to the demand of express techniques for supervision and control over the quality of water toxicity, this type of bioassay becomes increasingly important.

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Scientific CV

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International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

Analysis of farmers' attitude toward irrigation with desalinated brackish water in Israel's Arava Valley

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1. Introduction – Saline water irrigation is practiced in arid regions with access to brackish groundwater resources, such as the Arava Valley in Israel (from 30°57'N-35°23'E to 29°33'N-34°58'E). Local farmers have relied on it for decades, but the sustainability of this practice is questionable due to limitations on yields, choice of crops, and leaching requirements [1]. Desalination may be a resource-efficient alternative, but implementation has thus far been limited. High costs, lack of essential ions for crop growth, and brine disposal are often cited as limiting factors, but the farmers' perspective regarding their relative importance and how to overcome such limitations is largely absent from the scientific literature. This study uses survey-based techniques to analyze irrigation practices in the Arava Valley, farmers' attitude and concerns toward desalinated water, and their willingness to pay for desalination.

2. Experimental – A questionnaire was distributed in May 2016 among farmers residing in the Central and Northern Arava. In total, 128 questionnaires were collected through face-to-face interviews. Of the 28 questions, 9 are designed to gather information regarding the current farming practices, including water use and salinity. The central section consists of 14 questions that focus on assessing: (1) familiarity with desalination and its use in agriculture; (2) attitude toward environmental issues (e.g., water conservation, environmental impacts of desalination, renewable energy desalination); (3) willingness to switch to desalinated water, including willingness to pay for a private or communal desalination plant; and (4) concerns in adopting desalination and preferred policy approaches to deal with them. The remaining five questions collect general demographic and socio-economic statistics from the respondents.

3. Results and Discussion – Most respondents own the fields they cultivate, whose median extension is 5 ha. Pepper is cultivated by 54%, followed by dates (33%) and melons (19%). The average electro-conductivity of the water is 3.0±0.5 dS/m. Most respondents (89%) are concerned about increases in water salinity over time and 97% is familiar with the possibility to use desalinated water in agriculture. However, only 25% knows about desalination by nano-filtration membranes. About half is either already planning to switch to desalinated water (18%) or intends to do so over the next few years (32%). Only 7% is contrary to irrigate with desalinated water. At grid parity, 77% of the respondents would be interested in exploring solar desalination options. A positive willingness to pay for investment in desalination is stated by 23% of the respondents.

Most farmers (56%) would keep growing the same crops, aiming at higher yields with better water quality. Among those who would change cultivations (34%), salt-sensitive (apricots, strawberries, peaches, mango) and medium-sensitive crops (grapes) are frequently indicated. When asked to list the top concerns in transitioning to irrigation with desalinated water, economic reasons are cited by 87% of respondents; only 6% is concerned of potential damages to crops. Brine disposal is most frequently indicated by the 45% of respondents who express environmental concerns related to desalination. Governmental incentives are the preferred transition policy for 55% of respondents, followed by technical assistance in operation and maintenance of the desalination plant (20%). Financial incentives covering 50% of construction costs are preferred over incentives covering 70% of the costs to switch to new cultivations. Overall, our results support the notion that farmers in the Arava are aware of the issues with brackish water irrigation and open to the idea of exploring desalination as an alternative option. Our results may provide guidance to policy-makers interested in efficiently guiding the transition to sustainable water management practices in this and other areas with similar characteristics.

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Removal of dyes from aqueous solutions by adsorption on the shrimp carapace

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1. Introduction- Some of the chemicals, including dyes and pigments, are toxic or can lower the dissolved oxygen content of receiving waters, threaten aquatic life and damage general water quality downstream [1]. Researchers are particularly interested in the toxicity of azo dyes, which are characterized by the presence of azo group (-N = N-) Even though erythrosine is widely used in food industry and has a high toxicity, only few studies have considered its elimination/extraction from water [2] Thus, treatment of effluents containing dyes is essential to safeguard the environment. Adsorption is one of the most efficient methods to remove pollutants from wastewater. We propose in this study to remove textile dye: green methyl dye by adsorption. As adsorbent, the powder shrimp carapace was used, which is low-cost, abundantly available, highly efficient, and has been reported as an alternative to the current expensive methods.

2. Experimental- Adsorption experiments were performed in a batch system at ambient temperature 25°C. Series of 50 mL volumetric flasks containing 30 mL of dye solutions at different concentration were employed. The dye solution pH was adjusted with NaOH (0.1 N) or HCl (0.1 N) to desired initial pH prior to the experiment. A specific amount of adsorbent with particular particle size (between 50 and 800 µm) was added into each flask and was agitated at 100 rpm, until the equilibrium was reached and then centrifugated at 7000 rpm for 30 min. The sample was collected and diluted before analysis using UV-visible spectrophotometer (Model Specor 200 plus) at wave length of 633 nm.

3. Results and discussion- Adsorption isotherm plays a crucial role in the predictive modeling procedures for the analysis and design of an adsorption system. Thus, the correlation of the equilibrium data by theoretical or empirical equations is essential to practical operation. In this study, adsorption isotherms were analysed according to the linear form of Langmuir, Freundlich and Dubinin-Radushkevich (D-R) isotherms. Table I displays the results of the calculated isotherm constants of the three models.

Table I. Constants of Langmuir, Freundlich and (D-R) isotherms for Green methyl adsorption onto powder

of shrimp carapace

Langmuir			Freundlich			Dubinin-Radushkevich			
q_{max} (mg g^{-1})	K_L (L mg^{-1})	R^2	K_F	n	R^2	q_{max}($mg.g^{-1}$)	B($mol^2.J^{-2}$)	E($kJ.mol^{-1}$)	R^2
76.336	0.655	0.9681	32.24	3.6	0.979	73.9	2,39E-08	4.57	0.6

4. Conclusions- Powder of shrimp carapace is an effective adsorbent for the removal of green methyl dye from aqueous solutions. According to the experiments results, the equilibrium was achieved within 112 min of contact time. The adsorption capacity of green methyl dye onto powder of shrimp carapace is high by using basic solutions (pH up to 8). Langmuir, Freundlich and Dubinin-Radushkevich isotherm models were applied to describe the experimental data. The Langmuir adsorption isotherm was found to provide the best fit of the experimental data. Maximum adsorption capacity was evaluated at 76, 336$mg.g^{-1}$. The results of the present study suggested that shrimp carapace could be suitable as a sorbent material for removal of dyes from aqueous solutions.

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International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

Microbial Community Parameters as a Primary Attribute of Soil Quality Assessment

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1. Introduction – Rapid industrialization and urbanization of West regions of Kazakhstan led to contamination of soil and water (surface and ground) with petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAH) and heavy metals. Appropriate ecological assessment of these areas is essential to determine the degree of contamination. Application of microorganisms as bioassay systems for assessing and monitoring the environment is based on the possibility of evaluating microbial response and metabolic dynamics to the influence of environmental factors in the natural and technological conditions [1].

Table I. Microbial diversity in soil samples, CFU/g soil

Microbial taxonomy	Location of soil sampling sites	
	Aktau region, CFU	Atyrau region, CFU
Bacteria	$2,7x10^4$	$9,1x10^4$

2. Experimental - Soil sampling was carried out on the territory of Western Kazakhstan (Aktau and Atyrau regions); 12 samples from different spots were collected for investigation of microbial communities. Microorganisms in samples were quantified according to standard Koch's method [2].

3. Results and Discussion - In the soil samples from Atyrau and Aktau regions it was found that, the qualitative composition of the microflora is quite common, and the number of microorganisms in these samples does not exceed 10^4CFU/g (Table 1). It testifies to the fact that the microbial community of the examined areas is relatively restricted both in quantitative and qualitative composition, which undoubtedly negatively affect the process of natural self-purification of terrestrial ecosystems.

4. Conclusions - According to the microbial groups as a conditional test, not less than 1 million cells per 1 g of soil substrate adopted as valuable criteria, i.e., only with such a number of microorganisms may have important ecological benefits for bioremediation. The results show the law number of saprophytic microbes present in targeted areas, which necessitate the conclusion that natural remediation of these places proceed at an imperceptible rate.

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Advanced Oxidation for the Treatment of Organic Wastewater Containing p-Cresol in Batch Reactor: Operating Conditions Process Optimization and Kinetic Reaction Modeling

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Toxic organic substances are common contaminants in wastewater from the chemical and petrochemical industries. The interest of the scientific community in the study of these pollutants is increasing, as these can cause major changes in the environment, affecting the health of animals and humans. It is important to study and facilitate techniques capable of degrading these types of compounds, such as Advanced Oxidation Processes (AOP). The present work has as objective the kinetic study of synthetic solution containing an initial p-Cresol concentration ($C_{p\text{-}C}$) of 500 mg.L^{-1}, with the use of conventional AOP in a PARR batch reactor model 4848 with constant agitation speed of 500 rpm, in order to propose a kinetic model based on mineralization of Total Organic Carbon (TOC). The effect of the two factors was investigated: the air flow (F–L.h^{-1}) and the molar stoichiometric ratio of p-cresol/hydrogen peroxide (R–%).The Rotational Central Composite Design (RCCD) with factorial k (2^2) includes four axial points and five repetitions at the centre point (2^2+(2x2)+5) according to Table I, totalling 13 runs and sample collection times (t) of 240 min. The analysis of mineralization of total organic carbon by advanced oxidation reaction of p-cresol proved to be efficient, managing to obtain a percentage of approximately more than 62% TOC conversion. However, the p-cresol degradation is total (100%).

Tabla I. Factorial design to study the TOC of p-Cresol.

Tests		Coded Factors		Levels of the factors	
		R	F	R(%)	F(L.h^{-1})
1	Factorial Point 2^2	-1	-1	64	110
2	Factorial Point 2^2	+1	-1	92	110
3	Factorial Point 2^2	-1	+1	64	130
4	Factorial Point 2^2	+1	+1	92	130
5	Centre Point	0	0	78	120
6	Centre Point	0	0	78	120
7	Centre Point	0	0	78	120
8	Centre Point	0	0	78	120
9	Centre Point	0	0	78	120
10	Axial Point	+1	0	98	120
11	Axial Point	0	-1	78	106
12	Axial Point	0	+1	78	134
13	Axial Point	-1	0	58	120

The optimal operating conditions observed were: molar stoichiometric ratio of p-cresol/hydrogen peroxide (R) of 78% and the air flow (F) of 120 L.h^{-1} in reaction temperature of 90°C. The construction of an appropriate kinetic model was realized about these conditions for a period of 240 min. The kinetic model used to describe the profile of the residual TOC concentration in terms of carbon contained in liquid phase was the *Lumped Kinetic Model* (LKM), considering the chemical species into two groups (refractory and non-refractory compounds) and managed to satisfactorily represent the profile of the residual fraction of organic compounds analyzed. A non-linear regression was carried out from data obtained in TOC conversion up to 240 min for Kinetic Parameters (k) being these results: k_1 (kinetic rate constant for reaction from initial compound (A) to intermediate species (B)) of 4,73 x 10^{-1} min^{-1}, k_2 (kinetic rate constant for reaction from intermediate species (B) to CO_2 and H_2O (C)) of 5,52 x 10^{-3} min^{-1} and k_3 (kinetic rate constant for reaction from intial compounds (A) to CO_2 and H_2O (C)) of 0 min^{-1}. It can be observed that the k_3 value was zero. This implies that the direct mineralization of p-Cresol does not occur to the working range used, i.e. all p-Cresol is converted into other organic substances and parts thereof, then, are converted to CO_2. The kinetic model adjusted to the experimental data presented coefficient of determination R^2 (% of variance explained) from 0.9745.

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Treatment of Wastewater Containing Organic Effluents Phenolics by a Thermochemical Advanced Oxidation Process (DiCTT)

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Many organic pollutants are considered as toxic and detrimental even when present at very less concentrations. For this reason, their removal from the contaminated water is a high priority and consequently there is a need to efficient treatment of these compounds. Phenols are polluting organic substances with low biodegradability that often pollute industrial wastewater, surface water and ground water and is therefore a matter of extreme interest due to the magnitude of impacts caused to human health and environment when most of them are inadequately managed. Advanced Oxidation Processes (AOP) have been a viable alternative method for the treatment of wastewaters containing toxic and refractory organic pollutants, being studied in various combinations. They mainly based on intermediate reactions of hydroxyl radicals (•OH), an unstable and very reactive species, resulting in the degradation of toxic organic contaminants due to its high oxidizing power (Potential oxidation of 2.8 V) under acidic conditions. Currently, a non-conventional AOP called Direct Contact Thermal Treatment (DiCTT) has been investigated, which main attractive is the use of natural gas as energy source, the demonstrated ability to oxidize phenolic compounds at low temperatures and atmospheric pressure, and the generation of free radicals (•OH, •H, •CH_3 and •CHO) resulting from combustion of natural gas (methane) [1, 2]. In the present study, the thermochemical oxidation of phenol and its aromatic intermediates (particulary, hydroquinone, catechol and para-benzoquinone) was followed up to the partial mineralization of phenol into carbon dioxide and water accompanied by the formation of organic acids. The effect of the initial phenol concentration (C_{ph0}) of 500, 1000 e 1500 mg.L^{-1} on the degradation capacity of the DiCTT oxidative process was quantified by monitoring of the concentrations of phenol, catechol, hydroquinone and para-benzoquinone using a High Performance Liquid Chromatography (HPLC), the amount of Total Organic Carbon (TOC) employing a TOC Analyser aiming to quantify a phenolic mineralization and the hydrogen potential (pH) of reactional medium with a pH-meter. The experimental studies were performed using a liquid feed rate (Q_L) of 170 Lh^{-1}, a burner power dissipation (P) of 38.6 kW at an 10% excess air (E), a recycle rate of gaseous thermal wastes (V_R) of 100%, a molar stoichiometric ratio

of phenol/hydrogen peroxide (R) of 75%, an evaporation rate below 11% and a liquid effluent temperature ranging from 70 to 78 °C with a process time of 150 min. The result showed that when using these parameters, phenol degradation is almost complete and higher TOC mineralisation occurs. The organic pollutant can be degraded higher than 99% and a TOC mineralisation exceeding 40%, regardless of the initial phenol concentration. The results also showed the dynamic concentration evolution of the intermediates formed (catechol, hydroquinone and para-benzoquinone). These products were formed after 30 min of phenol consumption as the process progressed. The 1,4-dioxo-2-butene and glyoxal were likely the products in the reaction mixture that were formed from the degradation of hydroquinone and catechol/hydroquinone, respectively.

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Removal of geosmin and 2-MIB using photo-Fenton oxidation

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1. Introduction

- Taste and odour (T&O) compounds are produced a lot by cyanobacterial blooms, which makes a great concern of drinking water [1]. Geosmin and 2-methylisoborneol are most popular and problematic earthy-musty compounds in drinking water [2]. Generally, the removal of geosmin and 2-methylisoborneol is difficult in conventional drinking water treatment that many advanced oxidation process (AOPs) have been studied for the removal of Geosmin and 2-methylisoborneol. In this study, photo-Fenton oxidation, one of AOPs, have been applied for the removal of geosmin and 2-methylisoborneol.

2. Experimental

- The photo-Fenton oxidation was conducted at the concentration of Fe(II) (0.5-20 mg/L) and H_2O_2 (1-20 mg/L), respectively, in UV-C reactor. Also, some of water quality parameters such as pH, organic matter fractions, initial concentration of T&O compounds were examined to find the effect of photo-Fenton oxidation in distilled water and raw water. Geosmin and 2-methylisoborneol were measured by GC/MS (Agilent 7890A, Agilent 5975C MSD) (Aglient Technologies, Germany) equipped with a multi-purpose sampler (MPS, Gerstel, Germany).

3. Results and Discussion

- The optimum concentration of Fe(II), and H_2O_2 were 2 mg/L, and 20 mg/L, respectively. The highest removal rates were 48.38% (Geosmin), and 84.25% (2-methylisoborneol), respectively, at the UV dose of below 3,500 mJ/cm^2. The removal rate was greatly increased by decreasing from pH 9 to pH 3. 2-methylisoborneol was removed 95.47% at pH 3 within 15 min. The presence of natural organic matter slightly influence to the removal . Geosmin and 2-methylisoborneol using photo-Fenton oxidation due to competing effect. Geosmin and 2-methylisoborneol can be successfully removed below the guideline level in South Korea (20 ng/L) under UV dose = 1,500 – 3,500 mJ/cm^2 using photo-Fenton oxidation when the initial T&O compounds concentration under 50 ng/L in the distilled water and raw water.

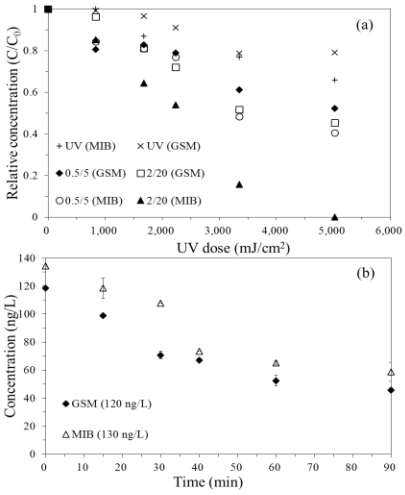

Figure 1

4. Conclusions

- The photo-Fenton oxidation was good candidate for removal of geosmin and 2-methylisoborneol in both distilled water and raw water.

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Acknowledgments

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- Advanced oxidation process for control algal-derived compounds in drinking water source
- Bacteria/virus transport/adsorption on Functional Materials

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Polymer based membranes and MMMs for pervaporation and esterification in a membrane reactor

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1. Introduction – Polymers have excellent properties to be applied in separation processes because of their high permeability, selectivity and long-term stability. On the other hand, mixed matrix membranes (MMMs), which are composed of a homogeneous dispersion of porous fillers embedded within a polymeric matrix, provide better performances than bare polymeric membranes [1, 2]. The objective of this work is to develop polymer based membranes and MMMs suitable for the separation of liquid mixtures in pervaporation and in a membrane reactor (which combines a selective membrane with a heterogeneous catalyst) processes, in order to provide energetic savings and reduction of waste products.

2. Experimental – Different polymers have been used, including polyimide Matrimid® 5218 and 6FDA-DAM. Polymeric membranes have been prepared following the method described elsewhere [2]. On the other hand, MMMs have been prepared containing MIL-101(Cr) and HKUST-1, according to the procedure described elsewhere [3]. Pervaporation experiments were carried out at 40ºC. A mixture ethanol/water (90%w ethanol) was fed to the membrane module with a flow of 5 mL/min. In esterification experiments a 0.05 mL/min of an acetic acid-ethanol equimolar mixture was fed to the module. Ionic exchange resin Amberlyst 15® was used as catalyst and reaction takes place at 70ºC. In both cases, a vacuum pump is connected to the permeate side maintaining a pressure lower than 10 mbar.

3. Results and Discussion – Several techniques (XRD, SEM, TGA and FTIR) were used for the characterization of membranes, showing homogeneous membranes with a thickness of 100 □m approximately. In pervaporation process separation factors up to 300 were obtained, with a total pervaporation flux of 0.25 kg/m^2·h. In the case of esterification reaction, equilibrium conversion at 70ºC was surpassed and membranes showed high stability, maintaining conversion for 3 days.

4. Conclusions – Polymer based membranes and mixed matrix membranes were successfully prepared. Membranes were applied to pervaporation of mixtures ethanol/water and to a membrane reactor to carry

out esterification reaction with excellent results. Then, the feasibility of the application of this kind of membranes to separation and reaction/separation processes has been demonstrated.

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[3] de la Iglesia, O., Sorribas, S., Almendro, E., Zornoza, B., Téllez, C., Coronas, J., Renew. Energ. 88 (2016) 12-19.

Scientific CV (optional)

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His research activity is developed at the Aragon Institute of Nanoscience (INA) within the group of "catalysis, molecular separation and reactor engineering group" (CREG). His research is focused in the preparation, characterization of nanoporous materials (zeolites, mesoporous materials, MOFs, etc.) as powders and films, and their application in liquid and gas separations, membrane reactors, adsorption and catalysis.

He is co-author of 19 articles in JCR journals, one book chapter, one academic book entitled "Environmental Technologies" and 3 congress proceedings with ISBN. He is also co-author of 39 communications to national and international conferences.

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The influence of temperature on the growth of predatory fungus from activated sludge

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1. Introduction

An innovative method of sludge bulking control is being developed. It consists in applying *Lecane* rotifers, feeding on filamentous bacteria, into bioreactors of wastewater treatment plants (WWTPs). However, it has been recently discovered that predatory fungi preying on rotifers occur in some WWTPs. In a few cases we observed that extensive growth of those fungi can destroy rotifer population. The biology of the fungi and the conditions promoting their occurance are poorly recognized. The aim of our research was to check the influence of temperature on the growth of one of the predatory fungi.

Experimental

The experiment was conducted on clonal population of *Lecane tenuiseta*, adapted to low (8˚C) temperature, and predatory fungus *Lecophagus sp*. Both organisms were isolated from activated sludge and maintained in clean cultures. Individual conidia (100 µm long) of the fungus were transferred to seperate wells of three 24-well tissue test plates. Approximately 100 rotifers were then added to each well. The test plates were incubated at 8, 15 and 20 ˚C. After 24 hours "successful" conidia with a caught rotifers were counted. After 48 and 72 hours since the start of experiment the fungus mycelium was measured and the mean growth rate was calculated for each temperature.

3. Results and Discussion

At the lowest temperature no conidium caught a rotifer during the first 24 hours (Fig.1). At higher temperatures the percentage of "successful" conidia was higher: at 15˚C it was 40%, and at 20˚C it was 79,2%. There are significant differences in the mean growth rate between temperature both after 48h (Fig. 2A) and 72h (Fig.2B). The growth rate was the lowest at 8˚C and did not change in time. However, the low but still positive growth rate at the lowest temperature shows that the fungus can survive even at such low temperature. The high growth rate at higher temperatures indicate that in favourable condition the fungus can develop quickly endangering rotifers population.

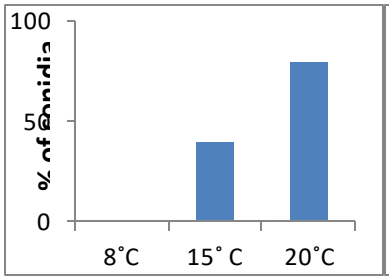

Fig.1

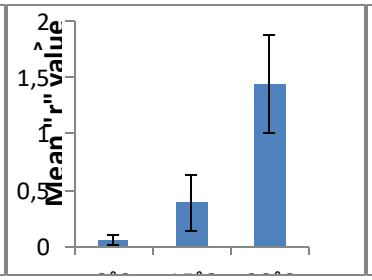

Fig 2A

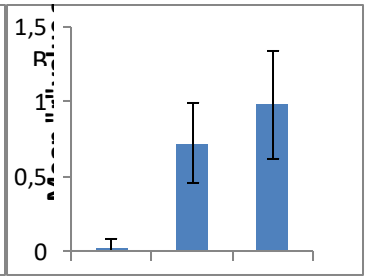

Fig. 2B

4. Conclusions

Our results shows that the temperature has strong influence on the growth of predatory fungus. The ability of conidia to catch rotifers increases with temperature. The growth rate of fungus also depends on temperature, being the highest at 20˚C. As *Lecane* rotifers are observed in WWTPs when temperature of activated sludge is over 15˚C, the predatory fungus might be a real threat to rotifer population. Therefore, before applying the rotifers into a bioreactor it is necessary to check if predatory fungi do not occur in the sludge.

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Restoration of the adsorption capacity of activated carbons from Nuclear Power Plant facilities

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1. Introduction – The use of activated carbons (ACs) as adsorbents of potential hazardous emissions on various facilities of Nuclear Power Plants (NP) is well established. In general, these materials are tailored to remove iodine species (mainly CH_3I) selectively, present a very microporous structure and a predominance of amine functionalities [1]. Due to safety reasons, these ACs filters have to be substituted by new ones, to prevent potential decay of adsorption capability due to ageing. After being replaced, the ACs filters are usually disposed of as wastes; however, the castoff carbons could still have the potentiality to be used as adsorbents, given their accessible pore volume, if suitable processes are implemented. In this work, several methods were applied to ACs used in NP filters to enhance their adsorption features; moreover, the ACs performance towards ethanolamine, an abundant compound in the primary circuit water of the NP, because of its anticorrosive characteristics, was tested. Annealing molecular dynamics (AMD) simulation studies complemented experimental adsorption results.

2. Experimental – The ACs were provided by Almaraz-Trillo Nuclear Plant, in Spain, after being used in several facilities. Different regeneration methodologies were studied, namely, acid washing (HCl and HNO_3, 80% w/w) and thermal treatment (N_2, 600 ºC). ACs were characterised using suitable techniques (N_2 adsorption, SEM micrography, PZC, FT-IR spectra and surface composition). Atomistically detailed slit-like carbon pore and fluid models were employed (see figure on the right). The AMD were performed in GROMACS at analogous experimental conditions under the NVT ensemble.

Table 1. Porosity characteristics, elemental analysis and point of zero charge of ACs.

	S_{BET}, m^2g^{-1}	V_{mi}, cm^3g^{-1}	V_{me}, cm^3g^{-1}	C, %	H, %	N, %	O, %	PCZ
C-Pristine	684	0.361	0.005	78.17	0.36	0.75	20.72	9.04
C-HCl	921	0.475	0.011	77.84	0.16	0.64	21.36	4.52
C-HNO_3	893	0.464	0.002	76.67	0.01	1.02	22.30	2.60
C-Pyr	934	0.485	0.009	85.21	0.06	0.77	13.96	10.24

3. Results and Conclusions – Regeneration processes had different effects on the AC surface properties; while pyrolysis caused a slightly higher enhancement of S_{BET} as compared to the other methods, it also involved a substantial decrease in the oxygen content, related to the thermal removal of surface functionalities and higher surface basicity. In all cases, the pore size distribution did not show a remarkable modification.

Adsorption results showed acid carbons did not perform well towards the adsorbate, C-Pyr provided moderate adsorption capacities, with q_0 values up to 22.7 mg g^{-1}.

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5. Acknowledgements

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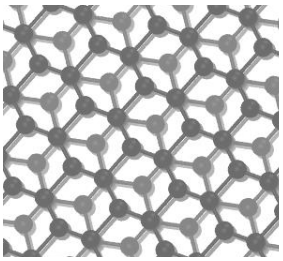

Figure 1. Example of molecular simulation

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Spent Nuclear Fuel Management: LCOE In Different Production Scenarios

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1. Introduction

The large consumption of resources necessitates the world to create efficient energy generation systems. Implemented with specific back-end strategies, renewable nuclear energy has been proven to be economically, environmentally and socially sustainable. There are currently three available options: open cycle, close cycle, and advanced cycle. The most significant cost of nuclear reprocessing is DGR, which is decreasing for the closed cycle and increasing for open cycle. Therefore, many other factors, such as waste management, the intangible asset, and the energy regulations of each country, should be taken into account when choosing the best strategy using the LCOE method. Many other countries have adopted a strategy meeting their national needs. Spain, however, is yet to make a decision. Based on the research carried out in this paper, it's suggested that costs are not a relevant criterion in order to select an energy policy for spent nuclear fuel management.

2. Results and Discussion

Using the data given by OECD-NEA, the LCOE can be obtained for all the three back-end strategies: Once-through Fuel Cycle, Partial Recycling and Advanced Fuel Cycle. Under a few assumptions, the results are shown in the tables and figures below:

Electricity Production	0% Discount Rate			3% Discount Rate		
	OFC	Partial Recycling	AFC	OFC	Partial	AFC
25 TWh/year	10.65	10.23	7.58	6.70	6.71	5.80
75 TWh/year	6.86	6.21	4.93	5.25	5.41	5.02
400 TWh/year	5.33	5.55	4.95	4.66	5.16	5.03
800 TWh/year	5.15	4.77	4.21	4.59	4.52	4.42

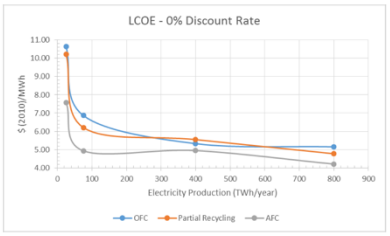

Figure 10. LCOE for different backend strategies: 0% discount rate.

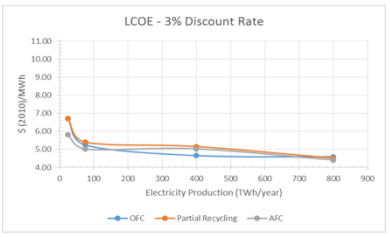

Figure 11. LCOE for different back-end strategies: 3% discount rate.

Figure 5: Comparison between different production scenarios and strategies

Also it can be observed that the capital recovery factor is higher from 40 to 60 years old than from 60 to 80 years old.

The figures show that the most profitable strategy is AFC because that the savings in the front-end cost achieved by the reduction in natural uranium requirement thoroughly compensate the FRS and integral processing plant costs. This is result is strongly supported by Figure 10 with the exception at discount rate of 3% and electricity production of 400,TWh/year, where the OFC is the optimal strategy in this case.

3. Conclusions

According to the LCOE results for the strategies analyzed, a greater decrease in costs is experienced in countries with a small nuclear energy production. Nowadays, spain has a production of 57 TWh nuclear energy per year, which implies that an increase in the nuclear energy production should lead to considerable cost savings.

It is also worth noting that decrease in the LCOE extending the NPP operational lifetime from 40 to 60 years is more significant than that from 60 to 80 years.

Furthermore, the differences between the open cycle and the closed cycle costs are lessthan an 8%, which is not relevant enough to make a decision based only on the economic aspects. This is why the fuel cycle cost only represent a small fraction of the nuclear electricity generation cost.

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Assessing energy consumption in water infraestructures to mitigate urban heat stress

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1. Introduction – Urban areas show elevated temperature in comparison to rural regions, phenomenon known as heat island effect. Annual average of air temperature in medium size cities is, approximately, 1 to 3°C warmer than its surroundings (Oke, T.R. 1997, Oke. T.R. 1982, Oke. T.R. 1987). According to the U.S. Environmental Protection Agency's report, "*Reducing Urban Heat Islands: Compendium of Strategies*" and the European Expert Group on '*Nature-Based Solutions and Re-Naturing Cities*', one of the factors contributing to heat island effect is the reduction of vegetated areas, which has been significantly diminished in past years. In this paper is presented the work carried out in energy characterization of different Sustainable Drainage Systems (SUDs) capable to reduce heat stress in urban areas.

2. Methodology – Eenergy consumption of 19 different urban drainage systems has been studied, considering traditional and sustainable alternatives. The analysis is approached considering construction and maintenance activities of the infrastructures. On the one hand, construction activities are disaggregated into work units to estimate energy used in electricity and fuel of machinery and materials. On the other hand, maintenance´s assessment is organized in two categories: periodic and annual. Periodic maintenance includes materials' reposition or replacement, activities performed every several years (e.g. remove, dispose and replace top gravel layer); while annual maintenance considers energy used in transport for adequately maintaining drainage systems.

3. Results and Discussion – During the study, 15 sustainable drainage systems and 4 conventional infrastructures have been characterized according to their electrical and fuel consumption in construction and maintenance activities. Results are expressed in a series of energy indicators which allow comparing energy demand of different water infrastructures. Energy demand indicators show that sustainable drainage systems, such as retention ponds (37 kWh/m^3), detention basins (26 kWh/m^3), filter drains (101 kWh/m^3) or infiltration trenches (56 kWh/m^3) are less energy intensive than conventional detention facilities (850 kWh/m^3), and integrated in urban areas as vegetated infrastructures, which provides global energy savings in the water cycle and reduces urban heat stress.

4. Conclusions – This paper shows the results of projects INICIA[1][2] and E²STORMED[3], where different water infrastructures were characterized energetically. The study shows that sustainable drainage systems (SUDs) have a great potential in reducing heat stress in urban areas, since potentiate evapotranspiration and are less energy intensive than traditional ones. Furthermore, sustainable drainage systems provide additional benefits such as reducing floods or droughts, and ecosystem services that provide additional value to citizenship.

[1] ACKNOWLEDGMENTS
This work was supported by projects INICIA- Ref. BIA2013-48157-C2-2-R (Ministerio de Economía y Competitividad) and E²STORMED (MED Programme).
[2] INICIA stands for "Methodology for Investment Assessment on Water Cycle Infrastructures based on Risk and Energy Efficiency Indicators"
[3] E²STORMED stands for "Improvement of Energy Efficiency in the Water Cycle by the use of Innovative Storm Water Management in Smart Mediterranean Cities" (http://www.e2stormed.eu/)

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A study of the possibilities for biofuels incorporation in the energy mix of the spanish ceramic tile industry

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1. Introduction – next to a growing concern on the unsustainability of the actual production model of the so called developed countries, there is the rapid growth of other economies, and especially of those of the BRIC countries. As a result EU manufacturing subsectors are more vulnerable to the increasing pressure from environmental regulations and policies. Accordingly the objective of the European Commission's Roadmap for moving to a low-carbon economy in 2050 is to achieve a reduction in CO_2 emissions of between 34% and 40% by 2030, and between 83% and 87% by 2050 compared to 1990. Since ceramic tile industry is an energy intensive industry, European ceramic companies are challenged to heavily reduce their CO_2 emissions in the medium and long-term. In Spain, an increasing contribution of electricity from renewable sources in the European electricity mix, no subsidies for new CHP (combined heat and power) plants and high natural gas prices, makes natural gas fuelled CHP not an attractive solution for CO_2 savings in this sector.

2. Methodology – It has been evaluated biomass resources availability, higher heating value and transport cost (according to present agricultural crops and forest) using Geographic Information Systems, in a Spanish province (Castellón province) where 90% of ceramic tile industry is concentrated. Analysis of ceramic tile production process and energy needs, and biomass technologies for heat generation allowed the assessment of potential natural gas substitution by biomass in this sector, and so CO_2 savings potential.

3. Results and Discussion - Preliminary results show that there is great potential for biomass from forest origin and woody crops, mainly citrus, olive and almond trees. Castellón province accounts for 38,000 and 181,000 tons of waste biomass from forestry and agricultural crops respectively, totalizing about 706 GWh of energy (in terms of higher heating value) with a final consumer cost (at consumer site) of about 0.020-0.025 €/kWh (natural gas is about 0.26-0.3

€/kWh). Available biomass could cover 51-56% of fuel needs for the drying process of Castellón ceramic tiles industry (annual production of 437 million m^2 of ceramic tiles, for 2015). Therefore net CO_2 savings, taking into account biomass transport and conditioning, could be about 0.4 kg CO_2 per m^2 of ceramic tile produced, so 94,000 tons of CO_2 savings.

4. Conclusions - After having performed a technical and socio-economic analysis on the viability of biofuels incorporation in the energy mix of the ceramic tile industry at the project ESTIBMEIC[4], our preliminary conclusions point that diversifying the energy mix to include sustainable sources of energy is necessary and possible for the case of the Spanish ceramic tile industry. Biomass derived from forestry, agricultural crops and agro-industries appears to be a feasible source of sustainable energy for the manufacturing process of ceramic tile products and can contribute to rural development and job creation.

[4] ACKNOWLEDGMENTS
This work was supported by the project ESTIBMEIC- GV/2014/049 (Generalitat Valenciana)
ESTIBMEIC stands from Socio-Technical Study on the Incorporation of Biofuels in the Energy Mix Ceramic Industry (project name in Spanish)

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Rome (Italy), 18-20 July 2016

RARE EARTH ELEMENTS IN PHOSPHOGYPSUM WASTE STACKS: A MODEL FOR MICROBIAL INTERACTION WITH *THERMUS SCOTODUCTUS* SA-01

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1. **Introduction –** Rare earth + Yttrium (REY) recovery from sources with low-grade ore such as phosphogypsum stacks or mine drainages have generated interest and different questions concerning the efficacy of the available extraction processes [1]. As such, bio-recovery could arise as an attractive alternative. Since metal recovery processes are usually associated with harsh environments, specialists' bacteria are selected to accommodate this extreme processing [2]. This presentation showcases the first bioaccumulation of REY with a thermophile *Thermus scotoductus* SA-01, a gram negative bacterium, with incredible capabilities to interact with a variety of metals ions, including the ability to reduce gold, chromium and uranium [3-5]. Now we define the bioaccumulation and possibly reduction of REY in *T. scotoductus* SA-01 as model for microbe-REY interactions.

2. **Results and Discussion** – In order to understand the interaction between *T. scotoductus* SA-01 and REY (Eu, La and Y) batch experiments were setup under aerobic and anaerobic conditions at 65ºC. The exposed cells were subjected to TEM-EDS in order to locate and identify REY interaction. Image 1 shows *T. scotoductus* SA-01 cells with REY deposition sorbed mainly on the cell wall. However, some REY particles have accumulated intracellularly. In fact, in anaerobic conditions the exposed cells showed a higher accumulation whereas aerobic conditions showed more biosorption, with the exception of Y interaction. The presence of REY was detected by EDS and XPS. The former determined that oxidation state for REY was 3+. It should however not be discarded that Eu is used as an electron acceptor by the bacterium when the nutrients are exhausted. This was supported by the ATP analysis that increased in the experiments under anaerobic conditions, with Eu, and when the carbon source was exhausted. The results suggest that Eu might actually be reduced like other transition metals, and this could be either to obtain energy or to be used as a cofactor in metabolic pathways. Also, the results by FTIR

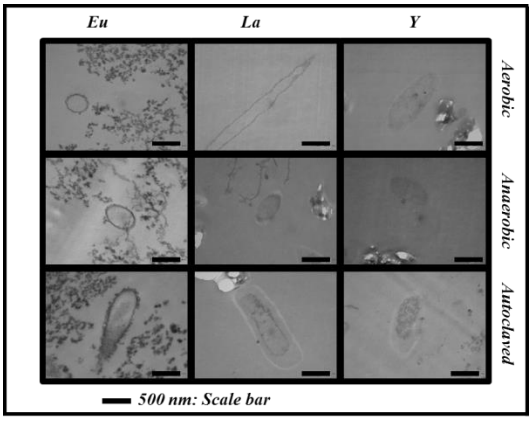

Image 1: REY sorption on *T. scotoductus* SA-01.

showed more amine groups under anaerobic conditions than other conditions which might indicate the activation of proteins.

3. **Conclusions** – *Thermus scotoductus* SA-01 was tolerant to REY under aerobic and anaerobic conditions, however different mechanisms might be involved from initial characterization. The results show *T. scotoductus* SA-01 could use Eu as electron acceptor under anaerobic conditions. The sorption (bioaccumulation or biosorption) of REY in *T. scotoductus* SA-01 but more excitingly the bioreduction demonstrates that the recovery by this bacterium could be explored as an alternative to extract low concentrations of REY from phosphogypsum waste stacks or mine drainages or other contaminated environments.

4. **References are available from authors**

International Congress on Water, Waste and Energy Management
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A possible bioremedial solution for nitrate contamination in open cast mines of Southern Africa

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1. Introduction

Explosives used in mining operations, leachates from excessive usage of fertilizers as well as spillages from wastewater systems contribute to high nitrate concentrations in the ground and surface water. This poses serious health risks (methaemoglobinaemia and stomach cancer) when consumed, especially if the nitrate concentrations are above 10 mg/L [1]. As more freshwater is being contaminated, an affordable, effective and sustainable remediation strategy is required to mitigate the contamination. Indigenous bacteria are already established natural attenuators of nitrate and can be managed to offer an alternative solution since they contain the full denitrifying operon required to reduce the nitrate to nitrogen gas [2]. In this study, the mechanisms employed by the denitrifying bacteria were evaluated by: 1) classical molecular techniques, 2) determining their required optimum conditions for the reduction of high levels of nitrate concentrations, 3) the effects of synergistic relationships of nitrifying, denitrifying and anammox bacteria for the development of an effective bioremediation system.

2. Experimental

Two sites (platinum and diamond mines) with high nitrate concentrations of 177 and 128 mgN/L respectively in their leachates were selected and characterised geochemically. The denitrifying genes on the required denitrification operon were identified by gene specific primers using PCR based techniques. The microbial diversities associated with each site were evaluated using Denaturation Gradient Gel Electrophoresis (DGGE) and 16S rRNA targeted metagenomics sequencing on the Illumina MiSeq platform. Nutrient broth medium supplemented with 100 mgN/L and various carbon sources (acetate, lactate, glucose and glycerol) was used to enrich and finally isolate the denitrifying bacteria. An up-flow bioreactor with 40% porosity and dolomite as matrix was used to test the remediation capacities of these indigenous bacteria while characterizing the stoichiometric balance of donor to acceptor in the leachate.

3. Results and Discussions

Genes facilitating nitrate reduction (*narG* and *napA*), nitrite reduction (*nirK* and *nirS*) and nitrous oxide reductase gene (*nosZ*) were detected by PCR based techniques from the water samples and enrichments. The complexity of the microbial communities in the samples was assessed and compared using DGGE. The 16S rRNA Illumina results revealed the presence of denitrifying bacteria including: *Pseudomonas* sp. and *Paracoccus* spp. both known to contain and express the complete denitrifying operon [3]. Amongst the tested enrichment media, basic nutrient broth supplemented with nitrate and glycerol yielded the best anaerobic bacterial growth with

approximately 96% nitrate reduction. Over 97% of nitrate was removed from the water samples after using the indigenous culture to seed the bioreactor with glycerol used as a sole carbon source.

4. Conclusions

The results obtained demonstrate a potential microbial diversity which actively promotes the natural attenuation of high nitrate concentrations in the wastewater treatments. Furthermore, these enrichments could be used to seed bioreactors aimed to treat wastewaters with multiple contaminants and elevated concentrations of nitrate, nitrite and ammonia. More studies are being conducted on the enrichments to determine their optimum nitrate reduction conditions, evaluating their limitations and proteins involved.

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Coupling downscaled multi-GCM outputs with a conceptual hydrological model for a study area in Turkey

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1. Introduction – This study purposes to examine the climate change impacts on streamflows under a climate scenario for Acisu sub-basin in Gediz Basin, which is located at Aegean Region of Turkey. In the study, a statistical downscaling strategy was applied to the monthly total precipitation and the monthly mean temperature series in order to generate the possible future scenario values of those variables. Reanalysis data and outputs of various general circulation models (GCM) were used during the downscaling process including a multi-GCM ensemble and bias-correction applications to obtain the precipitation and temperature forecasts for the 2015-2050 future period under a pessimistic RCP scenario, which is RCP8.5. After performing historical period results pertaining to downscaling application, the projected precipitation and temperature series for RCP8.5 have been used as inputs to a calibrated conceptual hydrological model to simulate the corresponding future streamflow regime in the study area for the same period.

2. Downscaling Application – The study has been carried out on Acisu sub-basin; one of sub-basins of Gediz Basin in Turkey. Downscaling strategy used in the study consists of artificial neural networks and least squares support vector machines. Since these downscaling models produce closer results in calibration (training) periods, the most appropriate model structure was determined by examining test period performances of models. According to performance measures, calibration and test period performances of the applied models have been found to be successful. Following the validating processes, raw outputs of twelve different GCMs are submitted to calibrated models as input and downscaled time series for historical and RCP8.5 scenarios are obtained at scale of stations. Then, a mixed model (ENSEMBLE) covering forecasts derived from GCMs was made up. ENSEMBLE process is applied to all stations and areal mean precipitation, mean temperature projections for Acisu sub-basin are determined. Accordingly under RCP8.5 scenario 17% decrease in precipitation and 4.74°C temperature increase are foreseen over sub-basin for 2015-2050 future period.

3. Streamflow simulation – In this section, a hydrological model was needed to examine the impact of changes in temperature and precipitation on flows. After hydrological model calibration, it is thought that hydrological model can be used in sufficient reliability under a scenario at the stage of streamflow simulation. Hence, areal average precipitation and temperature scenario time series, which are mentioned in the previous section, are converted into runoff

forecasts for each scenario via the calibrated hydrological model. Compared to past period scenario results, it is projected that there may be decrease of approximately 47% over the water year period 2016-2050 for Acisu flows under RCP8.5 scenario.

4. Conclusion – It can be said that the studies evaluating the potential impact of climate changes on flows by using RCP scenarios are relatively new. In this study presented with this reason, potential impacts of climate change on Acısu creek were analyzed with statistical downscaling and rainfall-runoff modeling integration under RCP8.5 scenario. Comparing historical climate statistics of region, the forecasts derived from the applied downscaling techniques indicate not only an increasing trend in the mean monthly temperature and potential evapotranspiration, but also a decreasing trend in the monthly total precipitation. Moreover, the hydrologic impact assessment study made with the calibrated hydrological model point out statistically significant decreasing on streamflows.

Acknowledgments – The research leading to this study is funded by the Scientific and Technological Research Council of Turkey (TUBITAK) under Grant No. 114Y716.

Establishing the operating baseline parameters for the commercially available gasifier PP20 from All Power Labs.

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All Power Lab (APL) from Berkeley, CA produces a 15 kW "Power pallet" turnkey gasifier based power system. The technology is a batch fed downdraft gasifier. Target market is the"personal scale power" and rural electrification or off grid generation. The system allows for aprox. 6-8 hour operation [1]. Being a "black box" turnkey solution, it becomes important to do an analysis of most the operating parameters in order to establish the benchmark for future research and operation beyond the standard «biomass feedstocks»

Biomass: Biomass is a non-fossilized and biodegradable organic material originating from plants, animals and micro-organisms, including products, by-products, residues and waste from agriculture, forestry and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes. The utilization of biomass is a very important source of energy in many parts of the world, especially for areas remote from supply of high-quality fossil fuels.*[2]*

Biomass energy conversion technologies especially pyrolysis and gasification have been substantially studied to promote renewable energy utilization and solving partially the environmental issues.

Biomass Gasification: Gasification is basically a thermo-chemical process which converts biomass materials into gaseous component. The results of gasification are the producer gas, containing carbon monoxide, hydrogen, methane and some other inert gases.

During the biomass gasification process, this renewable material undergoes different sub-processes. In a first step, biomass is dried up. Then, as the temperature increases, biomass is pyrolyzed and the lignin and cellulose are decomposed into volatile molecules such as hydrocarbons, hydrogen, carbon monoxide and water.*[3]*

Finally, the remaining solid fraction, which is called vegetal char, is oxidized when an excess of oxygen is available (combustion). When combustion developed with less oxygen than the stoichiometric, vegetal char is gasified by the pyrolysis and oxidation gases. This process is governed by the chemical reduction of hydrogen, carbon dioxide and water by char. The inorganic components in the biomass are not volatilized and remain in solid state as ash.

General Description of the Power Pallet 20: The Power Pallet is comprised of the GEK Hot TOTTI multi-stage gasifier; spark fired industrial engine, generator head, and electronic controller. The system automatically adjusts syngas/air mixture via a wide band Bosch oxygen sensor, shakes the grate when needed, and removes ash via a mechanical auger. The Process Control Unit (PCU) monitors and responds to all internal reactor, filter and engine conditions, displaying the results on an LCD screen. *[4]*

Power Pallet Performance:

Continuous Power Rating	15 kW@50 Hz/18 kW@60 Hz
Sound Level @ 30 feet:	85 dB(A)
Biomass Consumption:	1.2 kg/kWh
Run Time per Hopper Fill: approximate @ 250 kg/m3 fuel density	5 kW: 10 hrs 10 kW: 5 hrs 15 kW: 3 hrs
Max. Continuous Operation:	>12 hours
Start Up	: 10-20 min.

Key Properties of Biomass Relevant to Gasification*:[5]*

Moisture Content: Fuel inside the reactor should generally be below 20% moisture (dry basis).

Particle Size : This standard downdraft Imbert type reactor will work best with fuels in the range of 1,5cm – 4,0 cm. Fluidized bed are often used for fine materials.. Different gasifier designs can handle different sizes of fuel.

Void Space: The amount of void space in a fuel will impact proper combustion. More void space is generally better.

Bulk Density: Indicates the volume required to store a given mass of fuel.

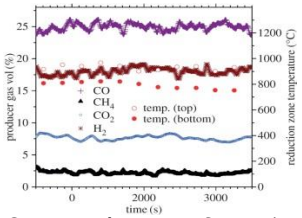
Ash Content: Ash (mineral content) can lead to slagging. Specific minerals can reduce slagging temperatures (and therefore the likelihood that slagging will occur at a given temperature). Grasses are often high in silica.

Hazardous Compounds: Materials including municipal solid waste (MSW), biosolids (sludge), coal, and plastics can contain high levels of compounds including chlorine, sulfur and heavy metals.

These materials require special consideration, testing, and handling.

Definition of the benchmark biomass feedstock: The Knowledge of the elemental composition of the feedstock biomass is crucial in the study of gasifier studies to the assessment / estimated composition and calorific potential of the gasification process. The elemental analysis is a technique that allows determining the organic constituents of a sample and its ratio, allowing the calculation of empirical formula thereof. The method is based on complete combustion of a sample of known mass of organic material, which mainly contains Carbon (C), hydrogen (H), nitrogen (N), sulfur (S) and oxygen (O) and subsequent Analysis of the gases resulting from the combustion process essentially dioxide carbon (CO2), water (H2O), nitrogen oxides (NOx) and sulfur dioxide (SO2).[6]

Establishing Baseline Test Conditions: The main objective of the tests to be carried in the PP20 is to characterize the main operating parameters of operation, establishing a baseline for further testing of feedstocks.

Data logging for each test:	**Further Laboratory analysis of :**
Combustion Temperature. Reduction Temperature. Combustion Pressure. Reduction Pressure. Volume of biomass used. Volume of the ash in the cyclone filter. Volume the ash in the ash collector reactor. Volume of the Condensates. Volume of Gas in the Exhaust.	Ash in the cyclone filter. Ash in the ash collector reactor. Condensates. Produced Gas Elemental Analysis and low calorific value..  **Gas output, and temperatures. System runing at 4kwe[7]**

1 hour long tests for the rated power output.

3kW	6kW	9kW	12kW	15kW

Conclusions:

Biomass has high potential to contribute to world energy needs. The fixed bed gasifier is the most practical option for production of a low calorific value gas for use in small-scale power generation or thermal applications.

Fixed Carbon to Volatile Ratio: In a gasifier, the tars can either be combusted with oxygen or thermally cracked. Char is needed for reduction. Gasifiers will generally operate better with more fixed carbon in the fuel. Wood averages 20% fixed carbon, 80% volatiles. This produces much more tar than is needed for combustion, thus we have to crack the excess. Lower volatile content woods reduce the problem. Using charcoal as fuel mostly eliminates it.	The physical and chemical characteristics of biomass, capacity of gasifier and its intended application decides the choice of gasification system. The downdraft gasifier is suitable for both thermal and engine applications. The study of the performance of different biomass feedstocks will allow for the mass deployment of these solutions.

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Biomass energy in Portugal

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1. Introduction – Portugal relies to a very large extent on imports to meet its energy needs. The predominant energy source is oil, which comes in its entirety from other countries. Renewables now are the second most significant energy source being hydropower the most important domestic source of energy. Since more than one third of the territory is forests, biomass is one of the potential renewable energy sources. Forest residues and municipal solid wastes are the major sources of biomass energy in the country. This paper presents the potential of biomass resources in Portugal.

2. Results and Discussion - Wood residues, animal waste and municipal solid waste, are the most common biomass resources available in Portugal. The resources can be utilized on a larger scale for energy production. As biomass resources that can be used for energy production are diverse, the estimated biomass potential in Portugal, available in official sources and existing literature. From the above the Portuguese biomass potential was estimate in 27,379 GWh/year. The following table summarizes the contributions of each bio resource.

Table I. Portuguese biomass potential [1-4]

Resource	Potential GWh/year
Animal manure	1,088
Forest residues	11,578
Agriculture residues	4,528
Wastewater treatment plants	207
Municipal solid wastes	1,600
Energy crops	8,378
Total	**27,379**

3. Conclusions - The Portuguese energy market is still largely based on imported fuels. The domestic production increased, especially from renewable energy sources. Energy production based on animal manure is not yet well developed. Forest residues besides the promotion for the construction of biomass power plants, the full potential is far to be achieved. The main reason is the overestimated availability of forest residues, which when all the predicted projects are implemented may lead to a biomass deficit of around 2 Mtonne/year. The

solution to this deficit may rely on energy crops. The available data on agricultural biomass potential is limited, so it is urgent to be drawn a detailed work to quantify this energy potential. Anaerobic digestion is a proved technology for waste water treatment plants. In Portugal the use of anaerobic digestion for this purpose is still very low compared to the estimated potential for this technology.

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International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

An Innovative View To The Sustainability, A Sample Of Ecologic Design; Botanical Bus

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1. Introduction – Today, environmental awareness and sustainability one of the most focused subject in the world. The most difficult problem is transportation and traffic jam for the metropolitan. Air pollution, energy consumption and noise are also included to these problems. [1] Environmentally friendly transport systems have a critical role for sustainability in modern public transport networks. [2] Electrical and hybrid buses are seen to be solution for the environmental problems of transport, today 98% of transportation is supplied by combustion engine buses. These buses cause a major part of air and noise pollution. [3] As mentioned above, million litres of fuel or other consumptions can minimize damage to environment. ISO 12064 Green House Gas Management System, ISO 14001 Environmental Management System or GRI (Global Reporting Initiative) systems can use to provide that minimization or to keep under control these consumptions. In addition to these, environmental projects have to be priority expectation from the municipalities by public. Local governments continue their projects and activities on the way to meet public expectations. At this point, it is clear to understand the importance of environmental awareness and environmental consciousness. In this case, the aim, details and consequences of an ecological designed bus explained with an innovative view to the sustainability.

Image 1. Botanical Designed Bus

2. Application Process

Firstly, feasibility study is completed at the application process of this project. After the feasibility the project bus is selected and applied impermeability to the top of bus. A mini garden is applied to the top of the bus by landscape architecture. The garden is irrigated with the water from the bus's air conditioning system. The plants are selected and applied. Packing material is also selected very light pearlite and peat which is not causes extra fuel consumption. Especially, green plants are applied which can live both in four seasons. The speciality of the bus is can carry the

garden to everywhere on its top. Therefore this is the first mobile garden of the Turkey. It is shown at figure 1 after the project finished.

3. Results and Discussion

After the project finished, especially after announcement, the project is get the attention of public and press. This shows us the project reached its aim. In addition, the project was the trend topic in the twitter in Turkey.

4. Conclusions

With this project, as seen the interest of the public which the aim at the beginning was creating an environmental awareness is reached. People was very interested with the project and wanted to learn knowledge about project. Especially university students wanted to learn the technical details of the project. After this project, solar bus project is applied in 2015 year.

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International Congress on Water, Waste and Energy Management
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Performance evaluation of MF, UF system forTreatment of oil-contaminated spring water in Iran (Case study)

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1. Introduction – In this research treatability study of oil-contaminated spring water source in a Village in Iran with MicroFiltration(MF) and UltraFiltration(UF) membranes were studied. In the pilot study, the real spring water sample with low oil content(<30 mg/l) was used as the feed.

2. Experimental- According to the high membrane fouling potential in hydrophobic membranes, hydrophilic MF_PVDF membrane with a pore size of 0.2-0.4 μm and the hydrophilic UF_PAN 20kDa membrane was used.

Experiments on the frame and plate module with cross flow done and in every section effect of different operating conditions, including two factors, the total membrane pressure (ΔP) in the range 1-6bar for the UF-PAN membrane and 1-3.5bar for the MF_PVDF membrane & cross-flow velocity 0.11 m/s & 0.42 m/s in a constant 20 ° C temperature, on the terms of flux, OIL removal percentage, Fouling factor were studied and the amount of required membrane surface area for the purification 1 m^3 of water with assuming a recovery of 75% for each condition were determined.

3. Results and Discussion - The results showed that both types of membranes with increasing pressure and & cross-flow velocity, flux will increase. However, at high pressures the flux is independent of pressure.

In the oil removal rate in both types of membrane, the oil removal rate decreased with increasing cross-flow velocity and pressure. In the fouling factor in both types of membrane, the fouling factor was decreased with increasing cross-flow velocity and the pressure was increased the fouling factor. Optimum operating conditions in MF_PVDF were 2 bar membrane pressure and 0.11 m/s cross flow velocity, under these conditions flux 156.2 $L/m^2.hr$, Fouling factor was 44.97 and Oil & Grease removal rate was %89.92. Under these conditions, MF_PVDF membrane reduced oil & Grease Parameter from 27.7 mg/l to 2.7 mg/l. Optimum operating conditions in UF_PAN were 3.5 bar membrane pressure and 0.11 m/s cross flow velocity, under these conditions flux 160.7 $L/m^2.hr$, Fouling factor was 39.4 and Oil & Grease removal rate was %93.8.

4. Conclusions - Under these conditions, UF_PAN membrane reduced oil & Grease Parameter from 27.7 mg/l to 1.71 mg/l. According to the comparisons done, the higher removal rate and lower fouling factor, PAN membrane for purifying polluted spring water sources after removal of free oils are considered.

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Improvement of Strength using Functional Industial Minerals

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1. Introduction – Industrial materials based on carbonates mineral and clay minerals have been widly used in the fields of construction and adsorbent materials. There is recent need for enviornmentally-friendly alternatives to those minerals, and studies for the development of enviornmentally-friendly materials are active. There is recent need for enviornmentally-friendly materials, and silicate minerals is getting the spotlight as an alternative to the existing minerals. However unlike the concrete there is no standard mixing ratio for silicate minerals and the required strength of silicate minerals is not guranteed, use of silicates minerals are limited. This study focuses on the feldspar to identify the adsorption and mixing ratio to improve the strength.

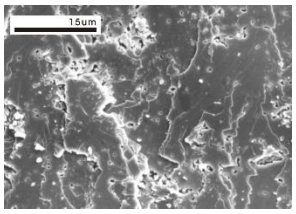

Image 2. Porous structure observed in weatherd feldspar(SEM Image)

2. Theoretical background –As seen in Image 1 photographed by SEM, feldspar has 200,000 pores per $1cm^3$. Feldspar is a madreporite due to weathering and metamorphism, and reactive power increases in powder form. Accordingly Feldspar shows active adsorption, elution, neutralization, and ionizatiopn effect during weathering and metamorphism(Hwang et. Al., 1996). Environmentally-friendly loess has high porosity ans specific surface area and is used for cement mixing but it is costly because of the low compressive strength, limited product, and high processing cost. This stusy uses a liquid hardening agent to improve the strength.

3. Experimental and results –A test piece was made with the combination of portland cement, feldspar powder, and hardening agent, and uniaxial compression test was performed. The test piece with only cement shows the strength of 12.2～14.7 MPa, while the test piece with hardening agent in weight ratio of 0.5% shows 15.4～19.1 MPa (~33% improvement). The test

piece with portland cement replace by 70% feldspar powder shows 15.4 ～18.2 MPa (~28% improvement).

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Thermoelectric $Bi_xSb_{2-x}Te_3$/Carbon Nanocomposite Films

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Introduction

Hetero-nanocomposites comprising multiform functional components and interfaces have been extensively considered as one of the most promising structures for obtaining remarkable thermoelectric performace. The abundantly formed hetero-interfaces with various chemical composites, dimensions, topographies, structures and scales are supposed not only to significantly suppress the thermal conductivity (κ) via enhanced phonon scattering, but even to selectively modulate the carrier transporting in matters under specific conditions. An applicable level of thermoelectric figure of merit ZT defined as $S^2\sigma T\kappa^{-1}$ could thus be achieved [1,2]. In this presentation, a novel hierarchical-assembled $Bi_xSb_{2-x}Te_3$(BST)/carbon(C) hetero-nanocomposite films were successfully fabricated using a dual-beam pulsed-laser-deposition (DBPLD) system. The influences of the introduction of carbon on the assembling architectures and the corresponding thermoelectric properties will be discussed.

Results and Discussion

Figure 1 shows the top-view and cross-sectional SEM images of the fabricated (a) BST film and (b) BST/C film. It was found that the electrical conductivity and Seebeck coefficent obviously vary with the carbon content. The optimized power factor ($S^2\sigma$) of the BST/C is significantly higher than that of the pure BST films. The carbon-content depdent structures as well as the corresponding thermoelectric properties will then be further discussed.

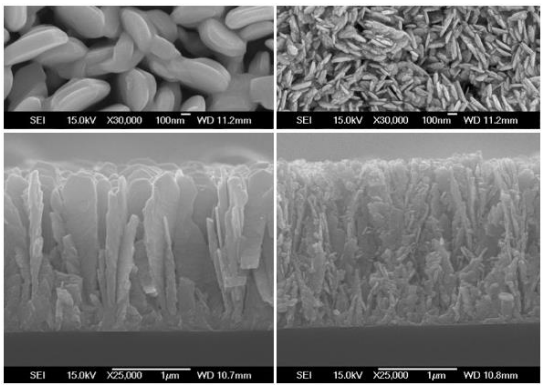

Figure 1. Top-view and cross-sectional SEM images of the fabricated (a) BST film and (b) BST/C film.

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Recycling of Postconsumer Aseptic Carton Using Hydrothermal Process

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1. Introduction – Aseptic carton is widely used all over the world as food and beverage packaging. This research uses postconsumer aseptic package, Tetra Brik, produced by Tetra Pak. Tetra Brik was made of paper (75%), LDPE (20%) and aluminium. Our main purpose is to separate the composite of Tetra Pak using hydrothermal process. There are 3 factors to be concerned in this research; the reaction temperature, the reaction time, and the consistency of the material. The reaction temperature was between 200 degrees Celsius and 240 degrees Celsius, the reaction time was between 0 minutes and 60 minutes. The result showed that Hydrothermal process was effective to separate Tetra Pak composite by decomposing the paper material and develop composites of polyethylene and aluminium (PEAL).

2. Experimental – The material under investigation is postconsumer Tetra Brik from Tetra Pak Japan. This material composed of three materials; Paper (75%), LDPE (20%) and Aluminium (5%) [1]. Tetra Brik was shredded into about 3mmx3mm in size, then washed and dried.
Hydrothermal experiments were conducted using a batch type autoclave reactor (MMJ-500, Japan) with 500 ml capacity. In this experiment, 9 grams of shredded Tetra Brik and 81 grams of ultrapure water from Mili-Q. The process was running under Argon atmosphere. The reaction temperature and holding time was set at 200°C, 0 minute; 200°C,60 minutes; 220 °C, 30 minutes; 240 °C, 0 minute;240 °C, 60 minutes. After completed, the product was dried at 105 °C for 24 h, and stored in a sealed bag before further analysis.
After drying process, the PEAL was cut down for cross sectional EDS analysis and the Char was analyzed using Elemental Analyzer for Ultimate Analysis.

3. Results and Discussion – Aluminium concentration in PEAL was changing as the time and temperature changing. At 200 °C, the PEAL haven't formed yet because of insufficient time to decompose paper attached to it. As we increase the time, paper began to decompose and PEAL could be formed. At 240 °C as more cellulosic material in paper decompose and become char, more char gets attached to the PEAL, resulting in decreasing of aluminum concentration.

Table I. PEAL Properties

Temp °C	Time (min)	Aluminum Concentration in PEAL	Densi (g/cm
200	0	NA	NA
200	60	66.31%	0.6
220	30	61.53%	0.7
240	0	48.91%	0.6
240	60	41.05%	0.7

Table II. Char Properties

Temp °C	Time (min)	C(%)	H(%)	N(%)	O(%)	Ash(%)	HHV (MJ/kg)
200	0	43.67	6.15	0.1	42.91	0.4	18.81
200	60	43.55	5.93	0.18	44.82	0.4	18.75
220	30	44.99	5.85	0.18	44.82	0.2	19.21
240	0	45.18	5.66	0.23	44.85	0.5	19.20
240	60	65.72	4.34	0.24	27.48	1	25.20

Hydrothermal treatment decomposes paper fraction of Tetra Pak and produces char with higher carbon content. Carbon fraction was increase with the increase of time and temperature from carbonization process happen in the process [2].

4. Conclusions – Hydrothermal treatment was effective to recover PEAL and produce char from Tetra Pak. Compare to PEAL produce in paper mill, we could produce PEAL with higher aluminium content. The char produced also have calorific value similar to sub bituminous coal. It could be utilized for solid fuel.

This experiment shows another application of hydrothermal treatment in the field of material recovery and solid fuel production.

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Cumulative CO_2 Assessment of an Ammonia-based Carbon Capture and Storage

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1. Introduction – Carbon capture and storage (CCS) is considered a promising option because the industries getting energy from fossil fuels can reduce CO_2 emission by using CCS. Among the industries, power generation sector is the greatest sources of anthropogenic CO_2. Thus, power generation sector has been trying to implement CCS in their plants. However, CCS needs to be more investigated because CCS process itself is energy-intensive because CCS requires additional energy. The objective of this study is to assess CO_2 emission of an ammonia-based CCS system to suggest the research and development (R&D) direction of the CCS technology.

2. Methods – A life cycle CO_2 assessment is performed to evaluate the net CO_2 reduction performance of a CCS.

3. Results and Discussion - The calculation result of the net CO_2 reduction shows that the reduced CO_2 is partially offset by increased CO_2 emissions due to carbon capture and wastewater treatment systems. Improving the major offset unit processes would increase the net CO_2 reduction rate of the CCS.

4. Conclusions – This study can provide valuable information needed to develop climate change mitigation policy and technology by showing the net CO_2 reduction ability and R&D strategies of ammonia-based CCS technology.

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Industrial Ecology Strategies to Reduce the CO_2 Emission of Product

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1. Introduction – To mitigate climate change, the carbon footprint of product should be reduced. The objective of this study is to present and assess industrial ecology strategies to reduce the CO_2 emission of product. The strategies are: (i) industrial symbiosis to utilize waste from a process as a feedstock for a plant; (iii) industrial and urban symbiosis to utilize waste energy generated in urban area as an energy resource for product; and (iii) environmental supply chain management to purchase a feedstock with lower CO_2 emission.

2. Methods – Based on these strategies, some scinarios are considered to reduce the CO_2 emission of product. Quantitative assessments are needed to estimate the amount of CO_2 emitted in product production stage. The strategy-based scenarios are compared to a baseline scenario. Uncertainty analysis is needed to examine the variability of the total CO_2 emission of product.

3. Results and Discussion - These strategies have a high potential to significantly reduce the cumulative CO_2 emission of product, compared to that of an existing product.

4. Conclusions - The industrial ecology-based product production strategies can be applied to produce low-carbon products and mitigate climate change.

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Investigation of Pedestrian Accessibility of Green Fields, Community Clinics and Schools in Atakum District

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1. Introduction – Social and technical infrastructures of urban areas have an important role to increase life quality and creating healthy life conditions. Theses infrastructures are roads, parks, green fields, car parks, schools, place of worship, shopping area, hospitals etc. [1] In the peoples living area to create a more proper environment it should be to determine the physical and social needs and the outdoors environment is necessary to meet these needs.

2. Experimental - In this study green fields (parks and playgrounds), community clinics and schools which are built in the urban areas are made domain analysis in terms of pedestrian availability. Study area are about 820 hectares and cover all of Mimar Sinan, Mevlana, Esenevler, K.Kolpınar districts and parts of Cumhuriyet, İstiklal, Balaç and Denizevleri districts in Atakum, Samsun City. Main road axes are selected as the boundary for pedestrian availability in the study area. Green fields, community clinics and schools areas and the other function areas spatial relationship are determine with examining development plan of study area.

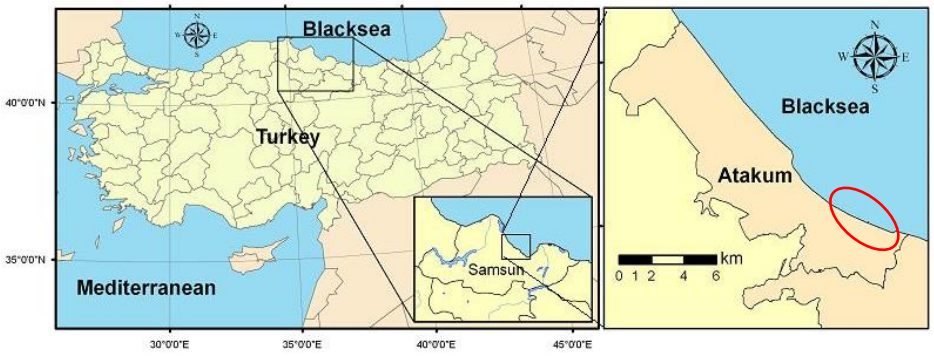

Figure 1: Study area

In this study, coverage area of green fields, community clinics and schools were evaluated according to the average speed of the pedestrian, using service area analysis in GIS[2]. In addition, necessity of new green fields, community clinics and schools locations were determined.

3. Results and Discussion – ıt was observed that in the study area, green fields, community clinics and schools have appropriate locations according to the pedestrian reach.

4. Conclusions - The quantity and quality of the social and technical infrastructures are directly affect the life quality of the citizens. Thus designing of the development plans are directly affect life quality.

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EU HORIZON 2020 programme project "Capacity Building on Energy Performance Contracting in European Markets in Transition" (EnPC-INTRANS)

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1. Introduction – A project has been proposed by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in cooperation with the Climate Protection and Energy Agency of Baden-Württemberg/ Germany and European competence centres on Energy Performance Contracting (EnPC) in Croatia, Greece and Slovenia, a competence centre for e-learning in Slovakia, and key actors for the promotion of EnPC at the local level in Latvia, Serbia, Romania and Ukraine. The objective of EnPC-INTRANS is to increase the market uptake of technologies for the improvement of energy efficiency (EE) in public buildings and services by means of fostering private sector participation in innovative financing schemes for EE investments. This will be achieved by means of implementing large-scale capacity building for local public authorities and small and medium-sized enterprises (SME) to jointly set-up and use adapted EnPC models for EE services.

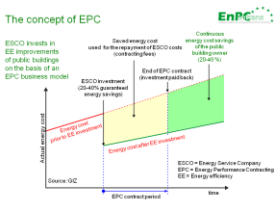

Image 1. The concept of EPC [1]

During the project implementation European best practices in EnPC are being adapted to local conditions and presented to relevant target groups in the partner countries. Training needs of local public authorities and SMEs have been assessed in intensive stakeholder dialogue, providing the basis for design and implementation of efficient training concepts and tools making use of advanced on-line technologies for European-wide capacity development. Trainers have been trained throughout the partners' networks and the developed training concepts and tools are being and will be demonstrated in national and international cooperation seminars. Project duration is two years – from March 2015 to February 2017.

2. Results and Discussion – Expected results of project are a total of at least 250 stakeholders and experts from the public sector, from energy service company (ESCO) and from SMEs in the partner countries involved in stakeholder consultations and training needs assessment. A total of at least 50 trainers from the partner countries trained for the implementation, dissemination and replication of capacity building and training measures developed in due course of the project. 2000 experts are planned to be trained on the demand side of EPC for public buildings and services by the performed road shows and training programme offered in the forms of webinars, e-learning courses and on-site trainings. The trained experts, stakeholder and local decision makers will cater for the initiation and development of new of EnPC projects for EE investments in at least 360 public buildings, providing for primary energy savings of more than 60 GWh per year when implemented. Expected impacts of the project are 60-90 GWh energy saved per year and 60-90 million new investments caused.

3. Conclusions – The project aims at raising awareness and realistic expectations on investment volumes that may be financed on the basis of future avoided energy cost; by promoting best practices in EPC for replication and up-scaling; adapting European best practices to local conditions and to user requirements and developing municipalities' capacities for the design, assessment, negotiation, and management of EPC projects.

4. References

[1] Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH / Germany.

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Comparison between Cl_2 and stabilized ClO_2 as disinfectant.

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1. Introduction – The natural resource of major impact and importance on a global scale is water. Therefore a critical topic is its correct treatment and sustainable use. Purification and water treatment plant are necessary facilities for the correct supply and conservation of hydraulic resources. Disinfection process is necessary in any water treatment system (cleanliness stages in the supply, final stage of treatment and purification or human consumption).

Multiple disinfection techniques exist, being the chlorine one of the agents mainly used in its form of chlorine gas, hypochlorite, or chloramines. All these techniques, with its advantages and disadvantages, in many situations neither fulfill these criteria for water sustainable use and legislation.

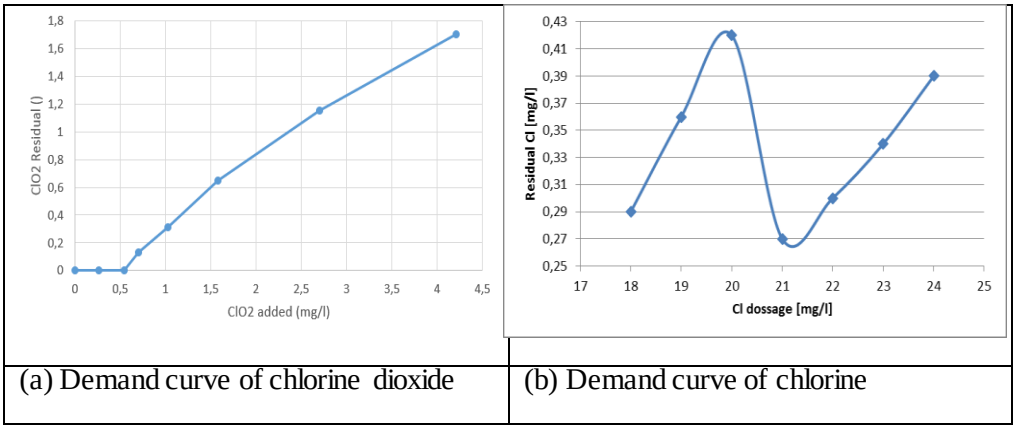
The chlorine dioxide, theoretically the best disinfectant that exists, was one of the agents less used for being an unstable explosive gas, with needs of in-situ generation, and low purity in the industrial applications. Nevertheless, its stabilization in water for less than 15 years, allows to overcome the above mentioned disadvantages. This makes dioxide chlorine an important agent to be consider due to its stability, disinfection power, competitive price and reduction of disadvantages vs other technologies.

The essays and realized procedures try to exhibit a comparison in the disinfection with hypochlorite and with chlorine dioxide. The water used in our research had similar characteristics to water treated in WWTP.

2. Experimental– For the development of this study, organic polluted water was prepared, and the use of chlorine was measured using a spectrophotometer and a fixed voltage potentiostat. The measurement of the dioxide of chlorine is not equivalent to the measurement of the chlorine, therefore the correct calibration of the equipment is necessary for a correct essay.

3. Results and Discussion Multiple essays were carried out with organic polluted waters whose characteristics are similar to waters from purification treatment plants. The COD range for the essays varies between 0 – 500 mg/ml.

Figure. 1 shows the comparison between demand curves for residual chlorine dioxide (a) and chlorine (b) treating water with COD=162 mg/ml load.



(a) Demand curve of chlorine dioxide

(b) Demand curve of chlorine

Figure 6: Comparison between chlorine dioxide and hypochlorite in water with 162 mg/ml COD

4. Conclusions – The results shows that the chlorine dioxide has a disinfection power 10 times greater than hypochlorite. Undoubtedly the no creation of chlorine derivatives as chloramines, trihalomethane etc, provide a big advance for multiple applications. Using chlorine dioxide, entire disinfection is obtained if we ensure any residual quantity of chlorine dioxide.

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Numerical study of a heat recovery system from stacked slabs at steelworks

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1. Introduction – The iron and steel industry, which is highly energy consuming and produces large carbon dioxide emissions, has to take on actions to increase energy efficiency, mainly by surplus heat recovery. For instance, continuous casting at steelworks yields intermediate products (billets, blooms and slabs) at temperatures close to the melting point. Subsequent processing in finishing mills may take place after cooling down to ambient temperature, without any heat recovery. This is currently the case in the ArcelorMittal plant at Avilés (Spain), where steel slabs at more than 1000ºC are usually stacked in storehouses for several days (Fig. 1). Their potential energy is about 40GJ/m^3. For that plant, Villar et al. [1] estimated a yearly-averaged potential for energy saving in the slab cooling process of at least 9 MW. To recover the heat given-off by the slabs, it can be used to warm up a flowing fluid, like air, liquid water or steam depending on the posterior application. This paper presents an analysis based on numerical simulations on the operation of a special heat recovery system in which the slab piles are covered with a metal casing that supports water piping. The casing has one horizontal top plus two vertical flaps in the longitudinal direction (Fig. 2). Water pumped into the system increases its temperature by an amount that depends on the thermal power released from the slabs, the flow-rate and the overall system performance.

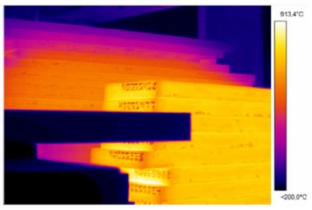

Figure 1. Thermography of a pile of slabs.

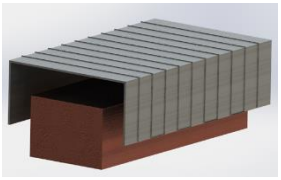

Figure 2. Casing for slab heat recovery.

2. Methodology - In that system, several heat transfer mechanisms take place simultaneously: heat conduction (slabs, metal panels and pipe walls), radiation (from solid surfaces), natural convection (solid surfaces - air) and forced convection (pipe-water). While radiation is expected to be dominant in the heat release from the slab and panel surfaces, convection processes are important too because they determine the warm-up of the two fluids involved, air and water. Thus, the system was simulated by means of a CFD code (Fluent) to solve the RANS equations for compressible flow with two phases, complemented with Fourier conduction and a surface-to-surface radiation model. Since the slab length is usually more than five times its width, the model was simplified to two dimensions, and it was halved because of symmetry considerations. Sensitivity analysis were performed to select appropriate calculation parameters regarding boundary conditions, mesh refinement (about 4·10^5 cells), turbulence model (k-ϖ) and time step (for unsteady simulations).

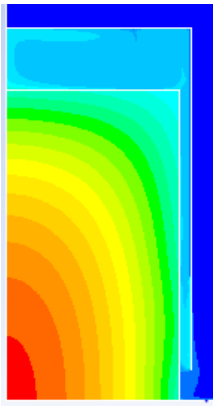

Figure 3. Temperature (K) distribution for a specific configuration.

3. Results and conclusions – Several simulation series were performed to compare the cooling rate with and without casing and to analyze the effect of the different geometrical parameters of the system on air circulation, water temperature gain and overall efficiency. Fig. 3 shows an example of temperature distribution for a specific configuration. While some open gap between flaps and floor cannot be avoided in real site conditions, it was found that the distribution of water on the casing can help to minimize the drop in efficiency from the entirely closed casing case, which was close to 80%.

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Modeling of Coil Cooling using 2D and 3D Computational Fluid Dynamics (CFD)

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1. Introduction – In hot-rolled steel production processes, controlled cooling after finishing rolling plays an important role on the final microstructure and mechanical properties of product [1]. Steel coil produced at a steel mill after the laminate must be cooled from a temperature of 673.15 K to ambient temperature to be transported and sold. In this article a model to simulate and measure the rate of cooling coil is developed. The coil geometry employed is a cylinder with height between 1.6 m and 1.8 m and an outer diameter of 1.8 m. They have a few diameter co-axial hollow centre.

Image 1. Steel coil

The coils cooling take between 4 and 6 days depending on weather conditions. Usually the cold coil will be stored in a warehouse. It produces unwanted stocks and thus represents a "bottleneck" in the marketing process.

In this study, the process of coils cooling is studied using CFD techniques. To do so, 2D (two-dimensional) axisymmetric and 3D (three dimensional) transient models were used. The objective is to obtain the optimal rate of temperature decrease depending on the geometry and the orientation (horizontal or vertical arrangement) of the coils.

2. Material and methods – The physical model selected for the coils is cylindrical with an inner diameter of 0.18 m and outside diameter of 0.9 m and 1.8 m high. The coil is assumed to be located in a spacious room measuring 4.5 m x 4.5 m for 2D axisymmetric and 6 m x 6 m x 6 m for 3D model. Natural convection process for cooling was considered. In the present study, the geometry are performed using Gambit 2.4.6 Fluent Inc. USA and CFD package ANSYS FLUENT 16.0.0. for the simulations. To study vertical and horizontal coils cooling 2D axisymmetric and 3D transient models were used respectively.

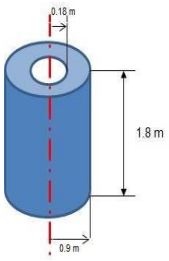

Image 2. Steel coil dimensions

3. Results and Discussion –To simulate the process, a transient simulations with different time steps were used. The Optimal time step is 800 s. Temperature and velocity distributions have been obtained.

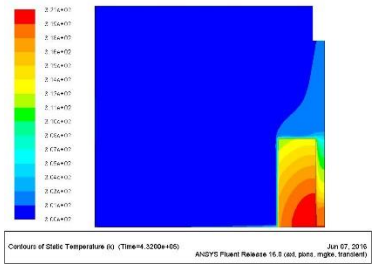

Image 3. 2D axisymmetric model

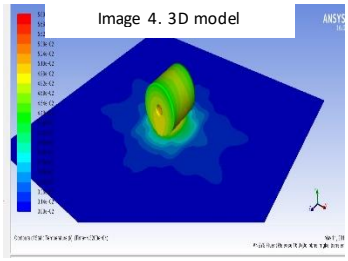

Image 4. 3D model

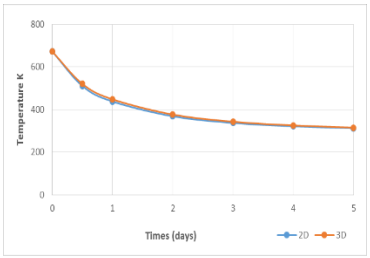

Image 5. Coil average temperature versus time

4. Conclusions –2D axisymmetric and 3D simulation models have been used to study steel coils natural cooling. Both models are consistent and the results obtained are quite similar. It takes 5 days time for a steel coil to be cooled from 673.15 K to ambient temperature; and relationship between average coils temperature and time is nearly equal. In future works, cooling considering several rows of coils and optimal spatial arrangement will be studied, as well as the possibility of forced flow.

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Analysis of sediments causing damage to water meters

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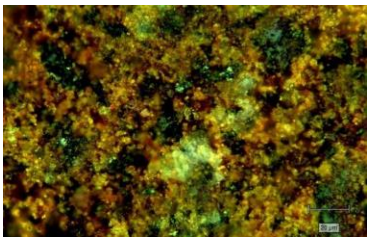
1. Introduction – Corrosion of water pipes in many large-city drinking water distribution systems (DWDSs) results in appearance of sediments, which change physical and chemical properties of water and make its organoleptic properties worse. It results in the need of frequent water supply network (WSN) flushing and the increase of WSN failure. Apart from negative influence on water health aspects, this problem should be considered in economic terms. Corrosion scales usually include inorganic iron-based compounds. Furthermore, water sediments can also contain quartz (SiO_2), calcium carbonates (*e.g.* calcite), etc. Chemical and phase composition of corrosion scales is usually determined using different methods such as elemental analysis, X-ray diffraction (XRD), scanning electron microscopy (SEM), and vibrational spectroscopy [1,2]. The aim of this work was to investigate, for the first time, chemical and phase composition of the sediments deposited on measuring parts of water meters disassembled from the Krakow DWDS. Due to high costs of exchange of faulty water meters in DWDSs, it is of great importance to improve our knowledge of sediments. Our analysis was mainly based on X-ray and vibrational spectroscopy methods to gain deeper insight into sediments composition and, as a consequence, to increase our understanding about sediments formation.



2. Experimental - Samples (Image 1 as an example) were collected from different water meters of the Krakow DWDS, which have been disassembled due to their failure. The phase analysis of sediments was performed by XRD technique. Elemental composition of samples was measured using Proton Induced X-ray Emission (PIXE). Finally, chemical composition was studied using infrared and Raman spectroscopy.

3. Results and Discussion – Results of PIXE measurements showed high content (20 – 50%) of iron in all studied samples. In most samples distinct contribution of silicon and calcium was also observed. XRD experiments revealed the amorphous to crystalline phase ratio to be of *ca*. 2.

Vibrational spectroscopy methods allowed identification of individual compounds including iron(III) oxide-hydroxides (goethite, lepidocrocite), iron oxides (hematite, maghemite, magnetite), and calcite. Furthermore, Raman microspectroscopy was applied for detailed studies of the sediments in order to check their homogenity.

4. Conclusions – The X-ray methods confirmed the high level of iron-based compounds and high content of amorphous phase. On the other hand, vibrational spectroscopy methods showed heterogeneity of the sediments found within the same water meter as well as composition diversity between different samples.

5. Acknowledgments
The research was performed using equipment purchased as part of a the project co-funded by the Małopolska Regional Operational Programme Measure 5.1 Krakow Metropolitan Area as an important hub of the European Research Area for 2007-2013, project No. MRPO.05.01.00-12-013/15.

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Co-digestion of Agri-Food Residues in WWTP Digesters With Sludge From Wastewater Treatment. Laboratory Tests.

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1. Introduction – The agri-food industry, especially industrial agri-food markets, are large producers of residues and wastewater (WW). On the one hand, WW is generated mainly in the washing, cutting of and adaptation operations for product sale. They are characterized by a high organic load due to their origin. On the other hand, residues comprise 76% organic matter (OM) [1], from fish, meat and vegetable waste [Image 1].

WW can be treated, according to Directive 91/271/CEE, in an exclusive WWTP for the agri-food structure or, as last resort, in an urban WWTP In both cases, anaerobic digestion (AD) is recommended due to the high content of OM.

Organic agri-food residues, according to SANDACH (Animal by-products not intended for human consumption), are classified as category 3 and can be incinerated, transformed into meat, bone and fish meal, or treated in biogas and composting plants.

In light of this, AD is presented as the most suitable option for waste valorization as it can be considered as a way of recycling, resource and energy valorization, and disposal. In order to study this biological process for energy valorization, some experiments were carried out to determine the metanization potential of the residues.

Image 2. Example of BMP test

2. Experimental – Experiments were carried out using the BMP test configuration [Image 2], following the European and Deutsch Normalized Associations techniques, with some improvements in order to create more similarities with real anaerobic digesters. An example of such includes using an agitation system to homogenise the substrate mixture, i.e.: with an orbital mixer, and using a TCD Gas Chromatograph to analyse biogas emissions (% methane, % carbon dioxide and % hydrogen), so all stages of the anaerobic digestion process can be monitored, including the hydrolysis stage, the most limiting one.

3. Results and Discussion – The ultimate goal of these essays is to obtain the biodegradation curves in terms of biogas formation, which show how the residue is degraded during the anaerobic process, and how much biogas is formed. [Image 3]

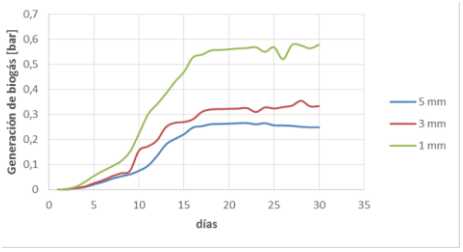

Image 3. Biodegradation curves obtained

Co-digestion of WWTP sludges and the three different residues was studied, so they were characterized in biodegradation terms, according to its characteristic. Also a study on how the grain size of the substrate affects the biogas formation was achieved.

4. Conclusions –

- AD of sludges from WWTP and residues from the agri-food indutry is the most suitable option for waste and energy valorization.
- The three different residues vectors were characterized in terms of biogas formation. The most suitable one for anaerobic biodegradation is the meat residue, due to its high fat content, that enhances biogas production.
- Grain size of substrate for AD is a key parameter for its correct biodegradation. It was observed that when the size is smaller, the biogas formed drastically increases.

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Stimulation of biogas production from sewage sludge by supplements addition

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1. Introduction

Anaerobic digestion (AD) is a common method of wastes treatment aimed at reduction of the amount of organic waste and energy recovery. AD is a complex process carried out by a number of microorganisms whose activities are determined by a variety of physicochemical parameters, as well as the availability of the nutrient substrates and growth supplements [1].

The objective of this work was to investigate the effect of addition of microbial supplements on the biogas production during anaerobic digestion of sewage sludge. During semi-continuous anaerobic digestion of sewage sludge from municipal sewage treatment plant in Oswiecim, the following supplements were tested:

- "microbial vaccine" containing specialized strains of archaea, bacteria and fungi - variant M
- "methanogenesis supplements" containing organic compounds which could stimulate the activity of methanogenic archaea - S variants: (i) S-CS supplement prepared from cattle slurry, (ii) S-L supplement prepared from sewage sludge and (iii) S-H hydrolysing extract.

2. Experimental

Anaerobic digestion in semi-continuous mode was carried out in the single-stage anaerobic laboratory reactor. The operating volume of the bioreactors was 1L. Digestion process took place for 20 days and was carried in 37°C. For the control of the anaerobic digestion process, the following parameters were determined: the volume and composition of the biogas, volatile fatty acids (VFAs), total solids (TS), volatile solids (VS), chemical oxygen demand (COD), total ammonia (NH_3) and pH. Daily biogas production was monitored by Milligascounter MGC-1 (Ritter). Methane content was analyzed by gas chromatography GC/MS (Agillent).

3. Results and Discussion

The results showed that only addition of the microbial vaccine M and the supplement S-L increased biogas production during anaerobic digestion of sewage sludge. Addition of those products resulted in enhanced biogas production (of 24% for S-L and 5% for M) and increased quality (elevated amount of methane) of the produced biogas. Furthermore, the addition of the M vaccine and S-L supplement also increased the reduction of organic matter. The reduction degree for control was 55%, while for anaerobic digestion with the M vaccine and S-L supplement was at the level of 83% and 85%, respectively.

4. Conclusions

The obtained results showed that the applied microbial vaccine and S-L supplement could efficiently enhance biogas production from sewage sludge.

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International Congress on Water, Waste and Energy Management
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The enhancement of anaerobic biodegradation of sewage sludge by artifical microbiological consortium

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1. Introduction

Sewage sludge is a hardly utilizable waste composed of microbial biomass, extracellular polymeric substances (EPS, composed of proteins, lipids and polysaccharides) and inorganic materials. Anaerobic digestion is widely applied for effective sludge stabilization and biogas production in wastewater treatment plants [1]. The initial and key step of anaerobic digestion is the process of hydrolysis of complex organic structures to smaller moieties of low molecular weights. Hydrolytic microorganisms and their enzymes are responsible for the organic matter degradation, which may have an effect on an overall biogas production.

Novel artificial microbial hydrolytic consortium (MHC) consists of thirty three strains representing the following genera: *Bacillus*, *Providencia*, *Ochrobactrum*, *Staphylococcus*, *Stenotrophomonas*, *Brevundimonas*, *Brevibacterium*, *Micrococcus*. All strains have high hydrolytic activities (lipolytic, proteolytic, cellulolytic) and a wide range of tolerance to various physical and chemical conditions.

The main aim of this study was to verify whether the constructed microbial consortium can hydrolyse organic compounds present in sewage sludge and enhance an overall production of biogas from sewage sludge.

2. Experimental

The anaerobic digestion process was performed in 1 L glass lab-scale bioreactor at 37 °C for 30 days. The feed ratio of methanogenic inoculum and sewage sludge for each reactor was 1:1 (10 gvs/L: 10 gvs/L). MHC was added as a lyophilisate containing 10^{10} cells/g. To monitor the anaerobic digestion process, the following parameters were determined: the volume and composition of the biogas, volatile fatty acids (VFAs) concentration, soluble chemical oxygen demand (sCOD), total solids (TS), volatile solids (VS) and the pH.

3. Results

It was shown that the MHC can be successfully applied for the utilization of the sewage sludge. The results demonstrated that addition of the novel consortium could (i) increase the efficiency of biogas production up to 15-30% and the (ii) increase methane content in produced biogas up to 4-14% and (iii) increase degree of reduction in total solids and volatile solids (up to 5-7%) The increase of VFAs concentration (up to 25%) and reduction sCOD (up to 40%) during anaerobic digestion was mainly due to the degradation of insoluble macro-molecular organic compounds of sewage sludge.

4. Conclusions

Pretreatment with novel microbial consortium enhanced the efficiency of the aerobic digestion of sewage sludge. It was revealed that constructed artificial consortium has a high potential to enhance sewage sludge degradation efficiency in the course of an anaerobic digestion.

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Improvement of the efficiency of sewage sludge anaerobic digestion by bioaugmentation with microbial consortia in concentrated forms.

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1. Introduction

In recent years an increase in the amount of treated wastewater resulted in elevated production of sewage sludge. Bioaugmentation of sewage sludge with specialized microorganism could be a powerful tool to improve the wastewater treatment processes to which we can include anaerobic digestion, one of the most popular method for effective sludge stabilization [1, 2].

The aim of this work was to check if bioaugmentation with microbial consortia in concentrated form produced on the basis of: (i) dairy wastes (DW), (ii) cattle manure (CM) and (iii) microbial consortium (MP) containing the isolates with high hydrolytic activities (proteolytic, cellulolytic, lipolytic) improves the efficiency of the anaerobic digestion of sewage sludge originating from the municipal wastewater treatment plant in Lodz (Poland).

2. Experimental

The anaerobic digestion process was carried out in 2.0 L reactors at 37°C for 30 days. The feed ratio of inoculum and sewage sludge for each reactor was 1:1 (10 gvs/L: 10 gvs/L). The tested microbial consortia (DW, CM and MP) were added as a concentrate containing 10^{10} cells/mL. To monitor the anaerobic digestion process, the following parameters were determined: the volume and composition of the biogas, soluble chemical oxygen demand (CODs), total solids (TS), volatile solids (VS) and the pH.

3. Results and Discussion

The obtained results demonstrated that bioaugmentation with concentrates from dairy waste, cattle manure and microbial consortium with elevated hydrolytic activities resulted in an

increased efficiency of sewage sludge anaerobic digestion and biogas production. The addition of DW, CM, MP: (i) increased the biogas yield (even up to 30%), (ii) increased content of methane in produced biogas (up to 10%), (iii) increased degree of reduction in total solids, volatile solids (up to 8-15%) and CODs (up to 25-35%).

4. Conclusions

Presented work showed that microbial consortia CM, DW and MP had a potential for improvement of the efficiency of sewage sludge anaerobic digestion and bioaugmentation with such consortia in concentrated form can be used in wastewater treatment plants in order to increase an overall efficiency of the biogas production.

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MiPG: The future of oil extraction and waste management in the UAE

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ABSTRACT

This paper provides a techno-economic analysis of the microwave-induced plasma gasification (MiPG) technology to convert municipal solid waste (MSW) and sewage sludge into a useful source of energy and raw materials for enhanced oil recovery (EOR).

Many petroleum producing countries in the Gulf, including the United Arab Emirates (UAE), are facing increased difficulty in recovering oil from the depths of the earth. The extraction of the oil available at present involves much deeper excavation and also necessitates the addition of pressurized carbon dioxide, steam, natural gas or other fluids to aid the extraction process called Enhanced Oil Recovery methods. This, coupled with a general increase in demand for petroleum and petroleum-based products in the world has meant that oil reserves continue to deplete rapidly. The difficulties in extracting oil has resulted in significant upward pressure on the costs involved, and as the present trends in the prices of oil suggest a persistent decrease, these oil-producing countries are expected to suffer a significant economic setback. The MiPG technology would therefore be a promising solution to reducing the costs of oil extraction while also offering a solution for waste management.

The rapid economic growth in these countries triggered primarily by the availability of oil has resulted in a significant increase in urban populations. At present, over 75% of the total population in the UAE reside in major cities. In a short span of time, the production of MSW, sewage and other waste has soared in these cities. Biologically hazardous waste from hospitals, industrial waste containing harmful chemicals and bio-wastes from farms also make a significant contribution to the already alarming extent of accumulation of waste. Waste incineration plants that are already in existence can only process small amounts of solid waste. This also means that a significant amount of toxic chemicals is released via smoke from these plants. Although, far from ideal, the most commonly used practices for the disposal of waste is the use of landfill sites to bury the waste or the use of oceans as a dump. They are not environmentally friendly methods of waste disposal as landfills release odors, breed disease carrying vectors and release methane into the atmosphere; while using the ocean as a dump destroys marine ecosystems.

In a MiPG reactor, a thermal plasma is generated and sustained by microwaves, producing core temperatures in excess of 5000 °C. The organic content in the feedstock is converted into syngas, while the remaining matter are reduced to their elemental state. Metals, silicon and heavy elements are removed as a semi-solid slag. Microwaves are much more efficient means of producing plasma than other electric sources such as arc torches. MiPG is the most energy efficient gasification method as it requires less energy for the production and sustention of the plasma than other techniques. Moreover, it is economically feasible for small-scale use and produces cleaner syngas. The syngas produced in the MiPG process can be used as a fuel in power

plants to produce electricity in petroleum extraction while the solid residue obtained at the end of gasification could be used as a raw material for construction purposes. Additionally, processes such as the Fischer-Tropsch or Sabatier-Senderens can be employed to convert syngas to methane or more complex liquid-gas fuels, which can be used in the EOR process. The syngas can be used to power thermal seawater desalination systems and the waste heat from the MiPG reactor can be harnessed in a cogenerated manner to power thermal desalination system. The carbon dioxide produced can be fed back into the MiPG or used for EOR, making it possible to sequester carbon dioxide in deep petroleum wells. Thus, the MiPG process will eliminate the UAE's dependence on natural gas imports, while achieving a zero landfill target, converting waste to power, and reducing the negative environmental impacts of MSW and sewage sludge.*

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Adsorption of Dye on Histidine Modified Chitosan

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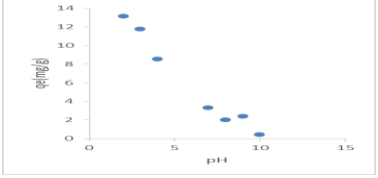
1.Introduction – Various kinds of synthetic dyestuffs found in effluentwastewater from a variety of industries such as for dyestuff, textile, leather and paper production, contain coloring substances which are toxic and need to be removed [1]. Adsorption is the most commonly used technique due to its inexpensive nature, environmental friendliness and its distinctive advantage of completely removing the dye molecule. Chitosan is a cationic polymer that shows high affinity for most dyes, especially for anion dyes, thus, it is widely used in dye adsorption from aqueous solutions. However, raw chitosan has poor mechanical strength. This can be averted through crosslinking. The adsorption properties of cross-linked chitosan may further be improved via modification with histidine, an amino acid that contains side chain donor groups such as amino and imidazole, which enhance chelation [2].

2. Experimental - Chitosan beads (CBs) were prepared using chitosan powder dissolved in of 7 vol% acetic acid. The chitosan slurry dropped into 2.5 M NaOH solution to obtain spherical bead. After that, chitosan beads were crosslinked by adding gluteraldehyde solution. The resulting crosslinked chitosan beads were immersed in 1.25 M Na_2HCO_3 10 histidine solution.

Batch adsorption experiments were conducted in the beaker and mixed by using magnetic stirrer.

The effect of temperature, pH and initial dye concentration parameters on textile dye adsorption on histidine modified chitosan were determined.

3. Results and Discussion – Experiments were carried out as a function of temperature, pH and initial dye concentration. Langmuir, Temkin, Freundlich models were investigated and Freundlich model was found to be fit to describe dye sorption onto chitosan at equilibrium (Fig.1). The constants that sorption capacity (kf) and sorption intensity ($1/n$) were recorded in Table 1. Also, pseudo-first-order, pseudo-second-order and intra-particle diffusion models kinetics were determined and the correlation coefficient R^2 shows that the pseudo-first-order model is indicative of a textile dye adsorption mechanism, which fits the experimental data slightly better than the other models.



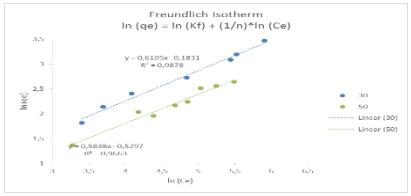


Fig.2. Pseudo first order kinetic for different concentration

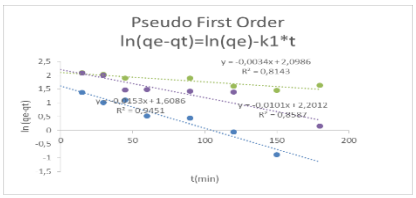


Fig.3. The effect of pH on adsorption

	kf	**1/n**
30 ^{0}C	0,8327	0,6105
50 ^{0}C	0,5888	0,5836

Table 1. Freundlich isotherm constants at different temperatures

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Optimization of Intallation Slope and Azimuth Angle for the Maximum Solar Energy Collection

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Abstract: In this paper, the optimization algorithm of solar energy such as thermal and photovoltaic power generation has been developed. The installation slope and azimuth angle of a solar-energy system are important variables to calculate maximum solar-energy collection. Surface angle is one of the installation specifications, which depends on the seasonal path of the sun. The accurate determination of the optimum azimuth angle for the installation is important for the maximum energy production by the solar power system. One of the Korean standard greenhouses was selected and calculated on various azimuth angles as 60 to -60 degrees to the south direction. The amount of solar-energy collection depends on the azimuth angles but changed as each seasons. This information shows that for maximum energy gain, the optimum condition of the solar system installation must be determined by accurately for each interested target sites.

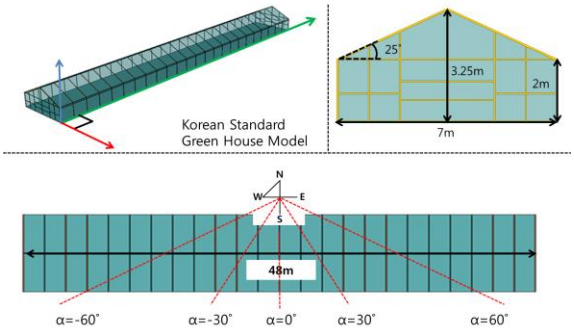

Fig. 1 KS Greenhouse - rooftop glass type .

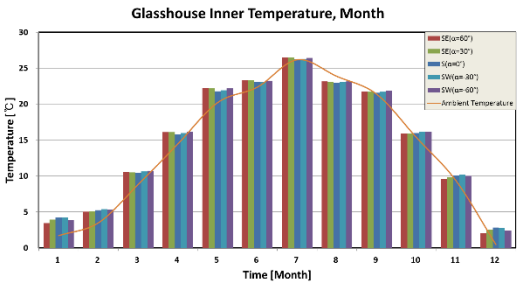

Fig. 2 Inner temperature profiles according to the azimuth angles.

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Wastewater Treatment Improvement by Addition of Organic Flocculants

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1. Introduction – Wastewater treatment is carried out in large facilities where polluted water is processed by bacteria whose metabolism consumes organic matter and nutrients provided by the incoming water. Therefore it may be stated that these microorganisms feed on pollution reducing its concentration to values that allow the processed water to be discharged into nearby water courses. The bacterial mass must be separated from water before discharging, a process which is carried out in a sedimentation tank. To do that bacteria must group together forming flocs that facilitate both bacterial respiration and decantation. Nevertheless some bacteria (known as filamentous) causes an excessive clustering which could give rise to the formation of foams on the water surface (foaming) or too large flocs which cannot properly decant (bulking) which will make difficult the settling process [1]. In order to deal with these problems several techniques have been used such as addition of ozone or thermal [2] or ultrasounds treatments [3]. They are usually expensive or troublesome. So in this work an alternative is proposed in order to improve settling: the addition of organic flocculants, an action that is very usual in drinking water treatment.

2. Experimental – In order to measure the efficiency of the addition of organic flocculants a number of samples of bacterial sludge from an actual plant suffering from usual bulking and foaming problems were treated and analyzed. To do that a Jar-test was carried out with different concentrations of flocculants and their efficiency was studied through the V30 (the volume the sludge takes up when a litre of sample settles during 30 minutes) and the Sludge Volume Index (SVI, the volume 1 g of sludge takes up) tests [1]. Two flocculants were used: bentonite (a very fine-grained clay) and potato starch.

3. Results and Discussion – Different concentration of both bentonite and potato starch were tested ranging from 0,25 g L^{-1} to 2 g L^{-1}, in increments of 0.25 g L^{-1}. For bentonite the best performance was obtained with 2 g L^{-1}, providing a value of 890 mL for V30 and 468,42 mL/g for SVI. On the other hand potato starch provided the best performance with 1.5 g L^{-1}: 590 mL for V30 and 328,27 mL/g for SVI. As it is usually assumed that values lower that 400 mL/g of SVI provide an optimal sludge settling it may be stated that that value of potato starch provided the best performance.

4. Conclusions – Laboratory scaled experiments have proved that organic flocculants may improve the settling capability of sludge in waste water treatment plants providing a way to compensate for the harmful increment of filamentous bacteria so that bulking and foaming may be avoided. The best behaviour was obtained with potato starch, an organic flocculant which was able to provide a noticeable improvement in the settling conditions of sludge samples obtained from an actual plant usually suffering from bulking and foaming problems.

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Respirometric protocol to improve biological nutriente removal and energy saving in WWTP

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1. Introduction –European Community regulations on pollutant reduction in Wastewater Treatment Plants (WWTP) are very restrictive. The Commission issues a biennial report concerning the performance of these processes, the last of which appeared in April 2016 [1]. In it, it was highlighted that, in Spain, only a 38% of the whole mass of processed water accomplish with the biological nutrient removal efficiency required. Therefore the performance of those processes must be improved. The water treatment is carried out by means of a biological nutrient removal process which need aeration to be properly carried out. To do so it must drive the system into alternating aerobic, anoxic an anaerobic cycles. Therefore knowledge of the bacterial demand of oxygen is necessary in order to achieve an optimal alternation which ensures an efficient nutrient removal. This information may be provided by respirometric measurements, as oxygen is consumed both in bacterial respiration (endogenous respiration) and in oxidations processes of organic or inorganic matter (exogenous respiration). Therefore integrating a respirometric protocol in the control process of a WWTP may be very useful to provide an efficient nutrient removal that allows accomplishing with legal regulations.

In this work an easy to carry out respirometric protocol is presented with the aim of obtaining the maximum specific growth rate of the biological culture (μ_{max}) which is closely related to the aeration and pumping processes in a WWTP [2]. This value will provide information to optimize both processes so that the treatment process may be improved not only to achieve the legal regulations but also to obtain energy savings, as aeration and pumping processes account for around 75 % of the energy consumption in a WWTP.

2. Experimental – The respirometric trials will be carried out in a vessel with a fixed volume. It will have aeration and stirring elements along with an oxygen probe, which will be connected to a controller that switch on and off aeration. The respirometric protocol is based on adding a known substrate to a bacterial culture, then aeration is switched on and off to ensure an oxygen concentration between 1 and 3 mg L^{-1}. A parameter, μ_{max}, describing the respirometry measurement is obtained. It is the gradient of the natural logarithm of the slope of the oxygen concentration when it falls from 3 to 1 mg L^{-1} when aeration is switched off.

3. Results and Discussion – In an actual WWTP the oxygen and pumping levels may be adjusted once μ_{max} has been obtained. That of Torremayor (an 8,000 urban agglomeration in the southwest of Spain) was selected to test the respirometric protocol. Biweekly sludge samples were picked

up during 5 months. From them it was stated that, for a value of 0.35 mL $MLVSS_{new}$ mL $MLVSS_{tot}^{-1}$ d^{-1} of bacterial sludge, the optimal aeration was 1.2 mg L^{-1} with a pumping rate around a 50% of the inflowing water.

4. Conclusions – An easy to implement respirometric protocol that provides information which may be used in WWTPs to improve their performance has been presented. When applied to an actual plant an increment of 30% in nutrient removal efficiency was obtained along with a reduction of 10% of energy consumption.

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GC Configuration for analysing and monitoring biogas production from anaerobic digestion of WWTP sludges and agri-food waste.

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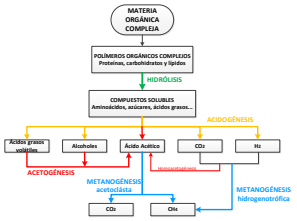
1. Introduction – The agri-food industry, especially industrial agri-food markets, are large producers of residues and wastewater (WW). On the one hand, WW are characterized by a high organic load due to their origin. On the other hand, residues comprise 76% organic matter (OM), from fish, meat and vegetable waste.



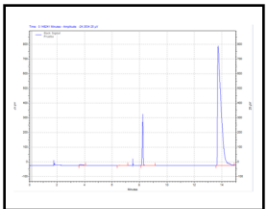
In light of this, Anaerobic Digestion (AD) is presented as the most suitable option for this waste valorization as it can be considered as a way of recycling, resource and energy valorization, and disposal. In order to study this biological process for energy valorization, some experiments were carried out to determine the methanisation potential (biogas production) of the residues. To analyze the composition of the biogas formed during the AD process, a TCD Gas Chromatographer, capable of determining the concentration of various gases (methane, carbon dioxide, hydrogen) is necessary. If these three gases are analyzed, all the stages of the AD process [Image 1] can be monitored, and completely controlled.

2. Experimental – For the experiments, an Agilent Technologies© Gas Chromatographer (GC), with a Thermal Conductivity Detector (TCD) was utilized. Nitrogen is used as carrier gas, due to its thermal conductivity difference between the analysed gases, so they could be properly separated.

For the analysis, the GC was equipped with two columns, both of them isolated with separated valves. One of the columns, a molecular sieve, combined with the other column, is capable of separating first the carbon dioxide, and after, the rest of the gas band (CH_4, H_2 and H_2S).

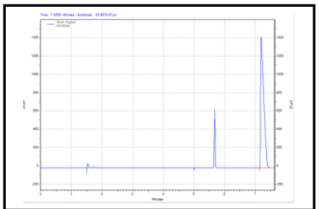
3. Results and Discussion – An initial method to first separate CO_2 from the rest of the gases is run. Then, an initial method [Table I] first separate all the gases in 15 min, using a constant temperature (30 ºC) in the oven, with a constant gas flow (5 ml/min). After that, making some modifications, some conclusions were achieved: While increasing the temperature, the essay time is reduced, and if the flow is reduced, the gases separation is elapsed.

Table I. Initial method



Temp.	30 ºC	
Flow	5 ml/min	
Total time	15 min	
Valve events	**V. position**	**Time [min]**
	V1 On	0.05
	V2 On	1.5
	V2 Off	7.5
	V1 Off	14.9

Table II. Final method



Temp.	(60-100-60) ºC	
Flow	(5-10) ml/min	
Total time	7.5 min	
Valve events	**V. position**	**Time [min]**
	V1 On	0.05
	V2 On	1.5
	V2 Off	5
	V1 Off	7.45

The final method, consisting on temperature ramps combination (60 ºC constant for 0.5 min, ramp up to 100 ºC in 0.75 min, ramp up to 60 ºC in 5 min, 60 ºC constant for 1.25 min) and a flow ramp combination (5 ml/min constant for 3 min, ramp up to 10 ml/min in 2 min, 10 ml/min constant for 2.5 min), separates all the permanent gases in half the time, with a correct elapse of peaks, so the CO_2 peak is better appreciated.

4. Conclusions –

- AD of sludges from WWTP and residues from the agri-food industry is the most suitable option for waste and energy valorization.
- AD process, including hydrolysis stage, is completely determined and monitored, by controlling the gas effluent composition.
- Combining a molecular sieve and column, isolated both of them with valves, permanent gases were correctly separated and differentiated.
- An optimal solution with different configurations of temperature and gas flows was achieved, halving the essay time, with a correct separation of peaks.

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Results concrete resistivity of the WWTP of Portalegre

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Abstract - Waste water treatment plants receive domestic and industrial effluents whose compositions incorporate a number of substances, some of which potentially harmful to the concrete structures. Some of these chemical compounds that flock to the WWTP, including sulfates, interact with the concrete by changing its alkaline nature, a fundamental factor for ensuring the protection of reinforcement embedded it. This change allows the dissolution of the passive protective film reinforcement, which is the guarantee of its durability. This work results from the monitoring of ion concrete resistivity of Portalegre WWTP structures. They are presented and discussed the results of these measurements.

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The Use Of Microwave Plasma Gasification For Waste Management In Urban Water Bodies And Removal Of Pelagic Pollution

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1. Introduction – This paper examines water pollution in urban water bodies, and the accumulation of solid wastes of human origin in seas and oceans; and proposes a novel waste-to-energy conversion method, namely microwave-induced plasma gasification (MIPG) as a viable solution for the cleanup of water bodies as well as for energy generation.

2. Discussion - The pollution of rivers and lakes is particularly pertinent in densely populated urban areas that lack the infrastructure to provide proper waste management. As a result, waste is discarded into water bodies resulting in their accumulation and consequent environmental damage. It leads to an overgrowth of algae, breeding vectors that can cause the spread of diseases. The waste also gets deposited into oceans by the discharge from the rivers and from surface runoff due to precipitation. Large oceanic currents called gyres carry marine debris and concentrate them in the interior forming patches of waste material[1]. Currently, most solid wastes generated is deposited into landfills by waste management service providers. Incineration is the most common waste-to-energy conversion measure in place. One disadvantage of incineration is that the waste has to be presorted because the incinerators can only accept specific types of waste materials. In addition, incineration leads to the release of significant amounts of carbon dioxide, oxides of sulfur and nitrogen, and toxic pollutants into the atmosphere [3].Thus, MIPG is proposed as a superior alternative to incineration and traditional gasification schemes. In a MIPG reactor, microwave radiation is focused into the core of the reactor to create a thermal plasma with temperatures in excess of 5000 °C. Organic materials, including biological matter, plastics, etc. are converted into syngas, while the remaining matter are reduced to their elemental state. Metals and heavy elements collect as a slag at the bottom, which is removed, allowing it to cool and harden into a glassy solid, which can be used as a construction material [4]. Microwaves are a much more efficient means of producing plasma than electric arc torches, making MIPG a highly energy efficient gasification method. Syngas can be converted into electricity and raw materials such as fuels, chemicals and fertilizers. Due to the extremely high temperatures, MIPG can accept any type of waste, The process releases less harmful gases, and produces syngas which is pure and clean. Some of the syngas made will be used to produce the electric power needed for running the plasma generator and onboard systems, while the remainder can be converted into fuels such as methanol and other useful products through the Fischer-Tropsch process [5] and excess electricity is fed into the power grid.

3. Conclusions - With these advantages in mind, MIPG is proposed as the best technique to solve the contamination and waste management problems. The proposed design for inland water bodies is to have MIPG stations set up on the shores with a collector system. A boat with a comb and boom could drive the refuse towards the collector stations. For the clean-up of the oceanic garbage

patches, it is proposed to have ships fitted with waste collector and filtration systems that feed the collected waste materials into MIPG reactors. This paper assesses the literature available on waste management and waste to energy conversion and proposes MIPG technology as the most cost-effective, versatile and efficient method of turning waste into energy and useful raw materials.

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Demand side management at a large scale water sypply system: Simulation of the Bodensee-Wasserversorgung

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1. Introduction – Water supply systems have been urged to raise energy efficiency in recent years. In a new research project on the system of Bodensee-Wasserversorgung annually supplying 125.800.000 m³ from lake Constance to its customers in Southern Germany. Pumping the water from lake Constance about 300 m up to the treatment plants before distributing takes the bulk of the 154 GWh annual power consumption. One objective of the research project is to run the facilities according to power market prices, saving energy costs, increasing the share of renewable energies of the system's power consumption. The steps of the water treatment and storage facilities are destined to evolve demand side management according to power market prices. Formerly, the pumps are run accordingly to a static two prices power procurement, respecting peak and off-peak time. However, renewable energies change the characteristic of market prices every day. We have shown how the system can be run accordingly to hourly power prices by means of unit commitment. A unit commitment model was developed including technical and operational constraints of running a water supply system.

2. Experimental - In a period of modelling, testing and interviewing the operator of the water supply system, we developed a mixed-integer linear program (MILP) of the facilities from the pumps to the distribution system feed-in with respect to the hourly accumulated system demand. The objective function is minimizing the power consumption costs accordingly to hourly spot market prices. Furthermore, grid fees were considered, that are charged depending on the peak demand of the water supply facilities during the peak times defined by the electricity system operator. We modelled the facilities step by step: The six water pumps may be operated discrete with a maximum capacity of combining four pumps at the same time. After first treatment through micro-filters that were not relevant in the MILP, the water is processed by ozone consuming power too. Thereafter, the water is hold in reservoirs of about 70.000 m³ and 80.000 m³ and conducted to sand filtration that were considered maximum flow rate and maximum change of flow rate. Finally the clean water is hold again in reservoirs before supplying two pipelines through 6 small pumps, also using height energy. Some further highlights of the MILP are, for example, modelling a minimum retention time, the combinatorial operation of raw water pumps and clean water pumps, the storage capability of the distribution system and the combined

operational reserve. The impact of demand side management as well as the effect of raising reservoir capacity were examined.

3. Results and Discussion - We have found that the facilities can be operated much more efficient in consideration of energy costs. Installing a reservoir between the micro-filters and the ozone treatment would increase the energy cost efficiency. However, we found that operating optimized to power market prices would increase the energy consumption about 1% to 2% as pumps work more often at maximum load, including more frictional loss in the pipes but with less expenses for power. Furthermore, we found that savings of grid fees were as significant as savings of energy cost.

4. Conclusions - Demand side management can be applied to minimize energy cost. That changes the principles of operating water supply systems including the goal to minimize energy consumption, raising energy efficiency. Demand side management, optimizing facilities to short-term power market prices, is furthermore an important contribution to raise the consumption of fluctuating power generated from wind and solar energy.

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How to obtain biofuel precursors from grape juice wastes?

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1. Introduction –In Spain, grape industry is the widest, and therefore, the one that generates the larger amount of by-products. The composition depends on the grape variety used, although that is mainly water (70-80%), and sugars (20%), specifically glucose, fructose and sucrose, being the rest organic acids such as tartaric, malic or cítric.[1] The main reasons for converting those residues are their low pH and their high BDO (80-89 g/L for white juice, 78-99 g/L for red juice) and high QDO (115-117 g/L for both varieties).[2]

We propose the development of a methodology for the dehydration of the sugars in the grape juice waste water, to obtain 5-hydroxymethylfurfural (HMF) and levulic acid (LA) as main products. Those chemicals have a great interest as platform compounds, with several applications in the biofuel industry among others.

2. Experimental – Preliminary studies were carried out on the pure monosaccharides (glucose and fructose). The solution (known concentration) was introduced in a microwave vessel and sealed with a cap for under pressure work. The required heterogeneous catalyst was added (see table 1) and the reaction set at 200 ^{o}C for 2-15 minutes depending on the sugar. The reaction crude was dissolved in D_2O to be analysed and quantified by NMR. The same experiments were carried out, under the optimal conditions, on several non-edible grape juices, which were provided as a similar residue to waste water sidestreams.

3. Results and Discussion – The preliminary studies with fructose and glucose showed that the montmorillonites as catalysts offer the best results (example with fructose):

Table 1. Results for the microwave conversion of 2M fructose

Exp.	Catalyst	Conversion (%)	Yield HMF (%)	Yield LA (%)	Select. HMF (%)	Select. LA (%)
1	*M-K10*	72.2	9.7	2.7	78.2	21.8

2	*M-KSF*	73.8	9.4	5.9	61.5	38.5
3	*Amberlyst 15*	27.7	1.6	0.2	90.0	10.0
4	*Amb15 10 min*	49.8	7.1	1.5	82.2	17.8
5	*Bentonite*	56.4	2.9	0	100	0
6	-	35.6	0.9	0	100	0

The reactions carried out with grape juice using montmorillonite KSF were successful in obtaining HMF and LA with a fast dehydration of fructose and a moderate dehydration of glucose. Also, the catalyst is potentially recyclable which was assessed by several experiments, showing also a moderate conversion.

4. Conclusions – In this work, we have been able to obtain HMF and LA as biofuel precursors using an alternative energy source and a potentially recyclable catalyst. Although it shows less efficiency on reusing, it is clean and cheap, and allows us to simply separate it from the reaction media.

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Energy from Pig Manure: Potential at a Farm Scale in Portugal

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1. Introduction – Pig farms occupy an important place in the livestock sector in Portugal. As the industry has evolved in the last decades, pig production has become more concentrated with a reduction in the number of producers and an increase in average farm size. From this intensive farming arise considerable amounts of pig manure which present a considerable number of environmental challenges. Animal manure, however, is widely viewed as an important source of bioenergy; in fact, its utilization as bioenergy feedstock for energy production has attracted much attention at national and local scales [1]. This is especially the case for local pig farms in Portugal as the energy content from manure can not only reduce the environmental externalities of animal production, but also provide clean energy and help alleviate financial pressure on farm owners. The main methods available for renewable energy extraction from pig manure include thermochemical and biochemical conversion processes [1]. In this study, the energy potential from direct combustion, syngas production via gasification and methane production via anaerobic digestion will be assessed on a preliminary basis. The results of this study will provide a framework for pig manure based-energy under different technological paths at a farm scale in Portugal.

2. Experimental - To estimate the energy potential of pig manure at the farm scale in Portugal, we (a) identified and classified a portuguese pig farm in terms of animal population and husbandry system; and (b) calculated the farm-specific manure production with its related combustion, syngas and biogas potential taking into account its chemical composition. The farm has a capacity for about 50.000 pigs for a total of 4.768 livestock units (LU). It is a closed cycle pig farm in an intensive production system. The annual production of pig manure is estimated to be 250 m^3/day and annual energy consumption in 2015 was 483.900 kWh/year of thermal energy and 718.525 kWh/year of electricity.

Table I. Energy potential from pig manure under three technological paths.

Pig manure (m^3/year)	Combustion	Gasification			Anaerobic digestion		
	Thermal energy (kWh/year)	Syngas yield (Nm^3/year)	Energy potential (kWh/year)		Biogas yield (Nm^3/year)	Energy potential (kWh/year)	
			Heat	Electricity		Heat	Electricity
91.069	63.648	50.971	65.880	43.920	7.843.773	3.529.698	2.353.132

3. Results and Discussion - The results of the preliminary methodology used in this work are presented in Table I and further discussed. The calculated total annual energy yield for the three conversion processes considered was 248.782 MJ/year of thermal energy, 50.971,2 Nm^3/year of syngas and 7.843,773 Nm^3/year of biogas. Direct combustion and gasification of pig manure would account for about 13% of thermal energy needs of the farm, with the added benefit of electricity production for the case of gasification (6% of total demand). Anaerobic digestion has the highest potential and constitutes the best option for on farm energy production.

4. Conclusions - The calculated potentials clearly demonstrate that the energy utilization of pig manure can have a significant impact on the energy budget at a farm level in Portugal. Specifically among the three conversion processes, anaerobic digestion of manure has the highest potential greatly surpassing the farm's annual energy needs and providing a valuable option for energy independence.

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Commissioning of Surface-flow Constructed Wetlands Dominated by Cladophora to enrich the Nutrients in diffuse domestic effluent

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1. Introduction To remove and make full use of more nutrients in diffuse domestic effluent (DDE) discharged into Taihu lake to alleviate the eutrophication, microcosm surface-flow constructed wetlands (SFCW) dominated by cladophora was applied to concentrate nitrogen, phosphorus and inorganic carbon in the effluent from a sequential anaerobic/ aerobic reactor which widely used to treat DDE around watershed of Taihu lake in Jiangsu province of china.

2. Experimental Determination of fresh weight of cladophora and removal mass of nutrients including total nitrogen (TN), total phosphorus (TP) and total inorganic carbon (TIC) to calculate cladophora biomass and nutrient loading rates (NLR). The commissioning under flow rate of 10.8 m^3h^{-1} lasted about 70 days experienced 4 sequenced stages, breeding stage, growing stage, concentrating stage, and decomposing stage, characterized by the range of cladophora biomass, 0～1.17g/L, 1.17～3.28g/L, 3.28～7.84 g/L and more than 7.84g/L. Density of microbes inhabited in cladophora assemblages for every stage also present in this paper.

3. Results and Discussion NLR tests indicated that maximum concentrating efficiency of nutrients and maximum density of microbes that could be used as fish food appeared in the concentrating stage when NLRs of TN and TP approaching 0 mg/($g^{-1}d^{-1}$), NLRs corresponded to BM6' on dash line illustrated the stimulus of dilution of cladophora on nutrient removal capacity of SFCW by doubling water depth. More than 9.14×10^{11} spirilla and many other pathogens were harbored in the microcosm SFCW during decomposition stage.

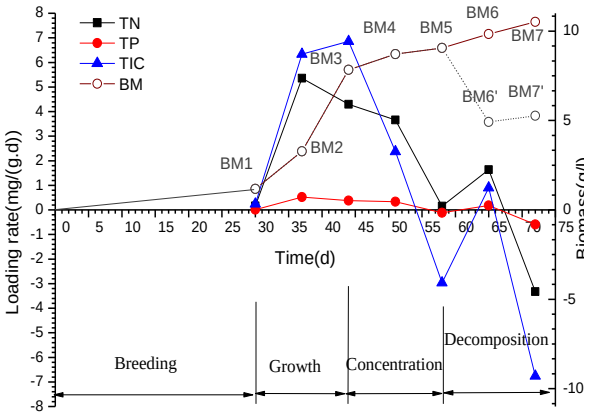

Fig 1. Cladophora biomass and nutrients loading rate during commissioning

4. Conclusions Commissioning of SFCW dominated by cladophora to enrich nutrients in DDE indicated nutrient removal and reuse can be achieved when SFCW being maintained in early or intermediate period of the concentrating stage.

5. Acknowledgements This research has been supported by the National Twelfth Five-year Major Projects (No. 2012X07101-005).

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Scientific interests: Eutrophication control, Environmental biotechnology

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Study of the electroadsorption process of Cu (II) ions

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1.Introduction.- The increased level of contamination of water due to the presence of heavy metals is a major problem for human health [1]. Heavy metals are a contaminant that generate serious problems to all bodies of aqueous medium as they are not biodegradable, have high toxicity and are bioaccumulative.
The aim of this work is to modify the porous texture and superficial groups of a commercial activated carbon through chemical and thermal treatment and subsequently study the kinetics of electroadsorption of Cu (II) ion for these carbons.

2.Experimental.- An activated carbon (AC), particle size 1.5 mm, from Merck (E. Merck Darmstadt Germany) was used as the starting material. This commercial AC underwent two treatments with the purpose of obtaining two different electrode materials. The first for heat treatment in N_2 to 900 °C (C-N_2-900). The second was obtained by treatment successively in SO_2, and H_2S at 30 °C and transport with N_2 at 200 °C (C-SO_2-H_2S-200). The chemical characterization was carried out using three tests: elemental analysis, immediate analysis, and surface functional groups analysis. The textural characterization of the AC samples was accomplished by nitrogen adsorption and mercury porosimetry.
The DC electrical conductivity (σ) was measured at room temperature by the technique of impedance spectroscopy over the frequency range from 20 to 10^6 Hz at a voltage of 1 V.

The electrodes to study were prepared from various raw materials. These raw materials were Carbon Black (Vulcan 3, V3), Polyvinylidene fluoride (PVDF) supply by Sigma-Aldrich Química S.L. and activated carbons (ACs). AC (Merck), C-N_2-900 and C-SO_2-H_2S-200 were used as materials in preparation of electrode.

The Cu (II) concentration was measured with the aid of a Perkin Elmer flame atomic absorption spectrometer, Model Thermo Corporation. In this study were tested different kinetic models, pseudo first order model, pseudo second order model and intraparticle diffusion.

3. Results and Discussion

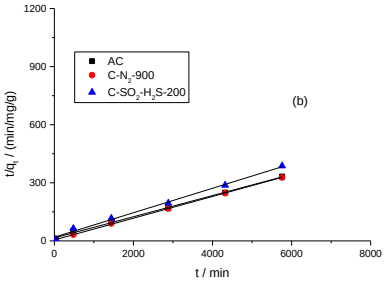

Figure 1. Graphical representation of the pseudo second order model: electroadsorption.

4. Conclusions.- The kinetics of these processes would be a pseudo second order one and with a kinetic mechanism that takes place in two stages. A first stage with the diffusion of copper ions through the limiting layer of the adsorbent and a second one corresponding to the intraparticle diffusion and union of the Cu(II) with the active sites of the carbons [2].

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Study of the adsorption process of Cu (II) ions within thermally and chemically modified activated carbon.

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1. Introduction.- Numerous recent data on the negative environmental impact of heavy metals have prompted a demand for the purification of industrial wastewater. Since heavy metals, especially, copper, zinc, cadmium, mercury, and lead, are toxic their concentration in wastewater should be reduced to environmentally acceptable levels before being discharged into the environment. In particular, copper is highly toxic because of its carcinogenic and mutagenic properties.

2. Experimental.- An activated carbon (AC), particle size 1.5 mm, from Merck (E. Merck Darmstadt Germany) was used as the starting material. This commercial AC underwent two treatments with the purpose of obtaining two different electrode materials. The first for heat treatment in N_2 to 900 °C (C-N_2-900). The second was obtained by treatment successively in SO_2, and H_2S at 30 °C and transport with N_2 at 200 °C (C-SO_2-H_2S-200). The activated carbons were characterized chemically and texturally and the electrical conductivity of them determined. The pseudo first order kinetic model, pseudo second order model and the intraparticle diffusion model were applied.

The electrodes to study were prepared from various raw materials. These raw materials were Carbon Black (Vulcan 3, V3), Polyvinylidene fluoride (PVDF) supply by Sigma-Aldrich Química S.L. and activated carbons (ACs). AC (Merck), C-N_2-900 and C-SO_2-H_2S-200 were used as materials in preparation of electrode.

The Cu (II) concentration was measured with the aid of a Perkin Elmer flame atomic absorption spectrometer, Model Thermo Corporation. In this study were tested different kinetic models, pseudo first order model, pseudo second order model and intraparticle diffusion.

3. Results and Discussion

Table 1. Kinetic parameters of adsorption .

Samples	Pseudo –first order			Pseudo –second order			Diffusion		
	q_e	k_1	R	q_e	k_2	R	C	k_{id}	R
AC	5.6	$9.7 \cdot 10^{-4}$	0.912	10.0	$7.7 \cdot 10^{-4}$	0.999	4.9	$7.6 \cdot 10^{-2}$	0.661
C-N_2-900	6.6	$1.1 \cdot 10^{-3}$	0.930	11.6	$6.4 \cdot 10^{-4}$	0.999	4.9	$1.0 \cdot 10^{-1}$	0.702
C-SO_2-H_2S-200	3.3	$1.5 \cdot 10^{-3}$	0.942	5.7	$1.5 \cdot 10^{-4}$	0.999	2.4	$5.2 \cdot 10^{-2}$	0.571

4. Conclusions.- The pseudo first-order model does not fit the data of adsorption kinetics of the Cu (II) in the prepared samples and thus the process is not entirely a first order reaction. The pseudo second order kinetic model describes well the adsorption of the Cu (II) ions according to the regression coefficients.

The kinetic mechanism takes place in two stages. The first stage represents the external mass transfer or heavy metal diffusion through the limit layer of the adsorbent, with a rapid distribution of Cu (II) on the external surface of the activated carbon. Because of the spontaneity of the adsorption process, this first part of the process can be considered fairly common to what has happened with other adsorbents [1]. The second stage represents the intraparticle diffusion and union of the Cu (II) with the internal active sites of the activated carbons.

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Urban Surface water Quality: monitoring nutrient levels and threats to water reuse

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Abstract

Introduction
The quality of surface waters traversing through many urban metropolises is under threat of degradation. This is due to indiscriminate disposal of waste from domestic, industrial and agricultural sources into the neural of urban water bodies. As a result, the capacity for self-purification of the water is hampered, and is likely to limit the effectiveness of wastewater treatment procedures in improving their quality [1-3]. Thus water needs to be evaluated in order to determine the effect of organic carbon and inorganic nutrient loads on the water quality using the chemical oxygen demand requirement as an indicator [4].

Experimental
Water samples were collected from 8 streams and rivers traversing residential, industrial and informal settlements within selected locations. The water samples were process and analysed using standard methods.

Results and discussion
Findings from the study showed that most of the surface waters were under threat of low oxygen content at circum-neutral pH (6.6 – 6.9), due to high organic and nutrient loads compared to water samples collected from the two peri-urban rivers which served as a control.
The nutrient levels in the streams/rivers ranged; Total Nitrogen (TN), 3.82 – 15.46 mg/L and $P\text{-}PO_4^{3-}$, 1.35 – 5.71 mg/L while Dissolved Organic Carbon (DOC) ranged between 24.8 and155.4 mg/L. The estimated biochemical oxygen demand (BOD) and chemical oxygen demand (COD) requirement for regeneration of the water quality were between 180.81 – 200.62 mg/L, and 250.27 –312.83mg/L, respectively. Analysis of variance showed significant differences between sampling sites as well as seasons (wet and dry) in terms of NL and oxygen levels in the evaluated stream/river waters, with higher NL values observed during the dry season.

Conclusion
Thus DO levels in almost all the investigated waters were low and in hypoxic condition. There is thus a need for regulatory intervention to ensure point of compliance necessary to boost the self-regeneration capacity of the water bodies in order to protect inland freshwater resources.

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WASTEWATER REUSE OF WEST ALEXANDRIA, EGYPT

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Due to the limited water resources in Egypt, there is growing interest in the reuse of wastewater. The wastewater Treatment Plant of west of Alexandria city (automatic system design of 460,000 m3/day) receiving raw sewage of industrial (<1.00 % of the total wastewater discharge), residential, and commercial. The plant is composed of mechanical coarse screens, grit removal chambers, scum removal units, fine screens, primary sedimentation tanks (Clarifiers), chlorination facilities, gravity thickening, and a sludge pumping station.

The effluent is discharged to the northwest of the main basin of Lake Mariuot. The plant removes 85% of the total-suspended solids (TSS), 97% of the Settleable solids, 74% of the COD, 69% of the BOD, 90% of the Grease & Oil, 52% of the Nitrate, 30% of the Phosphate, 74% of the Sulfides and 31 % of the total coliform. Despite this high performance is higher than that of the designed removal percentages, none of these parameters was compliance with the Egyptian standard limits. Therefore, to meet the Egyptian standard limits, it's important to store the treated wastewater to reach the permissible limits and to improve the effluent quality before discharging the wastes to Lake Mariuot and reuse.

Curriculum vitae

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Professional/Position: Professor of geochemistry and Vice President of the University of Sadat City.

Education: awarded Ph.D. In Geology, 1992, Post-doctoral at USGS, 1994&2004.

Scientific Interests: human and ecological risk assessment, recording the environmental condition and procedures of the environmental impact assessment, air and water qualities and industrial waste management. Stable Isotopes, Time Series, Global Changes, Environmental Remediation.

Active member and representative: Member of the World Federation for Medical Geology (IUGS) and the Regional, Director for Southern Mediterranean Medical Geology, Member of the European Geosciences Union (EGU) and Member of the Canadian Society of organic rocks (CSCOP).

Prizes/Awards: Ambassador of scientific excellence, USGS, United States of America, Award of Excellence from the National Council of Science and Technology, Executive Office of the President of the United States, Menofyia candidate for State Award of Excellence

Ph.D. & M.Sc. Theses Supervision: More than 30 students have finished their thesis and awarded their Ph.D. and M.Sc. certificates. .

Research Management Experience – Grants: I have managed more than 8 research grants that were awarded by different national and international funding agencies.

Publications: Over 40 published research articles.

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Using torrefied biomass wastes as low-cost adsorbents for methylene blue

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1. Introduction – Lignocellulosic wastes from forestry or agricultural industries are available in very significant amounts. These biomass wastes can be upgraded through torrefaction which is a thermochemical conversion process (200-300°C) that can remove moisture and volatile matter whilst rearranging the structure of the material, favoring its stability and hydrophobicity [1]. The bio-chars resulting from the torrefaction process can be used as low-cost adsorbents in order to remediate contaminated effluents containing significant concentrations of organic and inorganic pollutants. Activated carbon is generally used in effluent treatment but it is an expensive adsorbent with low regenerability. This work aims to test the adsorption properties of bio-chars produced by torrefaction of lignocellulosic wastes from the furniture industry and from a waste management company. Methylene blue (MB), a very common contaminant of industrial wastewaters, was used as the model dye for the adsorption experiments.

2. Experimental – Two different biomass wastes were grinded and sieved to 250 µm in order to produce bio-chars. Torrefaction was performed at 200 and 250 ºC during 60 minutes, using closed-lid crucibles in a muffle furnace (Naberthern). Methylene blue (Panreac) solutions were prepared with deionized water. Adsorption batch experiments were performed varying the adsorbent/dye ratio, contact time, pH and dye concentration. Final MB concentrations were determined through UV-Vis Spectrophotometry (Biochrom Libra S4) at 668 nm.

3. Results and Discussion – Both biomasses presented good adsorption properties without any thermal treatment, showing removal efficiencies of MB above 92%, for an initial MB concentration of 100 mg/L, and an adsorbent dose of 0.2g. After thermal treatment at 200ºC and maintaining the same experimental conditions, these removal efficiencies increased to 94.9% (for the furniture industry biomass) and 98.5% (for the waste management biomass), which is very close to values obtained using commercial activated carbon (99.9%). At the highest torrefaction

temperature, the removal efficiencies decreased due to the extensive rearrangement that occurs in the lignocellulosic structure at that temperature, removing the binding –OH groups from its surface. Furthermore the MB adsorbed at torrefied biomasses may be recovered by elution with aqueous acid in a much larger extent than from activated carbon, enabling the recovery of the dye and the regeneration of the adsorbent material.

4. Conclusions – The torrefaction of biomass wastes converts them to low-cost adsorbent materials with a good affinity for cationic analytes. The adsorption process is fast and reversible indicating that the dominant analyte interactions occur with functional groups from the bio-char surface. These bio-chars have a better adsorption efficiency than the original biomasses and are less susceptible to chemical or microbial degradation because of their low water content.

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Zeolite Membrane Scale-Up for Desalination

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The lack of sufficient available water resources has already affected every continent and thus represents a significant global problem. The concern about the water availability is in continuous growing and now has reached unsustainable levels. In fact, the drought, the water overuse and the pollution and exploitation of groundwater aquifers and surface water have led to a decrease of quantity and/or quality of available natural water resources in many countries [1].
Membrane technology has emerged, in the last years, as the main contributor to solve water shortage problems. In particular, membrane distillation have attracted increasing interest in applications related to the water treatment, such as desalination of seawater or brackish water and drinking water purification [2]. In this field, zeolite membranes, due to their crystalline structure and to their pore diameters close to molecular size of different species, have gained a growing importance.
In this work, for the first time, tubular silicalite membranes with a length of 30 cm were prepared using the secondary growth method coupled with the cross flow seeding procedure. Subsequently, the prepared membranes were characterized and then applied in desalination process by vacuum membrane distillation (VMD) to verify if their performance were comparable respect to those obtained for shorter membranes [3]. Deionized water and NaCl solutions at different concentrationswere used as feed.
The obtained results showed that is possible to reach a good reproducibility in the preparation of uncalcined defect-free membranes and aremarkable performance in desalination by VMD up to 50 g/L of NaCl.

Acknowledgements
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Non-catalityc and catalytic glycerin Reforming in a pilot plant. Infuence of variables

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1. Introduction –

Biodiesel is obtained by direct transesterification of vegetable oils and tallows; this process involves the alcohol (glycerol) displacement of the triglyceride structure, by means of the incorporation of another short alcohol chain (methanol or ethanol). Glycerin ($C_3H_8O_3$) is a byproduct obtained in the transesterification process in the biodiesel industry. An estimation ratio could be producing 10 kg of glycerin every 100 of biodiesel. However, glycerin obtained from these industries is usually contaminated with traces of metals and sales (fundamentally K_2SO_4), and this makes it necessary to subject this material to costly cleaning processes, which are usually more expensive than the value of the glycerin itself [1]. Many applications have been suggested for the glycerin, among the most usual are the production of cosmetics and personal care products, medical applications, as lubricant, etc. The increase in the worldwide biodiesel production has also indirectly provoked an overproduction of glycerin, difficult to be adsorbed by the markets before cited. Among the alternative uses of this product its energetic exploitation might be considered via gasification process [2].

With the aim of providing more insight into this topic, this work is focused on the study of steam gasification of glycerin (diluted in water) in order to produce a hydrogen-rich gas, making a systematic investigation on the influence of the temperature, water/glycerin volumetric ratio and inlet feed flow. The novelty of this work is that it uses glycerin obtained from real biodiesel production processes, instead of the pure chemical, as it is the case on most research studies.

2. Experimental – The experimental process was carried out in a pilot plant operating in continuous feeding, designed for controlling the different variables of the process. This plant consists of: glycerin drying reservoir, peristaltic bomb, reactor, heating system and temperature control, heat exchanger, distiller, stirrer system, refrigerator and electrovalves. A scheme of this pilot plant has been published elsewhere [2]. The raw glycerin used was obtained directly from a Green Fuel Extremadura Biodiesel Plant located in Los Santos de Maimoina, Badajoz (Spain). The previous characterization of the glycerin was carried out. The composition of the gas produced (H_2, CO, CO_2 and CH_4) was analyzed by gas chromatography (GC), using two gas chromatographs (HRGC 4000, KONIK, Miami, FL, USA) and two columns, Porapak Q and Carboxen, with different carrier gases: N_2 and He, respectively.

3. Results and Conclusions – According to previous tests, the optimum time to take gas samples was 1 h 20 min, thus the reaction was stabilized and the air percentage in the gas was drastically reduced. The influence of ratio water/glycerin in wt% (0.7-2), flow rate (14 and 30 ml·min^{-1}) and temperature (750, 850 and 950ºC) on produced syn-gas flow rate, generated power and hydrogen molar fraction for non-catalytic reforming was studied. In the case of catalytic reforming the catalyst used was $La(NO_3)_3.6H_2O$ prepared over rings of Al_2O_3 with a concentration of 5% (w/w), and the catalityc runs were done at 0.7-1.2 wt% water/glycerine, flow rate 30,40,45 ml/min and temperature conditions of 650,700,750 and 800ºC.

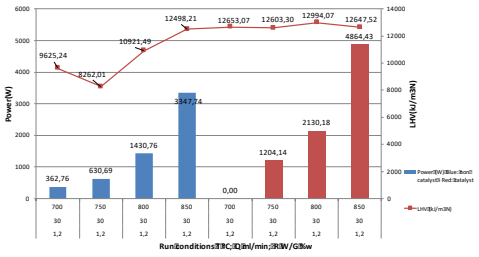

Figure 7. Values for LHV and Power and catalityc effect. *Power null means neglible flow rate

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International Congress on Water, Waste and Energy Management
Rome (Italy), 18-20 July 2016

An Energy and Economic Investigation of Biogas Exploitation Routes

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1. **Introduction** – The EU targets set by The Renewable Energy Directive (2009/28/EC) should reach 20% energy share from renewable sources by 2020. Thus, exploring alternative environmentally benign and energy efficient systems has become the focus of governmental policies and industrial as well as academic research. Biogas is a renewable energy source that can be produced from the anaerobic digestion of biomass, such as sewage sludge, municipal solid waste, agricultural wastes, and energy crops. The use of biogas for energy production would considerably reduce waste volumes in EU landfills as well as decrease dependence on imported energy [1]. There are various utilization pathways of raw and upgraded forms of biogas [2]. The aim of the project is to study the feasibility of the applicability of Fischer Tropsch (FT) in a coupled system for generation of liquid fuels from biogas. Following experimental analysis, an energy efficiency and economic investigation of various exploitation options (e.g. CHP, upgrading, ICE, injection to gas grid) for electrical generation was conducted. The economic investigations were based on current technologies and associated costs based on a 250KWe plant size.

2. **Experimental:** Efficiency multiplicative model was used to asses various exploitation routes. Economic analysis was investigated based on Return on Capital Employed (ROCE). Whereas, lab testing was carried out using a 30 cm quartz tube with 12mm ID and the Fischer Tropsch reaction took place at 210 ^{o}C and 1 bar with 2:1 H_2:CO using a commercial catalyst.

   Results and Discussion - Overall efficiencies showed the lowest values for liquid fuels via FT (~11%). However, liquid fuels have the highest energy content amongst other fuels and particularly in Northern Ireland there is a high demand on liquid fuel as most households do not rely on gas grids and use oil as their main

heating fuel. The current tariff system allows direct use of biogas in a CHP to be the only sustainable route (>12% ROCE) achieving a return of up to 22%. Liquid fuel was successfully produced at P=1 bar and T=210^{o}C with higher selectivity to liquid fuels within 1 week, proving potential small scale applicability

3. **Conclusions** - FT process is proven operational on an industrial level at elevated pressures which does not match the small scale biogas plants that are implemented in Northern Ireland. Currently, FT is unsustainable at small scale. Introduction of incentives and tariffs would dramatically increase profitability. There is an urgent need for scalability for smaller plants to become viable. Recommendations are made for the most effective route for biogas utilization in terms of economic viability and energy efficiency

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A Gis Based, Spatial Multi-Criteria Evaluation For Selecting Landfill Sites In Kirklareli (In Thrace Region)

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Kırklareli Province has natural conservation areas, wetlands, which are important bird habitats and lie along migratory birds' resting places, breeding and feeding grounds, including Europe's largest waterlogged forest, Maritza and west Black Sea water basin, fertile agricultural lands with rich aquifers. Two districts of the province have shores on the Black Sea. There are also endangered species in the red list among the inhabitants of the area, which require strictly protection. In this context, the province has one of the most important ecosystems in Turkey. The province's population rate increase generally lies below Turkey average. The increase in the urban population, how minor it may be, is among the most affecting human pressures, resulting in degradation of the natural resources and environment. This event has ushered the necessity to select sites for solid waste disposal in the past few decades, in order to develop environmental sustainability. Nevertheless anthropogenic pressures should be kept in balance with economic development, due to the fact that the ecosystem of the region is too valuable. While selecting the location of the solid waste disposal, one should consider a wide range of territorial and legal factors, in order to reduce negative impacts on such a valuable ecosystem and natural resources in the region. Some of the potential environmental impacts from solid waste management activities are the degradation of environmental resources, the creation of greenhouse gas emissions and other air pollutants, the contamination of ground and surface water, various health hazards, the discouragement in tourism and other business. Facilities near sensitive ecosystems or natural areas must ensure that their produced waste does not have a negative impact on the adjacent ecosystems.

A spatial multi-criteria evaluation methodology is utilized to assess land suitability for solid waste disposal sites. Values were assigned for their relative importance of the sub-criteria and criteria for spatial data analysis by Geographic Information Systems (GIS). This paper aims to exhibit a multi-criteria decision analysis alongside a geospatial analysis for landfill sites selection with minimal negative impacts on the environment in Kırklareli Province, western Turkey. The process of selection sites is specified on a scale based on territorial indices that measure the risk of contamination for many environmental components, including: surface water, land use, soil,

waterlogged forests, natural areas, special habitats and human health etc. Finally, alternative sites were suggested to the existing disposal site with the consideration of the natural values, the sensitive ecosystem, the sustainability of human activities and economic variables applied by GIS-based analysis.

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Torrefaction pre-treatment for upgrading an industrial waste containing biomass and polymers

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Image 1. Industrial polymer and biomass

1. Introduction – Material and energetic valorization of industrial wastes have been established as one important tool to achieve the goals defined by the European Union and promote a circular economy, with more efficient use of resources and reduction of energy costs. Most of the industrial wastes are composed of polymeric and lignocellulosic mixtures with high energetic value but with some limitations regarding their heterogeneity. Torrefaction can be used as a pre-treatment for polymeric and lignocellulosic mixed wastes with the aim of reducing the water content, and increasing density and calorific value. Simultaneously, this process improves raw material grindability, leading to greater ease of processing, transportation and storage [1]. This work intends to evaluate the potential of the torrefaction as a unit operation for upgrading polymeric and biomass mixed wastes and characterize the obtained chars in terms of composition, calorific power and adsorption properties.

2. Experimental – Torrefaction was tested at four temperatures (200°C, 250°C, 300°C and 350°C) and three residence times (15, 30 e 60 minutes). Proximate and ultimate analysis were carried out for the raw material and the produced chars. The biomass fraction of the raw material was determined through the selective dissolution test. The chars' granulometry was assessed by their particle size distribution as well as the chars' adsorption capacity for methylene blue dye.

3. Results and Discussion – The proximate and ultimate analysis of the raw waste are represented in tables I and II, respectively. The waste is a mixture of cork and polymeric materials that decomposes at relatively moderate temperature resulting in a very low percentage of fixed carbon; the char yield after torrefaction ranged from 62.7% to 97.3%. The biomass/polymer fraction of the raw waste was 1:5.5. After torrefaction, the waste became more grindable and the bulk density was reduced. Moreover, the adsorption of methylene blue was relatively efficient for chars produced at lower temperatures (200°C;30min.) with removal efficiencies of 64,5%, for fast adsorption tests and of 95,3% for adsorption tests at 24h contact time.

Table I: Raw waste proximate analysis

Proximate analysis	
Moisture (%wt, wb)	4.8
Volatile matter (%wt, db)	68.3
Ash (%wt, db)	29,7
Fixed carbon (%wt, db)	2,0

Table II: Raw waste elementar analysis

Elementar analysis	**(%wt, db)**
Nitrogen	0.6
Carbon	42.6
Hydrogen	5.6
Sulphur	0.0

4. Conclusions – Torrefaction improves the physical characteristics of the raw lignocellulosic/polymeric mixed wastes. The produced chars have a high carbon content but also a high ash content, what may limit their calorific value. On the other hand they present a good potential to adsorb cationic compounds even without any previous activation what may constitute an alternative for their valorisation.

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Remediation of landfill leachates using bottom ash from mixtures of biomass and RDF

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1. Introduction – Sanitary landfilling is still recognized and used as a viable waste management strategy to deal with urban and industrial solid wastes throughout the globe [1][2]. Despite the ease of implementation and environmental benefits that a sanitary landfill represents, generation of landfill leachate is a consequence of this waste management practice and its remediation involves substantial resources. Landfill leachate is mainly characterized by a dark strong color, bad odor and significant values of COD, ammonia nitrogen and heavy metals. Due to these characteristics, landfill leachate needs to be treated before being discharged into water bodies or land and this treatment may be complex and expensive. Bottom ash is a by-product from the combustion of solid fuels that is produced in significant amounts and valorized by incorporation in construction materials or used in soil amendment. When in contact with aqueous effluents, ashes dissolved partially, causing a significant raise of the solution pH. These conditions favor the formation of aggregates between the organic and inorganic components of effluents and ashes, leading to their partial coagulation and precipitation. This work aims to test the remediation of an industrial landfill leachate using bottom ash from the combustion of solid biofuels in a ceramics production company.

2. Experimental – Landfill leachate was collected from a non-hazardous industrial landfill. Batch experiments were performed varying the ash mass ratio, contact time, particle size distribution and agitation system. For each experiment COD, optical density (600 nm), pH, conductivity and total solids were monitored. All the tests were executed with replicates and according to the methodology described in Standard Methods for the Examination of Water and Wastewater.

3. Results and Discussion – Three different ash to leachate ratios were used (4, 6 and 8 g for 50 mL of leachate). Using a moderate ash mass ratio (6g/50 mL), with overhead agitation, a contact time of 24h and a particle size distribution of <500µm, resulted in a 50% decrease in COD values relatively to the raw landfill leachate. Optical density decreased significantly, achieving a 95%

color removal for the same conditions. The dissolution of the mineral component of the bottom ash led to an increment in total solids and conductivity of 17.5% and 30%, respectively.

4. Conclusions – This low-cost approach can represent a pre-treatment step in landfill leachate remediation. It can be combined with other biological/chemical treatments in order to further decrease critical discharge parameters, representing no added costs to the process, since most waste management companies are also responsible for disposing of bottom ash from different industries.

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Rome (Italy), 18-20 July 2016

Characterisation and activation of biochars obtained by pyrolysis of vegetable oils

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1. Introduction – Biochars are secondary products of thermochemical processes such as pyrolysis or gasification and their valorisation as biofuels, biomaterials or soil additives is of great importance in a bio-refinery approach.
The composition of the biochars depend on the nature of the raw materials subject to pyrolysis and on the conversion conditions selected. Biochars with a high carbon content may be valorised as fuels or soil correctors and the biochars with a well-developed microporous network and a high superficial area may be used as adsorbents for remediation of different effluents.

The pyrolysis of vegetable oils aims at producing bio-oils that may be refined and upgraded to yield liquid biofuels but in many operational conditions also originates solid products (biochars) with energetic or material value. In this work we performed the characterisation of biochars produced by pyrolysis of lipid wastes or mixtures of lipid wastes and lignocellulosic materials, to evaluate their composition and potencial valorisation as solid biofuels.

2. Experimental – The biochar samples were obtained by slow pyrolysis of two lipid wastes (sunflower oil, SO and used waste cooking oil, WCO, or WCO with incorporation of 9% to 38% of pine biomass wastes). Pyrolysis was performed in a batch reactor (Parr Instrument Company, USA), at different residence times and using reduced pressure or a methane atmosphere, with initial pressures from 2 bar to 6 bar. The pine biomass wastes were sieved to a granulometry lower than 500 μm before use. The different biochars were characterized by determination of the gross calorific value (IKA C200), elemental analysis (Thermo Scientific Flash 2000), thermogravimetric analysis (Perkin Elmer STA 6000) and mineral composition (X-ray fluorescence (XRF), Thermo Scientific Niton XL3t Goldd +).

3. Results and Discussion – The increase of the pyrolysis temperature or residence time contributed to an increase in the biochar yield obtained in the experiments with vegetable oil wastes; this behaviour is coherent with nature of the processes leading to biochar formation, which are condensation reactions between the pyrolysis primary products. Nevertheless, biochar yields higher than 10% were only obtained for the mixtures of vegetable oils and pine biomass wastes.

The contents of C, H and O of the biochars obtained from lipid materials are respectively 64.1-85.7, 9.3-29.2 and 3.9-5.8% w/w. The values of the gross calorific value were 32.6-39.4 MJ/kg for the SO derived chars and 30.8-34.9 MJ/kg for WCO derived chars. Increasing the relative amounts of pine biomass in the mixture subject to pyrolysis, resulted in an increase both in the biochar yield and in their gross calorific value what may result from recombination reactions between oil pyrolysis products and biomass pyrolysis products, to yield components with a higher carbon content than those obtained from biomass alone and with a higher molecular weight than those obtained from vegetable oils alone. The mineral composition analysis revealed significant concentrations of Mg, Al, Cr, Ni and Fe especially in the biochars derived from WCO, indicating some degree of contamination with materials used in their processing.

4. Conclusions – The biochars produced in the pyrolysis of lipid wastes showed excellent energy characteristics higher than bituminous coals [1] very close to the liquid petroleum fuels. Although the biochar yield in the pyrolysis of lipid wastes is low (<5 %w/w), the mixture with lignocellulosic biomass contributes to an increase in the yield and calorific value of the obtained biochars.

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Adsorption of cationic and anionic dyes in biochars obtained by gasification of different biomass wastes

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1. Introduction – Dye residues from textile and paper industries are produced in large scale quantities and create significant problems for natural water streams due to their high toxicity and stability. They can be effectively removed by adsorption using activated carbon, but the high costs of acquisition and regeneration have gradually limited its application [1]. Many works focused on the search of new low cost adsorbents and have confirmed that chars from gasification of biomasses have interesting adsorption characteristics, although intermediate treatments like chemical activation are often necessary to improve their performance [2]. This work explores the adsorption characteristics of four types of chars from gasification of biomass wastes, using two dye models (Methylene Blue (MB) and Methyl Orange (MO), simulating cationic and anionic compounds, respectively). The biochars that efficiently adsorb methylene blue and methyl orange probably possess a well-developed microporous structure that enables an efficient retention of cationic, anionic or neutral components by adsorption in micro and mesopores.

2. Experimental - Biochars were obtained by gasification of acacia biomass, olive bagasse and various other lignocellulosic materials in a pilot gasifier. These biochars were decontaminated by extraction with acetone and hexane and dried at 105ºC, overnight. The crude and decontaminated biochars were added to solutions of MB and MO with a concentration of 100 mg/L in a proportion of 5 g of biochar/L of dye solution. The mixture was homogenized, centrifuged and decanted. The solution absorbance was measured at 664 nm for methylene blue and 464 nm for methyl orange. The process was repeated for a contact time of 24 h of permanent agitation before centrifugation.

3. Results and Discussion – In the experiments of instantaneous adsorption, the acacia biochar collected in the reactor showed a very good adsorption behaviour with removal efficiencies higher than 95% for both dyes, even before decontamination. The acacia biochar collected in the cyclone also presented instantaneous removal efficiencies higher than 50% for both dyes. For longer adsorption times (24h), all acacia biochars had removal efficiencies higher than 94% for both dyes. The adsorption of both dyes by olive bagasse biochars improved from 9% to 64% for methyl

orange and from 30% to 47% for methylene blue when the contact time was increased for a few seconds to 24h, indicating that they have a different structure and probably different adsorption mechanisms. A similar behaviour was observed for the mixture of different biochars.

4. Conclusions – Gasification biochars may have a high potential for use as activated chars but the nature of the materials subjected to gasification and the operational conditions can strongly influence their adsorptive capacity. Contact time and decontamination procedures improve adsorption capacity.

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International Congress on Water, Waste and Energy Management
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Sonochemical Oxidation of Neonicotionids pollutants. Influence of Operating Conditions.

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1. Introduction—Neonicotionids, systemic insecticides, can be classified into one of three chemical groups, the N-nitroguanidines (imidacloprid, thiamethoxam, clothianidin and dinotefuran), nitromethylenes (nitenpyram) and N-cyanoamidines (acetamiprid and thiacloprid. Neonicotionids are often present in wastewater treatment effluents, rivers, lakes and groundwater. The advanced oxidation methods, like ultrasound, find a promising future in the area of wastewater treatment [1],[2].

The purpose of the present work was to examine the sonochemical degradation of aqueous solutions of four neonicotionids (imidacloprid, thiacloprid, thiamethoxam and acetamiprid) to evaluate the influence of several parameters of the ultrasound process (ultrasonic frequency, power and relationship pulse length -pulse pause) on removal efficiency

2. Experimental- An ultrasound multifrequency generator (MEINHARDT ULTRASONIC) connected to a stainless steel-made transducer (E 805/T/M), operating in continuous mode at frequencies of 578, 860 and 1140 kHz , electric power output of 20, 40 and 60%, and variable pulse length -pulse pause were used for the sonication experiments. Reactions were carried out in a 0.5 L cylindrical glass reaction vessel. Cooling of the reaction mixture was achieved by circulating water, so as to maintain an average temperature of 15 ± 2 °C. In all cases, aqueous solution Neonicotionids (5 ppm each one) were prepared and subjected to ultrasonic irradiation. The samples, periodically withdrawn from the reactor, were analyzed by HPLC.

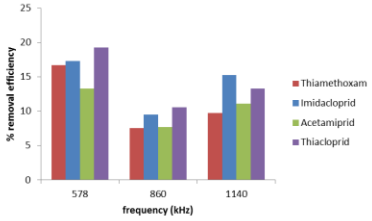

Image 1. Influence of ultrasonic frequency

3. Results and Discussion – The effect of operating conditions, such as ultrasonic frequency (from 578 to 1140 kHz), ultrasonic power (from 20 to 60%) and relationship pulse length-pulse pause (from1:1 to 3:1) was studied.

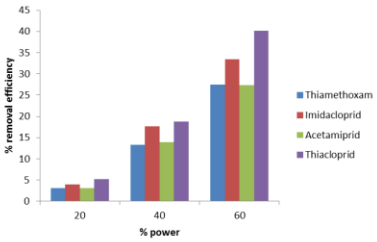

Image 2. Influence of ultrasonic power

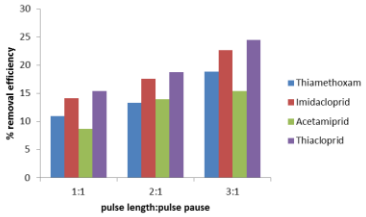

Image 3. Influence of relationship pulse length-pulse pause

4. Conclusions –Ultrasound process can promote the oxidation of Neonicotionids in relatively dilute synthetic solutions and the extent of degradation strongly depends on the operating conditions. Ultrasonic treatment alone may not be suitable for decontaminating completely Neonicotionids solutions. However, process efficiency may be improved by coupling with other chemical treatments.

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International Congress on Water, Waste and Energy Management
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BDD-Electrochemical Oxidation of Neonicotionids pollutants. Influence of Operating Variables.

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1. Introduction— Insecticides Neonicotionids are widely used in nurseries and, actually, they are replacing old cholinesterase inhibitors in veterinary products and in urban pest control. Neonicotionids are water soluble and their half-life or persistence in soil varies greatly among the neonicotinoid compounds depending upon the soil type, vegetation, and weather condictions. Loss of Neonicotionids from agricultural soils is presumably via degradation or leaching in soil water. In this way, Neonicotionids have been detected in groundwater, stream, storm-water ponds and tidal creeks. As a consequence of their high water solubility and persistence in soil they pose a risk of water contamination [1].

The purpose of the present work was to examine the BDD Electrochemical degradation of aqueous solutions of four neonicotionids (imidacloprid, thiacloprid, thiamethoxam and acetamiprid) to evaluate the influence of several parameters (current density, concentration of supporting electrolyte) on removal efficiency.

2. Experimental- Electrochemical oxidation trials were carried out in a single-compartment electrochemical flow cell working under a batch operation mode [2]. Diamond-based material was used as anode and stainless steel (AISI 304) as cathode. Both electrodes were circular of 100 mm diameter with a geometric area of 78 cm^2 and an electrode gap of 9 mm.

Electro-oxidation experiments were conducted at galvanostatic mode. A thermo-regulated water bath was used to maintain a constant temperature (15 ± 0.1ºC). The effect of operating conditions, such as current density (from 12.82 to 38.46 $mA \cdot cm^{-2}$) and concentration of supporting electrolyte (from 2.5 to 7.5 g/L) was studied. In all cases, aqueous solution Neonicotionids (5 ppm each one) were prepared. The concentration of each Neonicotionids present in each sample was determined by HPLC.

3. Results and Discussion -The effect of operating conditions, such as current density (from 12.82 to 38.46 $mA \cdot cm^{-2}$) and concentration of supporting electrolyte used in this investigation, Na_2SO_4 (from 2.5 to 7.5 g/L) was studied.

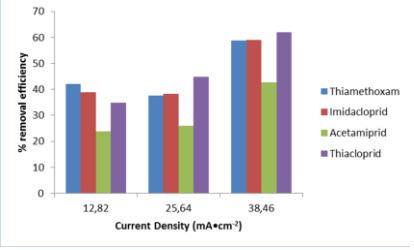

Image 1. Influence of current density

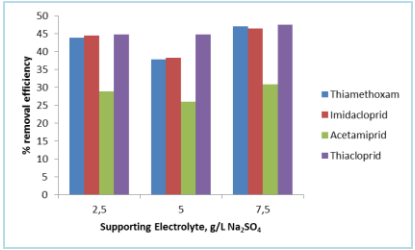

Image 2. Influence of concentration of

4. Conclusions –Electrochemical Advanced Oxidation of Neonicotionids on Boron-Doped Diamond Electrodes in aqueous solution has been studied, in order to establish the influence of operating variables. Electrochemical Advanced Oxidation of Neonicotionids on Boron-Doped Diamond Electrodes process can promote the oxidation of Neonicotionids in relatively dilute synthetic solutions and the extent of degradation depends on the operating conditions.

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The alchemy of waste: a contribution to sustainability

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Modern societies face two main challenges to their sustainable development: how to ensure resources to sustain population growth and how to manage the diverse waste-flows continuously produced by the growing populations.

The resources needed for development include water, food, energy and raw materials for various industries, but the processes of obtaining each of these resources can be conflicting.

Some examples are the excessive use of water in food production that may impair the availability of drinking water and the excessive use of fertile land for the production of energy crops which may compete with food production.

On the other hand, the amount and diversity of the resources needed by the societies grow as they become more developed, creating large differences in what concerns resource availability and use, among different populations.

Also the more developed countries are the ones that generate larger and more diverse amounts of waste, that must then be dealt with, representing a considerable burden on their populations and on their economy.

Waste recycling together with advanced valorisation processes such as composting or anaerobic digestion aim at removing as much waste as possible from the one that is still deposited in landfills.

Nevertheless, there is a large fraction of the waste that is not recyclable or adequate for other valorisation pathways, that often represents the majority of the waste produced.

Therefore there is a need to implement efficient processes that could be applied to different wastes, taking into account their different characteristics of water content, mineral composition, presence of hazardous components and biodegradability.

Given the complexity and variety of the wastes produced, these advanced processing methodologies should combine chemical and thermochemical processes, bioremediation, biovalorisation and material science techniques so that they could be classified as zero waste technologies.

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Biological activated carbon: effective technology to remove persistent micropollutants from wastewater

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1. Introduction. The biological activated carbon (BAC) is unique technology, where adsorption, desorption and biodegradation occur simultaneously; however, application to remove micropollutants is not well developed [1]. In this research we present results from experiments with specially acclimated biomass from industrial bioreactor. Attention was paid for metoprolol (MET) biodegradation and adsorption-desorption. Therefore, experiment results were combined with reactor runs in the laboratory.

2. Experimental. Adsorption, desorption experiments were done with Norit GAC 830 Plus activated carbon (AC). 0.4 g/L of carbon were weighted in triplicates to serum bottles and equilibrated with MET concentrations: 4, 16, 64, 256 mg/L. Biodegradation tests were performed with special biomass from industrial BAC reactor (Nieuw Amsterdam, the Netherlands), using the same concentrations as in adsorption-desorption experiments. Reactor runs were performed under conditions which are listed in a Table I.

Table I. Experimental conditions

Parameter	Value
Temperature, °C	20
Dissolved oxygen, mg/L	4
Total dissolved salts, g/L	<1
MET conc., mg/L	1÷200

3. Results and Discussion. The best fit of adsorption-desorption data was observed using Freundlich adsorption model. The maximum carbon adsorption capacity (K_f) of MET was 62 mg_{MET}/g_{AC}, showing high affinity (Image I, A); therefore, after desorption K_f value was 92 mg_{MET}/g_{AC}, indicating that there is hysteresis between isotherms. Hysteresis is an important factor for AC bioregeneration.

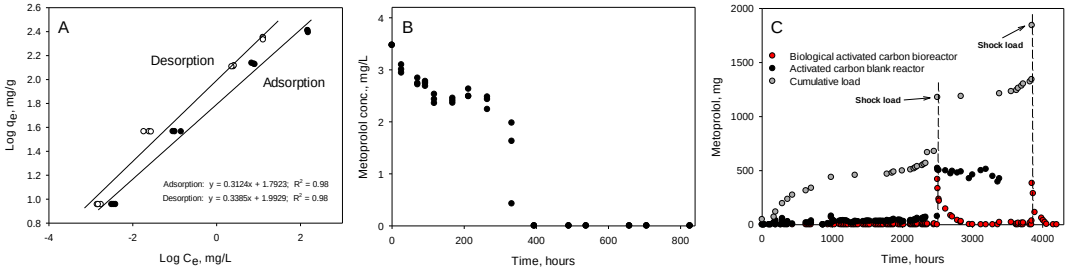

Image I. Metoprolol adsorption-desorption on virgin carbon (A), biodegradation (B) and removal in BAC reactor (C)

The biodegradation experiments showed that MET is biodegradable; biodegradation rate was 18.3 □g per 1 hour (Image I, B). Bioreactor experiments showed that after carbon saturation in a blank reactor, the BAC performance was still good – over 97% metoprolol was removed (Image I, C). The phenomenon that can explain great BAC performance over activated carbon reactor is bioregeneration [2]. Biomass is able to regenerate activated carbon and can prolong the lifetime of the adsorbent. Moreover, BAC system can eliminate toxic compounds and absorb shock loads.

4. Conclusions. The adsorption, desorption and biodegradation processes are the main driving forces in BAC reactor. Because of biomass present, MET loaded AC can be bioregenerated, therefore the lifetime of carbon increases. In this work max carbon capacity was 62 mg_{MET}/g_{AC}, while biodegradation rate was 18.3 □g per 1 hour. Bioregeneration of carbon occurred in a BAC reactor – the blank reactor showed complete saturation while BAC still removed MET.

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Application of Dummy Regression in The Land and Parcel Valuation

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1. Introduction – The soil is determinative basic function both production factor and settled lives. Thus the soil remains on the agenda of economic social and law until today. The soil is the most important part of mankind because it has the some natural property and it is cannot be produced source. The added value arises as a result of the using of the soil in urban and rural area. The parcel and land valuation is depends to economically rant, the economically rant depends on the position, the position depends on suitability, the suitability depends on closeness. The closeness concept is the spatial closeness to economical centre [1]. In the last years, depending on Turkish economic situation, the increasing had occurred in residential investment. Therefore the parcel and land valuations applications increased. However, the valuation has disadvantages so the applications have not general systematic and evaluated of all reals have been realized by considering differently. In this case before the mathematics solution is done, the factors effects on the real value must be determined locally.In this study, the different city of Turkey (Samsun and Antalya) was made the multivariable regression application to monitor regional variation of the parcel and land valuation.

2. Experimental - The most commonly used methods in the real estate valuation are sales comparison, income, cost methods, Nominal Method, Statistical Approaches [2]. Many variables are qualitative in land and parcel valuation process. Thus, the dummy variables must be used in regression analysis of the valuation [3-5]. The location as district and zoning status are qualities, the area is quantities from the variables selected for this study. The 10 examples of different variable combinations, totally 60 examples are obtained from the internet sales sites for Samsun and Antalya.

mage 1. The case study area (Samsun - Antalya)

3. Results and Discussion - The dummy regression analysis was realized for these examples by using Minitab 16 software and the results were given in following.

$$Value_{Samsun} = -5{,}86 + 19{,}71 * D0 + 49{,}11 * D1 + 98{,}74 * D2 + 0{,}055 * Area$$

$$Value_{Antalya} = 294{,}20 - 591{,}77 * D0 - 652{,}55 * D1 + 571{,}40 * D2 + 0{,}116 * Area$$

The zoning status and area are increasing effect on valuation process.While the first district (İlkadım) has not significant effect on valuation process in Samsun dummy regression analysis, the other districts (Atakum – Canik) have significant effect. The location variables have got the negative coefficient. It is said that the changing of location variable is not increased the value of

land and parcel in Antalya. Therefore, the most valuable land and parcels are located in Canik for Samsun; in Konyaaltı for Antalya.

4. Conclusions - At the end of this study, according to selected variables, the lands and parcel value is more in Antalya than Samsun. The most attracted district is Konyaaltı for Antalya. The land and parcel valuation process must carry out using mathematical models. For realistic valuation the variables number must be increased and the suitable mathematical methods should be investigated.

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Effect of ultrasound pretreatment on the anaerobic codigestion of rendering waste streams and pig manure.

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1. Introduction – Until recent days, the customary treatment of animal by-products not intended for human consumption was directed primarily to the use of certain fractions as animal feed. However, current legislation affecting removing of these products restricts its use as animal feed because of health reasons, but enables the implementation of new technologies for their treatment, opening a wide field of work for the energy recovery using anaerobic digestion and the subsequent use of the digestate as a fertiliser source. Under these circumstances, this paper aims to demonstrate a sustainable alternative to the management of pig carcasses and manure, addressing current environmental problems derived from its management and valuing these waste streams through its transformation into biofuels and organic fertilisers, with the corresponding environmental and socio-economic added value. Four streams and their mixtures have been considered for anaerobic codigestion in this paper, all of them generated during pork meat processing or in related industrial activities: flour (FL), process water (PW), pig manure (PM) and glycerine (GL). Sonication has been tested as a pretreatment method to improve methane production and anaerobic biodegradability of the studied agro-food waste streams and their mixtures.

2. Experimental - In order to study the biomethane potential and biodegradability of these waste streams, and the influence of the ultrasound pretreatment, batch experiments of sonicated and not sonicated samples were run in glass serum bottles with a liquid volume of 300 mL (1000 mL of total volume). All the experiments were developed at 37±1 ºC in a thermostatic room, at an initial pH 7.2 ±0.1 and continuously stirred on a shaking-table (adjusted 125 rpm). Anaerobic sludge from a sugar factory digester, with a concentration of 34±1 gVS L-1 was used as inoculum for the anaerobic assays. The concentration of the inoculum in all the assays was 5,0±0,5 g/L and substrate/inoculum (S/X) ratio was 0,50±0,05 gVSwaste/gVSinoculum. All the assays were conducted in triplicate.

3. Results and Discussion - The study shows that animal by-products are substrates to be considered in the process of biogas production, but they are high in fat and protein what causes inhibition by long chain fatty acids and/or ammonia accumulation. This could paralyze the process.

The codigestion of these products with waste streams such as pig manure and wastewater from rendering processes, together with the use of ultrasounds as a pretreatment method, favours the

anaerobic digestion, limiting the amount of flour in the mixture to co-digest, which should not exceed 10%. The proportion of other tested substrates is less critical, because different mixtures reach similar values of methane generation. The presence in the mixture of process water contributes to a quick start of the digester, something very interesting when operating an industrial reactor. The analysis of the digested fraction reveals that this can be suitable for agricultural recovery, since it is free of pathogens and the remaining nitrogen and phosphorus content is high.

4. Conclusions - Summarising, the results so far show that the codigestion of meat by-products) with effluents generated in the carcasses rendering process plus pig manure is a viable way and a profitable alternative to manage these waste streams. Furthermore, it can be assessed that methane productivity enhances by sonication pre-treatment in all the cases (10-40% depending on the selected waste streams mixture).

Scientific CV

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Nanometer Pores Graphene Membrane Using Hollow TiO_2 Thin Film For Water Desalination

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1. Introduction – Even though over 75 % of surface of the earth is covered by water, 97 % of water is sea water. Because weather of the earth is getting worse and the population is increased, lack of fresh water is a serious problem in our life these days. Among several methods for water desalination, the reverse osmosis is one of highest energy efficient method having a good performance. For water desalination, the membrane filter having very tiny pores is needed to filter the ions. As one of candidate of 2-dimensional membrane filter, graphene is introduced by lots of researchers. Graphene which is a two-dimensional allotrope of carbon is an extremely thin film with just one carbon atom thick which is very strong mechanically and has an excellent chemical, electrical and mechanical properties. For a high performance membrane for water treatment, the thin film structure having tiny pores to filter the ions in water is needed [1]. For making subnanometer pores in graphene, S. C. O'Hern used an ion bombardment on the surface of graphene [2]. Although this method is available to make a subnanometer sized pores, it is not easy to make an ordered array of nano pores. In this work, a nanometer pores graphene membrane filter using hollow TiO_2 thin film for water desalination application was investigated.

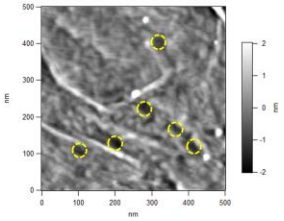

Image 1. AFM image of nanometer

2. Experimental – Graphene was synthesized by thermal chemical vapour deposition. It was synthesized on Cu thin film and transferred by PMMA transfer method. To make an ordered nanometer pores on graphene sheet, the hollow TiO_2 tube, top and bottom opened, was used as a shadow mask. To control the size of pores, a metal was deposited on pored TiO_2 by atomic layer deposition. The ordered nanometer pores graphene was made by etching process of O_2 plasma.

3. Results and Discussion - The nanometer pores graphene membrane was fabricated by TiO_2 nanotubes as a shadow mask and O_2 Plasma etching process. To reduce the size of pores in TiO_2, Zn was deposited by atomic layer deposition and final diameter of pores in shadow mask was about 50 nm. After O_2 plasma process, we obtained a thin film of graphene having 40 nm diameter pores. It was evaluated by AFM image in image 1. The reason why the size of pores in shadow mask and in graphene is not coincidence each other is that etching time is not proper to etch a graphene firmly. The optimal condition of etching process should be obtained to fabricate subnanometer pores on a graphene sheet.

4. Conclusions – In this work, we obtained a graphene sheet with nanometer pores. To make an ordered pores on graphene, the hollow TiO_2 tubes was used as a shadow mask. It will be a good candidate of membrane filter for water desalination.

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A coupled agronomic – economic model to evaluate options for managing variable salinity irrigation water: the case for dates and bell peppers in the Arava Valley

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1. Introduction – Irrigation is essential in arid regions to increase crop production. The Arava Valley, shared by Israel and Jordan, is characterized by extreme aridity and deep aquifers containing brackish (2-7 dS/m) water. The limited and non-renewable local water resources restrict agricultural expansion in the region. The two crops currently preferred by Israeli growers in the Arava Valley are the date palm, which is extremely well adapted to the region, and bell-pepper which can be locally grown during seasons of scarcity in distant markets. In Israel, natural water resources and land are legal property of the state. One repercussion of this is an exclusive volumetric water pricing model for Israeli agriculture, based on the electrical conductivity (EC) of the water source, where, as EC increases cost to farmers decreases.
We aimed to develop a unique quantitative tool to optimize land and water allocation based on understanding of crop response to environmental conditions combined with economic considerations. We demonstrate the tool for a case of a single farm unit in the Arava comprised of two crops (date palm and bell pepper), under variable irrigation water EC (0.4-4 dS·m-1).

2. Experimental - We assumed that the farmer can mix desalinated water with local brackish water in order to reach any desirable irrigation water salinity with no significant effect on the SAR.
Yield-water-salinity production functions generated by the ANSWER model (Shani et al. 2007) were coupled with financial profitability analysis of each crop, accounting for the variable water prices. Optimization was considered as maximization of farm net returns from agricultural production subject to land water constraints. We applied the coupled model to two scenarios. In the first (S1) we considered a farm with a given 1 ha of date palms and 3 ha of peppers and used the optimization procedure to determine allocation of water for maximum profit for different irrigation water salinity levels. In the second case (S2) we determined the optimum land and water allocation, for a single 4 ha farm between the two crops for variable combinations of irrigation water salinities.

3. Results and Discussion - Results indicate that the volumetric water pricing policy and salinity have a great effect on land and water allocation, for both investigated crops. Profits from the date palm, characterized with EC_{50} (saturated soil-paste extract EC causing yield decrease of 50%) of 4.5 $dS \cdot m^{-1}$, are influenced strongly by the cost of fertigation, which reaches 28% of total annual production costs in dates (compared to 11% for peppers). Conversely, peppers, with a relatively low EC_{50} (2.5 $dS \cdot m^{-1}$), and the profits generated by them, are particularly sensitive to irrigation water salinity. Under the S1 scenario, when a farm has only a single water quality, quantities allocated for peppers were consistently higher than for date palm, due to the need to provide more water to leach salts, reduce soil salinity, and subsequently increase yields and profits.
The contrasting irrigation productivity indices of peppers and dates led to three distinctive solutions depending on irrigation water salinity for the S2 scenario. At low salinity (<1.6 $dS \cdot m^{-1}$) maximal profit is possible when pepper is grown on the entire farm. At salinity higher than 3 $dS \cdot m^{-1}$ profit is maximized when all the land is allocated to dates. When irrigation water is at a moderate range (1.6-3 $dS \cdot m^{-1}$), optimization occurs with allocation of land and water to both crops.

4. Conclusions - The optimization procedure presented bridges agronomic soil-water-plant-atmosphere understanding of processes with economic tools and can benefit decision making by policy makers, planners and growers.

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