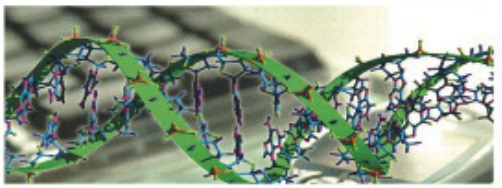
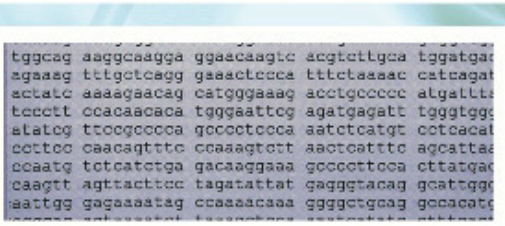
Volume 280S, 30 August 2018

ISSN 0168-1656

ELSEVIER

Journal of BIOTECHNOLOGY





European Biotechnology Thematic Network Association

Supplement Issue

European Biotechnology Congress 2018 held in Athens, Greece during 26–28 April 2018 organized by EBTNA.

Special Issue

European Biotechnology Congress 2018

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Novel photo-fuel cell that absorbs visible light

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Photo-Fuel cells are photoelectrochemical cells that can produce useful forms of energy by photocatalytic degradation of organic wastes. TiO_2 is the most successful photocatalyst but it is burdened with the disadvantage of the absorption by only UVA light. Thus, in the present study there have been efforts for its photo-activation through smaller energy band gap semiconductors that absorb in the visible part of solar spectrum. For TiO_2 sensitization with quantum dots CdS, CdSe the low-cost SILAR method was used and sol-gel solutions were also prepared for its substitution by semiconductors like WO_3 or $BiVO_4$. The quality and efficiency of the cathode plays an equally important role as the performance of the photocatalyst. In this work metal chalcogenides and reduced graphene oxide have been prepared by electrodeposition and spin-coating methods respectively, for their use as counter electrodes. The efficiencies with the combination of the new photocatalysts and counter electrodes reached 8%, under visible light irradiation.

Acknowledgements: This project is implemented under the "IKY fellowships of excellence for postgraduate studies in Greece-Siemens Program"

https://doi.org/10.1016/j.jbiotec.2018.06.295

Effect of bioethanol blending with gasoline on emissions characteristics with spark plug alteration for SI engine

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In recent years, enhancement of engine technology was speeded up due to global environmental issues, rapid depletion of fossil fuel and economical reasons. For this reason, scientists have been carried out many techniques such as dual-fuel utilization and spark ignition (SI) improvement. In this study, above mentioned techniques were implemented in a naturally aspirated, single cylinder, SI test engine and their effect on emissions characteristics was observed. For this purpose, two different spark plugs; copper (conventional) spark plug (CSP) and iridium spark plug (ISP) were used. For each spark plug, two different test fuels were evaluated which are conventional gasoline and 5% bioethanol added gasoline (E5). Experimental results have shown that iridium spark plug leaded to reducing unburned-hydrocarbons (UHC) and carbon monoxide (CO) emissions because of increased combustion quality. Similarly, higher oxygen content of bioethanol helped to increase combustion completeness and thus, HC and CO emissions were diminished because of bioethanol usage.

https://doi.org/10.1016/j.jbiotec.2018.06.296

Effect of alkaline pretreatment on the characteristics of different parts of corn stalk

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Lignocellulose is resistant to biological or chemical treatments, therefore, pretreatment is a crucial procedure aiming to the improvement of material's structure for the following microbial and enzymatic processes. Each part of the plant has different composition and characteristics, and it is reasonable its behaviour to be different in each treatment. Therefore, in order to achieve more efficient use of biomass, it is necessary to study the biomass from each corn part separately. In the present study the effect of alkaline pretreatment on different parts of corn stalk (stem, flower and cob) was investigated. Porosimetry was performed to investigate the effect on specific surface area, pore volume and pore diameter, while scanning electron microscopy was used to reveal the effect on corn stalk surface. Finally, the effect on lignin content was also evaluated. The results are important and very promising for potential enzymatic hydrolysis of the biomass, improving the accessibility of enzymes to cellulose.

Acknowledgements: Post-doctoral research was implemented with a scholarship funded by IKY, within the framework of the action "Supporting Postdoctoral Researchers" of the Operational Program "Human Resources Development, Education and Lifelong Learning", with Priority Axes 6,8,9 and co-funded by the European Social Fund - ESF and the Greek State.

https://doi.org/10.1016/j.jbiotec.2018.06.297

The study of possibility of using wastewater for cultivation of cyanobacteria – biodiesel

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The cultivation of cyanobacteria on wastewater polluted by organic substances allows to purify it, on the other hand, to obtain biodiesel fuel based on their biomass.

For studying the possibility of using municipal wastewater the collection strain Cyanobacterium sp. IPPAS B-1200-2 was cultivated on wastewater from primary sedimentation tank, aerated tank and from secondary sedimentation tank of wastewater treatment plant of Almaty, Kazakhstan, as a control Zarrouk medium was used. It was detected that dry weight of Cyanobacterium sp. IPPAS B-1200-2 grown on wastewater from primary sedimentation tank, aerated tank and secondary sedimentation tank compose 3.4, 5.6, 3.8 g/l respectively, while dry weight of control is 4.5 g/l. As a result of investigation, it was detected that after cultivation of collection strain of cyanobacteria*Cyanobacterium sp.*IPPAS B-1200-2 on wastewater from secondary settler, water purification made up 86–90%, it indicates the high ability of this strain to bioremediate wastewater.

Thus, it was established that the use of municipal wastewater from the secondary sedimentation tank of the Almaty treatment plant for the cultivation of cyanobacteria would make it possible to

reduce the cost of obtaining biomass for the production of biodiesel fuel based on cyanobacteria*Cyanobacterium sp.*IPPAS B-1200-2.

https://doi.org/10.1016/j.jbiotec.2018.06.298

Stem cells, biomaterials, tissue engineering

Micro hardness and water absorption properties of Cotton/Epoxy Bio-Composite

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Sustainability issues all around the world lead the investigations on renewable and eco-friendly materials that are not synthetic. Composite materials have a great importance especially in automotive and aerospace industries. Lighter and safer materials are critical in these sectors. Mostly carbon fiber reinforced composites and glass fiber reinforced composites are used for manufacturing purposes but both fibres and matrices are synthetic materials. In this study, cotton fibers were used as reinforcement agents and by using hand lay-up method cotton/epoxy composite materials (30% by weight) were fabricated. After the composite fabrication, micro hardness properties and water absorption characteristics of the specimens were investigated experimentally. The hardness measurements were evaluated by using a THV-1MD Micro-Vickers Hardness Instrument with 20 s dwell time and 1kgf load (9.81 N). The experiments showed that cotton/epoxy bio-composite has 114.54±6.42 HV1 hardness value. The water absorption of the specimens was observed, and it increased up to limit of 3.28% in 240 h. The average of maximum water absorption of all specimens was calculated as 2.62%. Cotton fibers can be used as reinforcing agent instead of synthetic fibers considering experimental results, the relatively lower cost and being renewable characteristic of cotton fibers.

https://doi.org/10.1016/j.jbiotec.2018.06.299

Cotton/Epoxy Bio-Composite usage as an impact attenuator material for formula student race cars

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The automotive industry is involved in serious work on security issues as well as technological vehicle production. Significant techniques are being studied especially in the field of motorsports to protect the human life. One of the important issues raised on this area is the impact attenuator. Metal and foam are also using as a raw material while the use of composite materials are newly preferred nowadays. Impact attenuators can be designed by composite structures on sandwich panels or honeycomb geometries. In this study, applicability of Cotton/Epoxy Bio-Composite was investigated as impact attenuator material. Cotton fibers were used as reinforcement agents and by using hand lay-up method cotton/epoxy composite materials (25% by weight) were fabricated. The density of composite was measured as 1.1867 g/cm^3. The hardness measurements were evaluated by using a THV-1MD Micro-Vickers Hardness Instrument with 20 s dwell time and 1kgf load (9.81 N). The experiments showed that cotton/epoxy bio-composite has 112.37±4.82 HV1 hardness value. Charpy Impact tests were evaluated with a composite sample and 0.95 J/mm was obtained as the average value. Thus, to improve the energy absorbing values, alternative composite materials Cotton/Epoxy Bio-Composite can be a reasonable alternative material with its mechanical properties for especially honeycomb structure.

https://doi.org/10.1016/j.jbiotec.2018.06.300

Collagen-chondroitin 4-sulfate-fibronectin scaffold: characterization and*in vitro* biocompatibility

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Goals of periodontal therapy include the regeneration of lost tissues that surround the teeth or implants. Therefore, the design of scaffolds which mimic the complex periodontal organization represents a significant challenge in regenerative periodontology. We prepared a biomimetic matrix using nondenatured collagen type I (COL), chondroitin 4-sulfate (Sigma) (CS) and fibronectin (Sigma) (FN) in a weight ratio of 10:1:0.001. The mixture was conditioned as 3D porous scaffold by lyophilization. Porous scaffold was seeded with osteoblasts and cultured *in vitro* for 24, 48 and 72 h. Tests of scaffold cytotoxicity were performed by MTT assay. The colonization of scaffold by the osteoblasts has been evaluated by fluorescence microscopy after DAPI staining and osteocalcin immunocytochemistry. DAPI staining showed that many osteoblasts appeared healthy, with morphology similar to that seen in normal control dishes, express osteocalcin and firmly attached to the scaffold. Moreover, osteoblasts, migrate and proliferate inside the scaffold. Cytotoxicity tests indicated high values of cell viability (>80%). These results suggest that the COL-CS-FN scaffold had good biocompatibility*in vitro*and can be used for future periodontal tissue engineering.

Acknowledgements: This work was supported by a grant of Ministry of Research and Innovation, CNCS-UEFISCDI, project number PN-III-P4-ID-PCE-2016-0715, within PNCDI III.

https://doi.org/10.1016/j.jbiotec.2018.06.301