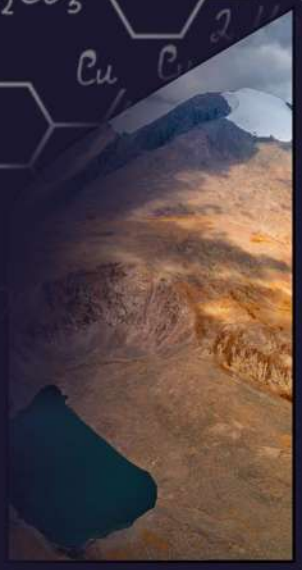
MONGOLIAN ACADEMY OF SCIENCES

INSTITUTE OF CHEMISTRY AND CHEMICAL TECHNOLOGY

ICCIUNR 2021

"Chemistry as Catalyst for Sustainable Development"

ABSTRACT BOOK



5th INTERNATIONAL CONFERENCE ON CHEMICAL INVESTIGATION AND UTILIZATION OF NATURAL RESOURCES

Ulaanbaatar, Mongolia
14-15 October 2021

MONGOLIAN ACADEMY OF SCIENCES
INSTITUTE OF CHEMISTRY AND CHEMICAL TECHNOLOGY

Fifth International Conference on Chemical Investigation and Utilization of Natural Resources 2021

ABSTRACT BOOK

Ulaanbaatar, Mongolia

14-15 October 2021

CONFERENCE IN HONOR OF THE PRESIDENT OF MONGOLIAN ACADEMY OF SCIENCES, ACADEMICIAN REGDEL DUGER'S 70TH BIRTHDAY

REGDEL DUGER
President,
Mongolian Academy of Sciences

PROFESSIONAL EXPERIENCE

1976–1986	*Researcher, Institute of Chemistry and Chemical Technology ; Institute of Physics and Technology, Mongolian Academy of Sciences (MAS)*
1986–1997	*Head, Laboratory of Biochemistry, Institute of Chemistry and Chemical Technology, MAS*
1997–2001	*Principal secretary, Institute of Chemistry and Chemical Technology,MAS*
2001–2009	*Secretary General, Mongolian Academy of Sciences*
2009–2016	*Senior Vice-president, Mongolian Academy of Sciences*
2016–Present	*President , Mongolian Academy of Sciences*

PROFESSIONAL MEMBERSHIPS

Member, National Committee for Sustainable Development
Member, National Science and Technology Council,
Member, Minister's Council, Ministry of Education and Science,
Member, Board of the National Council for Education Accreditation (2016-2020),
Chairman, Board of the Mongolian University of Education (2019-2021)
Chairman, Board of the Mongolian National University of Medical Science (2018-2019)
Chairman, Member, Board of the Mongolian National University (2016-2019)
Presiding Member, Mongolian Chemical Society

MAJOR AWARDS

Mongolian State Prize (1996)
Mongolian meritorious Scientist (2006)
Polestar order (1998)
A.von Humboldt Prize and Medal, Humboldt University zu Berlin (1986, Germany)
Gold Medal, International Turkic Academy (2018, Astana)

Academician D. Regdel made a significant contribution to the development of space-biology and space-medicine in Mongolia. He played a key role in developing 11 test programs implemented during the Soviet-Mongolian joint space flight in 1977-1982 and participated in summarizing the program results and promoting the programs abroad and domestically. As a result, in 1982, for the first time, a "Mongolian-made" food was included in the menu of astronauts.

Based on his theoretical biochemical studies, he discovered a new way of reaction mechanisms of plant-neutral lipoxygenase enzymes and identified many specific features of plant lipoxygenase including its self-inactivating syncatalytic mechanisms and its ability to interact with biological membranes.

He, together with his colleagues, completed the biochemical and technological studies of meat from Mongolian livestock that graze at Mongolian pasture land and thus contributed significantly to the development of animal husbandry and meat production.

Academician D.Regdel has published about 200 publications, including over 50 articles in international scientific journals, edited 40 books, developed 30 technological guidelines, and defended 10 inventions and patents.

OPENING REMARKS

Dr. Professor L. Jargalsaikhan, Director, Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences

Dear Minister of Education and Science of Mongolia,
Mr. Enkhamgalan Luvsantseren,
Dear President of Mongolian Academy of Sciences, Academician Regdel Duger,
Dear scientists, researchers, and all the participants,

I am delighted to warmly welcome all of you to the international conference, organized by our institute.

Since 1999, our institute is organizing the international conference on "Chemical Investigation and Utilization of Natural Resources" (ICCIUNR) every four-years and this year's conference is being organized under the motto "Chemistry as a catalyst for sustainable development". We are now organizing the 5th conference and it coincides with the 60-year anniversary of the foundation of the Mongolian Academy of Sciences (MAS) as well as the Institute of Chemistry and Chemical Technology (ICCT). This conference is dedicated to the 70th anniversary of Academician Duger Regdel, the president of the Mongolian Academy of Sciences.

The history of our institute begins in 1961 when the division specialized in chemistry was founded within the Natural Sciences Institute of the Mongolian Academy of Sciences, established in the same year. During the last 60 years, the scientists and researchers of our institute have made continuous efforts to develop the chemical science and the chemical industry in Mongolia, especially, in the use of Mongolian natural resources including minerals and raw materials from plants and animal origin based on our theoretical and technological studies. As a result, more than 6000 scientific papers have been published, 300 national and international patents, more than 500 technological instructions and feasibility studies have been elaborated; 150 new technologies commercialized; and 200 new natural substances have been discovered.

We are proud to announce that the "Mongolian Journal of Chemistry" issued by our institute in English, is the first scientific journal from Mongolia listed in Scopus with a reputable ranking. Our special thanks go to the international members of the editorial board.

Since its foundation, the ICCT has been in the forefront of advancing chemical sciences and educating and training highly qualified researchers in Mongolia. We are extremely proud of the 10 Academicians, 20 doctors of science and 120 doctors of philosophy who rightfully belong to our Institute.

One of the prominent scientists from our institute is an Academician D.Regdel who won the title of the honored scientist and the state award for his great achievements in science and technology. During the 25-years since the start of his carrier in 1976 in our Institute, he worked as a junior researcher, the head of laboratory of biochemistry, then to the scientific secretary of the Institute. He has made extraordinary contribution for the development of theoretical and applied biochemistry and in educating highly qualified professionals.

The Academician D.Regdel is the first president of the MAS to be born from the cohort of the chemists and considered as a talented manager in the scientific community. On behalf of the staff of the ICCT and personally, I would like to wish Academician D.Regdel all the best and a great success in his scientific activity.

Although the ICCIUNR-2021 is organized virtually due the worldwide pandemic, approximately 150 participants from more than 10 countries including Japan, China, Germany, Russia, USA, Denmark, South Korea, Kazakhstan, India, and Mongolia are joining this scientific event. A total of 37 oral and 45 poster presentations in the 15 different fields of chemistry will be presented and discussed during the conference. As our conference is organized virtually, it has the advantage of allowing interested researchers, students, and any interested individuals to listen to the presentations.

We are proud that the reputation of our international conference is growing from year to year. The conference proceedings containing 23 selected peer-reviewed papers is now listed in the Springer Nature, published by the Atlantis press.

We thank all the sponsors and the members of the organizing committee for their great efforts. We also thank the international and national referees for their thorough review of the scientific papers.

I congratulate you all on the occasion of the Centenary of the establishment of the modern scientific organization and the 60-year anniversary of the Mongolian Academy of Sciences and the 60-year anniversary of the Institute of Chemistry and Chemical Technology.

I would like to finish my opening remarks, by citing the great theoretical physicist Edward Teller "The science of today is the technology of tomorrow".

Thank you for your attention.

CONGRATULATORY MESSAGE

Mr. L.Enkh-Amgalan
Member of Parliament, Member of Government
Minister, Ministry of Education and Science

Dear scientists and chemists,

On behalf of the Mongolian Government, the Ministry of Education and Science, and personally, I would like to express my warm congratulations and wish success to all participants of the international conference dedicated to the 100th anniversary of the establishment and development of modern scientific organizations in Mongolia, the 60th anniversary of the Mongolian Academy of Sciences and the 60th anniversary of the Institute of Chemistry and Chemical Technology of the Mongolian Academy of Sciences.

I am grateful that this conference is dedicated to the 70th anniversary of Regdel Duger, the President of the Mongolian Academy of Sciences, an honored scientist, laureate of the state premium, and academician, and I wish you great success in your work and all the best in your life. Academician Regdel is a world-class scientist in the field of biochemical sciences and one of the leading managers, who makes a significant contribution to the development of Mongolian science.

During my visit to the Institute of Chemistry and Chemical Technology, I recognized that the main activity of this institute is to conduct various studies on the processing technology of minerals, plants, and animal-based raw materials. Moreover, it is an important institution for the development of the chemical industry, providing a scientific basis for the comprehensive and environmentally friendly use of natural resources, and ensuring sustainable development of our economy.

The Institute of Chemistry and Chemical Technology has many successful achievements including world-ranked scientific results in some fields, a number of published scientific articles in international peer-reviewed journals, and a number of certified international and national patents, numerous new technologies introduced into the practice. Also, the research journal issued by the Institute is ranked at the international level. These achievements are the great results of the work by all the scientists working now at the institute and the alumni scientists. Therefore, I would like to congratulate all researchers on the 60th anniversary of your institute and wish every success in the research work.

I would like to wish all the scientists and researchers participating in the 5th International Scientific Conference under the motto " Chemistry as catalyst for Sustainable development " every success in their future research works.

CONGRATULATORY MESSAGE

Academician B. Avid,
Secretary General, Mongolian Academy of Sciences

Dear honorable guests, our friends, and colleagues from abroad as well as in Mongolia and all the participants to the ICCIUNR-2021,
On behalf of the Presidium's Office of the Mongolian Academy of Sciences and personally, I wish you my best and convey my greetings with the 100th anniversary of the establishment of the modern scientific organization in Mongolia and the 60th anniversary of the foundation of the Mongolian Academy of Sciences (MAS).

The MAS and its whole community of generations in the past have been at the forefront in bringing modern scientific and technological achievements to our country and in developing the knowledge-based economy in all sectors of society. Particularly, it is worth to mention those who dedicated their energy and enthusiasm in forming Chemistry as a leading branch of science, and those who are distinguished by their shrewd thinking, invention, and discovery, and those who have contributed to the development of chemistry.

In order to provoke the 4th Industrial Revolution successfully, to achieve the Sustainable Development's Objectives, and to implement "Vision-2050"'s long-term development strategy, the leading economic sectors must be developed based on the scientific knowledge and this convoluted process requires active intervention of chemical science. For instance, to manufacture marketable products from the mining industry, to produce value-added products from agricultural waste feedstocks, to extract medical additives from natural plants, and to develop technology for reducing environmental pollution, the specialized branches of chemistry can play a crucial role.

It is worth emphasizing that the 5th international conference on "Chemical Investigation and Utilization of Natural Resources" is being now held when we are celebrating the 60th anniversary of the foundation of the Institute of Chemistry and Chemical Technology and it is just the precise time to discuss and explore the above-mentioned subjects in connection with the thoughts and opinions to be delivered by respectable scientists and scholars from overseas as well as from here in Mongolia. I have no doubt that this conference will result in flourishing new ideas, good outcomes and expand cooperation between all the participants.

My special thanks go to the whole staff of the Institute of Chemistry and Chemical Technology for organizing the conference successfully using modern digital technology despite the difficult time when we are all suffering from the worldwide pandemic, and wish successful follow-up and congratulate them with their own Institute's historic anniversary.

SCIENTIFIC COMMITTEE

Acad. Gan-Erdene Tudev, Presidium's Office, Mongolian Academy of Sciences
Acad. Purevsuren Barnasan, Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences
Acad. Avid Budeebazar, Presidium's Office, Mongolian Academy of Sciences
ScD. Narangerel Janchig, ICCT, MAS
Prof. Dr. Ochirkhyag Bayanjargal, National University of Mongolia
Prof. Dr. Damdindorj Boldbaatar, Mongolian National University of Medical Sciences
Prof. Dr. Ganzorig Chimed, National University of Mongolia
Prof. Peter Kuznetsov, Russian Academy of Sciences
Dr. Altansukh Batnasan, Akita University
Dr. Gunbileg Disan, University of Copenhagen
Prof. Dr. Ilchgerel Dash, Mongolian University of Science and Technology
Prof. Dr. Munkhtsetseg Baatar, Ulaanbaatar State University
Dr. Azzaya Tumendelger, ICCT, MAS
Dr. Amarsanaa Badgaa, ICCT, MAS
Dr. Bayarjargal Munkhuu, ICCT, MAS
Dr. Bayarmaa Barkhuu, ICCT, MAS
Dr. Nyamdelger Shirchinnamjil, ICCT, MAS
Dr. Oyun-Erdene Gendenjamts, ICCT, MAS
Dr. Khulan Bayasgalan, ICCT, MAS
Dr. Munkhtsetseg Tsednee, ICCT, MAS
Dr. Otgonjargal Enkhtur, ICCT, MAS
Dr. Shiirav Gandandorj, ICCT, MAS

ORGANIZING COMMITTEE

Dr. Azzaya Tumendelger. Scientific Secretary, ICCT, MAS

Dr. Khulan Bayasgalan. Head of Laboratory of Organic Chemistry, ICCT, MAS

Dr. Munkhtsetseg Tsednee. Head of Laboratory of Natural Product Chemistry, ICCT, MAS

Dr. Shiirav Gandandorj. Head of Laboratory of Coal Chemical Technology, ICCT, MAS

MSc. Anudari Dolgormaa. Researcher at Laboratory of Material Science and Technology, ICCT, MAS

MSc. Sukhbat Sandag-Ochir. Researcher at Laboratory of Mineral Technology, ICCT, MAS

MSc. Enkh-Ariun Altantulga. Researcher at Laboratory of Biochemistry, ICCT, MAS

MSc. Gantsetseg Byambasuren. Researcher at Laboratory of Organic chemistry, ICCT, MAS

SCHEDULE

Date: Thursday, October 14, 2021

08:30-09:00	**Zoom logging and Registration at Conference Hall**		
09:00-11:30	Plenary event		
09:00-09:30	Opening ceremony		
09:30-11:30	**Special session**		
11:30-12:30	Lunch break		
12:30-13:05	**Plenary session 1**		
13:05-13:10	Zoom group photo		
13:10-15:00	**Parallel oral sessions**		
13:10-15:00	**Oral session 1** Coal chemistry (Zoom room 1)	**Oral session 2** Petroleum and organic chemistry (Zoom room 2)	**Oral session 3** Natural product and pharmaceutical chemistry (Zoom room 3)
15:00-15:10	Coffee break (Zoom room 1)	Coffee break (Zoom room 2)	Coffee break (Zoom room 3)
15:10-15:40	**Panel discussion**		
15:40-16:00	Free session		

Date: Friday, October 15, 2021

08:30-09:00	**Zoom logging**		
09:00-09:35	**Plenary session 2**		
09:35-09:40	Session break		
09:40-12:50	**Parallel oral sessions**		
09:40-11:10	**Oral session 4** Nanoscience, materials and physical chemistry (Zoom room 4)	**Oral session 5** Nutrition and biochemistry (Zoom room 5)	**Oral session 6** Mineral processing and inorganic chemistry (Zoom room 6)
11:10-11:20	Coffee break (Zoom room 4)	Coffee break (Zoom room 5)	Coffee break (Zoom room 6)
11:20-12:50	**Oral session 7** Environment, energy and ecological chemistry (Zoom room 7)	**Oral session 8** Nuclear and industrial chemistry (Zoom room 8)	
12:50-13:30	Lunch break		
13:30-15:45	**Parallel poster sessions**		
13:30-14:50	**Poster session 1** Mineral processing and inorganic chemistry (Zoom room 1)	**Poster session 2** Natural product and pharmaceutical chemistry (Zoom room 2)	**Poster session 3** Nutrition and biochemistry (Zoom room 3)
14:50-15:00	Coffee break (Zoom room 1)	Coffee break (Zoom room 2)	Coffee break (Zoom room 3)
15:00-15:45	**Poster session 4** Nanoscience, materials and physical chemistry (Zoom room 4)	**Poster session 5** Petroleum, coal and organic chemistry (Virtual room 5)	**Poster session 6** Environment, energy and ecological chemistry (Virtual room 6)
15:45-15:50	Coffee break (Virtual room 4)	Coffee break (Virtual room 5)	Coffee break (Virtual room 6)
15:50-16:20	**Closing remarks**		

DETAILED PROGRAM

Date: Thursday, October 14, 2021
Venue: Zoom platform and Conference Hall, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia

Time	Activities
08:30-09:00	Zoom logging and registration at Conference Hall, Mongolian Academy of Sciences
09:00-11:30	**Plenary Event**
	Zoom link: https://us06web.zoom.us/j/84167988169?pwd=Ym1oaVhsd3RiR293S2lIVmllWEFidz09 Meeting ID: 841 6798 8169 Passcode: 206317
09:00-09:30	**Opening Ceremony** **Welcoming speech** Prof. Dr. Jargalsaikhan L. Director, Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia Mr. Enkh-Amgalan L. Minister, Ministry of Education and Sciences, Mongolia Academician Avid B. Secretary General, Mongolian Academy of Sciences, Mongolia
09:30-11:30	**Special session: Dedication to 70th birthday of Academician Regdel Duger** (In Mongolian language and synchronous in English) **Tributes:** **Special presentation: D.Regdel – Scientist and Manager** Academician Gan-Erdene Tudev Presidential advisor, Mongolian Academy of Sciences, Mongolia Greetings Closing
11:30-12:30	Lunch break
12:30-13:05	**Plenary session 1** Moderator: Dr. Azzaya T. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
12:30-13:05	**Plenary presentation** **Green chemistry and sustainable development** **Academician Avid Budeebazar** Secretary General, Mongolian Academy of Sciences, Mongolia
13:05-13:10	Zoom group photo
13:10-15:00	**Parallel oral sessions**
13:10-15:00	**Oral session 1: Coal chemistry** Zoom room 1 Moderator: Dr. Ilchgerel D. Mongolian University of Science and Technology, Mongolia
13:10-13:40	**Keynote presentation** **Thermal solvolysis of coals under mild conditions as an alternative way to produce aromatics for carbon materials** **Prof. Peter Kuznetsov** Institute of Chemistry and Chemical Technology SB RAS, Federal Research Center "Krasnoyarsk Science Center SBRAS", Krasnoyarsk, Russia
13:40-14:00	**Stimulation of low-temperature dissolution of organic matter of brown coal, group and component composition of bitumoids** Prof. Sergey I. Zherebtsov Federal Research Center of Coal and Coal Chemistry, Siberian Branch, Russian Academy Sciences, Russia
14:00-14:20	**Investigation on characterization and pyrolysis of some coals from Mongolia** Acad. Puversuren Barnasan Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:20-14:40	**Macromolecular structural features for the brown coal extractions** Dr. Munkhtsetseg Sambuu School of Arts and Sciences, National University of Mongolia, Mongolia
14:40-15:00	**Production of humic substances with increased biological activity from brown coals** Mr. Konstantin Votolin Federal Research Center of Coal and Coal Chemistry, Siberian Branch, Russian Academy Sciences, Russia
15:00-15:10	Coffee break

13:10-15:00	**Oral session 2: Petroleum and organic chemistry** Zoom room 2 Moderator: Dr. Narangerel J. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:10-13:40	**Keynote presentation** **The new horizon of late transition metal precatalysts for ethylene reactivities** **Prof. Wen-Hua Sun** Key Laboratory of Engineering Plastics, Institute of Chemistry, Chinese Academy of Sciences, China
13:40-14:00	**Utilization of polytetrafluoroethylene waste and obtaining promising materials based on them** Prof. Ayurova Oksana Zh. Laboratory of Polymer Chemistry BINM SB Russian Academy of Sciences, Russia
14:00-14:20	**Natural gas storage by adsorption: a techno-economically feasible solution for mobile application** Dr. Balathanigaimani MS. Rajiv Gandhi Institute of Petroleum Technology, India
14:20-14:40	**New polymer forms of tamarixidin and their properties** Dr. Arailym Amanzholkyzy Al-Farabi Kazakh National University, Republic of Kazakhstan
14:40-15:00	**Concurrent improving the catalytic activity and thermal stability of iron pre-catalysts of type 2-(1-(2,4-dibenzhydryl-6-fluorophenyl-imino)-ethyl)-6-(1-alkyl-phenyl-imino)-ethyl)-pyridyl-ferrous chlorides** Dr. Chantsalnyam Bariashir Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:00-15:10	Coffee break
13:10-15:00	**Oral session 3: Natural product and pharmaceutical chemistry** Zoom room 3 Moderator: Dr. Munkhtsetseg Ts. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:10-13:40	**Keynote presentation** **Recent progress in natural product chemistry: isolation and synthesis** **Prof. Hans-Joachim Knoelker** Faculty of Chemistry, Technical University of Dresden, Germany
13:40-14:00	**Development of biomacromolecule-based carrier systems for pharmaceutical agents** Dr. Gantumur Battogtokh R&D Center, Upexmed Co., Ltd, Republic of Korea
14:00-14:20	**Metabolomics on Australian Koala-Eucalypt herbivory interaction** Dr. Gunbilig Disan Det Natur-og Biovidenskabelige Fakultet Plant Biochemistry, Københavns Universitet, Denmark
14:20-14:40	**Characterization of population-wide variability in perchloroethylene toxico-kinetics in mouse population** Dr. Chimeddulam Dalaijamts Department of Veterinary Integrative Biosciences, Texas A&M University, USA
14:40-15:00	**Metabolic features of grazing-tolerant plants in Mongolian pasture** Dr. Munkhtsetseg Tsednee Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:00-15:10	Coffee break
15:10-15:40	**Panel discussion**
15:10-15:40	Zoom link: https://us06web.zoom.us/j/84167988169?pwd=Ym1oaVhsd3RiR293S2lIVmllWEFidz09 Zoom meeting ID: 841 6798 8169 Passcode: 206317 **Topic: Chemistry as catalyst for sustainable development** **Moderator:** Academician Gan-Erdene Tudev Presidential advisor, Mongolian Academy of Sciences **Panelists:** **Academician Avid Budeebazar,** Presidium's office, Mongolian Academy of Sciences **Prof. Dmitry Shalbuev,** East-Siberia State University of Technology and Management, Russia **Prof. Wen-Hua Sun,** Chinese Academy of Sciences, China **Prof. Hans-Joachim Knoelker,** Technical University of Dresden, Germany **Prof. Kitae Baek**, Jeonbuk National University, Republic of Korea
15:40-16:00	**Free session** Introductory videos of Mongolia, Introductory videos of Mongolian Academy of Sciences and Institute of Chemistry and Chemical Technology

Date: Friday, October 15, 2021
Venue: Zoom platform, Ulaanbaatar, Mongolia

Time	Activities
08:30-09:00	Zoom logging
09:00-09:35	**Plenary Event**
	Zoom link: https://us06web.zoom.us/j/89004936734?pwd=bEYyeG9GVzd4cXJETFZCaU12a0xKZz09 Meeting ID: 890 0493 6734 Passcode: 763049
09:00-09:35	**Plenary session 2** Moderator: Dr. Amarsanaa B. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
	Plenary presentation **Biopolymer and its fields of application** **Prof. Dmitry Shalbuev** East-Siberia State University of Technology and Management, Russia
09:35-09:40	Session break
09:40-12:50	**Parallel oral sessions**
09:40-11:10	**Oral session 4: Nanoscience, materials and physical chemistry** Zoom room 4 Moderator: Dr. Enkhtuul S. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
09:40-10:10	**Keynote presentation** **Molecular spintronics for spin qubits and single molecule memory** **Prof. Masahiro Yamashita** Department of Chemistry, Tohoku University, Japan
10:10-10:30	**Experimental study on the effect of oil recovery and transportability through the rock core using SiO_2 nanoparticles fluid for sandstone** Prof. Kazunori Abe Graduate School of International Resource Sciences, Akita University, Japan
10:30-10:50	**Nanoscale calcium salt-based formulations as potential therapeutics for osteoporosis** Dr. Khandmaa Dashnyam Monos Pharm Drug Research Institute, Mongolia
10:50-11:10	**Fabrication and characterization of copper phthalocyanine-based field effect transistors** Dr. Nergui Uranbileg Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
11:10-11:20	Coffee break
09:40-11:10	**Oral session 5: Nutrition and biochemistry** Zoom room 5 Moderator: Dr. Amarsanaa B. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
09:40-10:10	**Keynote presentation** **From discovery to molecular structure of epithelial sodium channels (ENaC) and acid-sensing ion channels (ASIC)** **Prof. Cecilia Canessa** School of Medicine, Department of Basis Sciences, Tsinghua University, China
10:10-10:30	**The characterization of acid-soluble collagen from sheep tail tendon** Dr. Lkhagvasuren Damdindorj National University of Mongolia, Mongolia
10:30-10:50	**Investigation of natural pigments from *Tamarix hispida* flowers** Dr. Assem Rakhimova Al-Farabi Kazakh National University, Republic of Kazakhstan
10:50-11:10	**The physicochemical composition of Sea buckthorn (*Hippophae rhamnoides* L) oil and its treatment characteristics** Dr. Bayarmaa Barkhuu Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
11:10-11:20	Coffee break
09:40-11:10	**Oral session 6: Mineral processing and inorganic chemistry** Zoom room 6 Moderator: Dr. Khasbaatar D. National University of Mongolia, Mongolia
09:40-10:10	**Keynote presentation** **Metal recovery and recycling towards sustainable mineral and resource development** **Prof. Atsushi Shibayama** Graduate School of International Resource Sciences, Akita University, Japan

10:10-10:30	**Effect of organic extractants on the extraction of rare earth elements from sulfuric acid leach liquor** Dr. Altansukh Batnasan Graduate School of International Resource Sciences, Akita University, Japan
10:30-10:50	**Cu(II), Pb(II) and Cr(II) sorption on the modified activated carbon** Dr. Ganchimeg Yunden Mongolian University of Science and Technology, Mongolia
10:50-11:10	**Study on beneficiation of lithium ore using flotation** Dr. Otgonjargal Enkhtur Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
11:10-11:20	Coffee break
11:20-12:50	**Oral session 7: Environment, energy, and ecological chemistry** Zoom room 7 Moderator: Dr. Azzaya T. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
11:20-11:50	**Keynote presentation** **Role of dissolved organic matter from biochar in interaction of arsenic and biochar in soil** **Prof. Kitae Baek** Department of Environment and Energy, Department of Environmental Engineering, and Soil Environment Research Center, Jeonbuk National University, Republic of Korea
11:50-12:10	**Chlorophyll catabolites in senescent leaves of lima bean (*Phaseolus lunatus*) and in the frass of *Spodoptera littoralis* after defecation** Dr. Amarsanaa Badgaa Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
12:10-12:30	**Vertical profile of water and sediment in lake Oigon** Prof. Dr. Bolormaa Oyuntsetseg National University of Mongolia, Mongolia
12:30-12:50	**The contamination of persistent organic pollutants in environmental, food, and human milk samples** Dr. Enkhtuul Surenjav Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
12:50-13:30	Lunch break
11:20-12:50	**Oral session 8: Nuclear and industrial chemistry** Zoom room 8 Moderator: Dr. Suvdantsetseg B. Presidium's Office, Mongolian Academy of Sciences, Mongolia
11:20-11:50	**Keynote presentation** **Applied research development and knowledge generation of the university motivated by the industrial demand** **Prof. Battsengel Baatar** German-Mongolian Institute for Resources and Technology, Mongolia
11:50-12:10	**Primary recovery of Angot oil reservoir in the north part of Afghanistan by water drive based on Buckley-Leverett theory** Dr. Khwaja N. Seddiqi China University of Petroleum Beijing
12:10-12:30	**Waterflooding technique to the Kashkari oilfield in the north part of Afghanistan** Mr. Zabihullah Mahdi Akita University, Japan
12:30-12:50	**Supercritical hydrothermal synthesis of new materials** Dr. Narandalai Byamba-Ochir Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
12:50-13:30	Lunch break
13:30-16:10	**Parallel poster sessions**
13:30-14:50	**Poster sessions (1)-(3)**
13:30-14:50	**Poster session 1: Mineral processing, inorganic and analytical chemistry** Zoom room 1 Moderator: Dr. Narandalai B. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:30-13:35	**Removal of antimony, arsenic and bismuth from polymetallic sulfidic concentrate by alkaline leaching** Dr. Nyamdelger Shirchinnamjil Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:35-13:40	**The possibility of increasing for the content of rare earth elements in concentrate by leaching with hydrochloric acid** Dr. Azzaya Tumendelger Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

13:40-13:45	**Study on beneficiation of manganese from low-grade manganese ore using flotation** Mr. Baasanjav Dashtseren Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:45-13:50	**Chemical composition of peloid from lake Khyargas, Mongolia** Ms. Batnasan Bayaraa Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:50-13:55	**Chemical characterization of crud in solvent extraction-copper electrowinning process** Ms. Bayardulam Jamiyansuren German-Mongolian Institute for Resources and Technology, Mongolia
13:55-14:00	**Hydrogeochemical and Geothermometry of Otgontenger hot springs in Mongolia** Ms. Bolormaa Chimeddorj National University of Mongolia, Mongolia
14:00-14:05	**Assessment of groundwater quality in the Khan-uul district, Ulaanbaatar, Mongolia** Dr. Khureldavaa Otgonbayar Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:05-14:10	**Leaching kinetics of copper and iron from molybdenite concentrate in acidic nitrate solution** Ms. Narangarav Tumen-Ulzii Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:10-14:15	**Beneficiation and sulfuric acid leaching of manganese ore** Mr. Sukhbat Sandag-Ochir Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:15-14:20	**Technological study on extraction of reduced iron from standard concentrate** Ms. Unursaikhan Buyannasan Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:20-14:50	Q and A
14:50-15:00	Coffee break
13:30-14:50	**Poster session 2: Natural product and pharmaceutical chemistry** Zoom room 2 Moderator: Dr. Sarangerel O. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:30-13:35	**Composition of extractive compounds of *Rheum rhabarbarum* L.,collected in Mongolia: Methods for isolation of stilbenes and anthraquinones and study of pharmacological properties** Dr. Ganbaatar Jamsranjav Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:35-13:40	**Structure–activity relationships for antioxidant activities of flavonoids from *Landolia punctata* in vitro and in vivo** Ms. Bolor Tsolmon Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:40-13:45	**Acetylcholinesterase inhibition activity of *Aquilegia sibirica* L.** Ms. Nomin Munkhbat Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:45-13:50	**Biological activities of Herecleum dissectum L.** Ms. Nomuun Tsevegsuren Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:50-13:55	**Evaluation antimicrobial activities, synergistic effects of combinations and essential oils from *Pinus sylvestris, Picea obovate* and *Thymus gobicus* grown in Mongolia** Ms. Javzmaa Namshir Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:55-14:00	**Flavonoids from *Lactuca tatarica* (L.) C.A.Mey** Mr. Odnyam Renchindorj Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:00-14:05	**Alkaloids of some Aconitum and Delphinium species grown in Mongolia** Mr. Purevdorj Erdenetsogt Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:05-14:10	**Fractions and their biological activities from *Leptopyrum fumarioides* (L.) Reichenb. growing in Mongolia** Dr. Solongo Amgalan Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:10-14:15	**Study of antioxidant activity of *Pedicularis flava*. Pall** Ms. Bayanjargal Lkhagvasuren Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:15-14:20	**Dracocephalum foetidum extract attenuates a nonalcoholic steatohepatitis in rats with methionine and choline deficiency** Dr. Sarangerel Oidovsambuu Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:20-14:50	Q and A
14:50-15:00	Coffee break

13:30-14:50	**Poster session 3: Nutrition and biochemistry** Zoom room 3 Moderator: Dr. Erdenechimeg N. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:30-13:35	**Study of Mongolian natural zeolite as a modified delivery for cephalosporins** Ms. Altantogos Myagmar National University of Mongolia, Mongolia
13:35-13:40	**Antioxidant and antihypertensive activity of collagen and elastin hydrolysate at different molecular weight** Dr. Bayarjargal Munkhuu Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:40-13:45	**Screening of superoxide dismutase activity in some plants of Mongolia** Dr. Bayarmaa Jambalsuren National University of Mongolia, Mongolia
13:45-13:50	**Nutritional value and antioxidant activities of Mongolian edible mushrooms** Mr. Enkh-Amgalan Lkhagvajav Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
13:50-13:55	**Effect of shikonin extracts from onosma hookeri for wound healing process** Ms. Khaliunsarnai Tsogtbaatar Monos Pharm Drug Research Institute, Mongolia
13:55-14:00	**Development of Rapid and Sensitive PCR DNA chromatography for Yersinia pestis** Dr. Khishigjargal Tserendug National Center for Zoonotic Disease, Mongolia
14:00-14:05	**Bioactive compounds microencapsulation using inulin as encapsulating agent** Ms. Munkhtsetseg Byambaa Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:05-14:10	**Antioxidative activity of phenylethanoid glycosides from the whole plants *of Pedicularis resupinata* L. and their structure activity relationship** Mr. Nyamsuren Erdenetsogt Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:10-14:15	**Phenolic content and anti-microbial activity of *Helianthus tuberoses* L cultivated in Mongolia** Ms. Oyundari Ganzorig Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
14:15-14:50	Q and A
14:50-15:00	Coffee break
15:00-16:00	**Poster sessions (4)-(6)**
15:00-15:50	**Poster session 4: Nanoscience, materials and physical chemistry** Zoom room 4 Moderator: Dr. Nergui U. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:00-15:05	**Cu doped ZnO nanoparticles with enhanced photocatalytic and antibacterial activity** Ms. Ariunzaya Tsogoo National University of Mongolia, Mongolia
15:05-15:10	**Comparative study of porous materials obtained from kaolinite clay by various treatment** Ms. Bayarzul Uyat Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:10-15:15	**Removal of cationic dye from wastewater using coal ash as a low-cost sorbent** Dr. Darhijav Burenkhangai Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:15-15:20	**First-principles study of adsorption of hazardous atoms on the silica surface** Dr. Tamiraa Ganbold National University of Mongolia, Mongolia
15:20-15:25	**Synthesis of montmorillonite clay and multi-walled carbon nanotubes for nanocomposite** Mr. Mandakhsaikhan Luvsandagva Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:25-15:45	Q and A
15:45-15:50	Coffee break
15:00-15:50	**Poster session 5: Petroleum, coal and organic chemistry** Zoom room 5 Moderator: Dr. Chantsalnyam B. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:00-15:05	**Thermal dissolution of Mogoin gol coal with hydrogenated phenanthrene** Dr. Ariunaa Alyeksandr Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:05-15:10	**Potential of VFAs for microbial lipid production** Ms. Battsetseg Erdenee Wuhan University of Science & Technology, China
15:10-15:15	**Adsorption of methylene blue from aqueous solution by using the gelatin modified magnetic nanoparticles**

	Ms. Anudari Dolgormaa Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:15-15:20	**Hydrocracking of atmospheric residue from Tsagaan-els oil, Mongolia** Ms. Byambajav Ganbold German Mongolian Institute for Resource and Technology, Mongolia
15:20-15:25	**Photodemirization of trans-Cinnamic Acid Derivatives: trans-4-(trifluorometyl)-cinnamic** Ms. Nomin Tamir Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:25-15:45	Q and A
15:45-15:50	Coffee break
15:00-15:50	**Poster session 6: Environment and ecological chemistry** Zoom room 6 Moderator: Dr. Oyun-Erdene G. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:00-15:05	**Characterization of biochars produced from various biowastes** Ms. Bayarjargal Bayartsengel National University of Mongolia, Mongolia
15:05-15:10	**Fabrication of flat tubular clay-based porous support filters** Ms. Dolgorjav Rentsendavaa Mongolian University of Science and Technology, Mongolia
15:10-15:15	**Microbiological and hydrochemical parameters of deep wells used for drinking water in Ulaanbaatar, Mongolia** Ms. Dulamsuren Ganpurev Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:15-15:20	**Chemical composition of atmospheric fine particulate matters (PM2.5) in Ulaanbaatar,** Mongolia Dr. Narmandakh Dambajamts National University of Mongolia, Mongolia
15:20-15:25	**Removal of Cu(II) and Pb(II) ions from aqueous solutions by KOH-activated carbons** Dr. Narandalai Byamba-Ochir Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
15:25-15:45	Q and A
15:45-15:50	Coffee break
15:50-16:20	**Closing remarks**
15:50-16:20	Moderator: Dr. Amarsanaa B. Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia Remarks from national and international participants **Closing remarks** Prof. Dr. Jargalsaikhan L. Director, Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

PLENARY, KEYNOTE, INVITED PRESENTATIONS

Plenary speaker: Avid Budeebazar

Mongolian Academy of Sciences, Mongolia
Research interest: Coal chemistry

Green chemistry and sustainable development

Avid Budeebazar*

Mongolian Academy of Sciences, Mongolia
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Abstract: The twentieth century was unique in terms of human development for creating new innovations and solving basic problems. It seems that this should have ensured happiness for humanity. The current model of development has brought good things to hundreds of millions of people, but on the other hand, as poverty does not decrease and inequality increases, the climate, and biodiversity deteriorate year by year, making the world more complex and difficult. Climate change and global warming have become very common words used. This is not a fashion WORD, these are the results of the concern of humanity, which is feeling the pressure of environmental problems. Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. A large number of sustainable development goals stand to benefit from the direct contributions of green and sustainable chemistry, including zero hunger, good health and well-being, clean water and sanitation, affordable and clean energy, sustainable consumption, and production and climate action. Our life is not possible without chemicals. But we also cannot put up with the consequences of unsatisfactory regulation of chemicals. Green chemistry is not sub disciplines of Chemistry, it is a new philosophy and a new concept of Chemistry and it not only helps us in designing new ways to synthesize the desired product economically, user-friendly and it also helps to save the environment.

Plenary speaker: Dmitry Shalbuev

East-Siberia State University of Technology and Management, Russia
Research interest: Biochemistry, chemical biology, mechanics, fluid dynamics, thermodynamics

Biopolymer and its fields of application

Dmitry Shalbuev*, Tyana Tumurova, Maksim Deryabin

East-Siberia State University of Technology and Management, Russia
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Abstract: Polymers are dispersed organic compounds with a very high surface of contact with atmospheric oxygen with an oxidation reaction. Moreover, the products of their oxidation, even at room temperature, have a negative impact on the environment. Greenpeace calls them "the most environmentally damaging type of plastic". All polymer materials are FIRE HAZARDOUS and the main damaging factor in fires is the volatile combustion products of foamed polymers. An alternative to polymers can be biopolymers, which are obtained from organic waste generated during the processing of raw materials. Biopolymers are high molecular weight (polymer) compounds synthesized by living organisms. Biopolymers are the structural basis of living organisms and provide their vital activity, performing a variety of biological functions. Biopolymers include proteins, nucleic acids and polysaccharides. To obtain a biopolymer, organic waste was used after the processing of leather raw materials. The resulting biopolymer was a homogeneous liquid of a beige colour with the smell characteristic of animal raw materials. The obtained biopolymer has surface-active properties. The material refers to non-Newtonian fluids, thixotropic subsystems that are stable in time and change their structure upon application of a mechanical load. The amino acid composition of the bioactive preparation includes 15 amino acids with glycine, alanine and lysine forming the majority. As a result of studies, the data confirming the possibility of applying the obtained biopolymer in light industry, medicine, construction, agriculture sector and in the preparation of composite materials etc.

Keywords: *biopolymer, organic containing waste, recycling, collagen*

Keynote speaker: Peter Kuznetsov

Institute of Chemistry and Chemical Technology SB RAS, Federal Research Center "Krasnoyarsk Science Center SBRAS", Krasnoyarsk, Russia

Research interest: Coal chemistry, solid fuel chemistry, thermal dissolution, tungstated zirconia

Thermal solvolysis of coals under mild conditions as an alternative way to produce aromatics for carbon materials

Peter Kuznetsov[1,*], Avid Budeebazar[2], Lyudmila Kuznetsova[1], Barnazan Purevsuren[2], Xing Fan[3], Zinfer Ismagilov[4], Vladimir Safin[1,5]

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Abstract: Coal tar is currently the main source for the production of carbon materials of wide applications, the predominant part (over 75%) is traditionally used as a binder and impregnation agent for the production of carbon anodes and graphite electrodes. However, there is a steady tendency towards a decrease in the production of coal tar because of decrease in need in metallurgical coke. This presentation reports the cooperative research results on the study of the solvolytic conversion of coals into soluble products. The solvolysis of different-ranked coals from various deposits of Russia and Mongolia in technical hydrocarbon fractions as solvents is studied. The correlations between the properties of coals, their molecular structures and conversions into soluble products are analysed. The chemical and group composition, the characteristics of molecular structure and empirical properties of the products obtained are characterized by different analytical techniques. Based on the results obtained and correlation analysis, criteria indications to the properties of coals suitable for thermal solvolytic processing to obtain soluble aromatic substances are suggested. The solvolytic conversion of coals at mild temperature is considered as an efficient alternative way to produce aromatics as a source for the production of various carbon materials as well as liquid fuels.

Keywords: *coal, structure, solvolysis, aromatics, pitch*

Keynote speaker: Wen-Hua Sun

Institute of Chemistry, Chinese Academy of Sciences, China
Research interest: Polymer science, catalysis, materials chemistry, organometallic chemistry, crystallography

The new horizon of late transition metal precatalysts for ethylene reactivities

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Abstract: Late transition metal complexes have extensively been explored as efficient precatalysts towards ethylene polymerization and oligomerization over past two dozens of years, in addition to common catalysts based on titanium[1] chromium[2] and vanadium catalysts[3]. Pioneered by Brookhart[4,5a] and Gibson,[5b] late transition metal precatalysts have provided new horizon of ethylene reactivities.[6] Beyond conventional polyolefins, new materials of polyethylenes are promising upon their unique properties and microstructures: highly linear polyethylenes using iron (and cobalt) precatalysts[7,8] as well as highly branched polyethylenes using nickel.[8,9] Practicing, simple modifications or variations of the chelating ligands can have profound effects on performance which can manifest itself in higher efficiency and increased thermo-stability. Moreover, these technologies are scalable with linear and highly branched polyethylenes now produced on the pilot plant level. Pursuing novel models of the catalysts, elegant organic strategies have been developed by us to produce a wide range of novel ligand frameworks.[10] New multi-purpose ruthenium catalysts have been developed to facilitate the formation of such *N*-heteroatom-containing cyclic compounds; their use in the transformation of biomass into fine chemicals represents an additional spin-off application.[11] In general, we are working on developing novel catalytic systems for fundamental research as well as industrial application.

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References [1]Yuan, S.-F.; Yan, Y.; Solan, G. A.; Ma Y.; Sun, W.-H., *Coord. Chem. Rev.,* **2020**, *411*, 213254. [2]Bariashir, C.; Huang, C.; Solan. G. A.; Sun, W.-H., *Coord. Chem. Rev.*, **2019**, *385*, 208–229. [3]Phillips, A. M. F.; Suo, H.; da Silva, M. F. C. G.; Pombeiro A. J. L.; Sun, W.-H., *Coord.* Chem. *Rev.*, **2020**, *411*, 213332. [4] Johnson, L. K.; Killian, C. M.; Brookhart, M., *J. Am. Chem. Soc.*, **1995**, *117*, 6414. [5 a] Small, B. L.; Brookhart, M.; Bennet, A.M. A., *J. Am. Chem. Soc.* **1998**, *120*, 4049; b) Britovsek, G. J. P.; Gibson, V. C.; Kimberley, B. S.; Maddox, P. J.; McTavish, S. J.; Solan, G. A.; White, A. J. P.; Williams, D. J., *Chem. Commun.*, **1998**, 849. a) Gibson, V. C.; Redshaw, C.; Solan, G. A., *Chem. Rev.*, **2007,** *107*, 1745; b) Bianchini, C.; Giambastiani, G.; Rios, I. G.; Mantovani, G.; Meli, A.; Segarra, A. M., *Coord. Chem. Rev.,* 2006, 250, 1391; c) Bianchini, C.; Giambastiani, G.; Luconi, L.; Meli, A., *Coord. Chem. Rev.*, **2010**, *254*, 431. [5b] Wang, Z.; Solan, G. A.; Zhang, W.; Sun, W.-H., *Coord. Chem. Rev.*, **2018**, *363,* 92; b) Flisak, Z.; Sun. W.-H., *ACS Catal.*, **2015**, *5*, 4713. [6] Suo, H.; Solan, G. A.; Ma, Y.; Sun, W.-H., *Coord. Chem. Rev.*, **2018**, *372,* 101 [7] Wang, Z.; Liu, Q.; Solan, G. A.; Sun, W.-H., *Coord. Chem. Rev.,* **2017**, *350*, 68. [8] Pan, B.; Liu, B.; Yue, E.; Liu, Q.; Yang, X.; Wang, Z.; Sun, W.-H., *ACS Catal.,* **2016**, *6*, 1247. [9]Wang, Z.; Li, Y.; Liu, Q.; Solan, G. A.; Ma, Y.; Sun, W.-H., *ChemCatChem,* **2017,** 9, 4275.

Keynote speaker: Hans-Joachim Knölker

Technical University of Dresden, Germany
Research interest: Natural product chemistry, organic chemistry, organic synthesis

Recent progress in natural product chemistry: Isolation and synthesis

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Abstract: In natural product isolation, we have investigated different soft corals, *Sinularia vanderlandi*, *Sinularia gravis*,[1] and *Capnella fungiformis*,[2] collected along the coast of Madagascar. From these natural sources, we have obtained the novel cadinane-type sesquiterpene vanderlandin,[1] the spatane-type diterpene gravilin,[1] the cembranoid diterpene isodecaryiol,[1] and the diepoxyguaiane sesquiterpene oxyfungiformin.[2] Moreover, we have studied the extracts from different Mongolian medicinal plants. The alkaloid fraction of *Caryopteris mongolica* Bunge has provided seven polycyclic pyridine alkaloids.[3] We have developed a novel method for the conversion of olefins into ketones by an iron-catalyzed Wacker-type oxidation using hexadecafluorophthalocyanine–iron(II) as catalyst, triethylsilane as additive, and oxygen as sole oxidant.[4] Application of this procedure led to a highly efficient synthesis of the carbazole alkaloid euchrestifoline (7 steps, 64% overall yield).[5] More recently, we have described an improved protocol for the iron-catalyzed Wacker-type oxidation with tris(dibenzoylmethanato)iron(III) as catalyst and phenylsilane as reductive additive in the presence of air, which was applied to transform the pyrano[3,2-*a*]carbazole girinimbine into euchrestifoline.[6]

Keywords: *sesquiterpenes, diterpenes, iron catalysis, carbazole alkaloids*

References:
[1] M. P. Rahelivao, M. Gruner, T. Lübken, D. Islamov, O. Kataeva, H. Andriamanantoanina, I. Bauer, H.-J. Knölker, *Org. Biomol. Chem.* **2016**, *14*, 989–1001. [2] M. P. Rahelivao, T. Lübken, M. Gruner, O. Kataeva, R. Ralambondrahety, H. Andriamanantoanina, M. P. Checinski, I. Bauer, H.-J. Knölker, *Org. Biomol. Chem.* **2017**, *15*, 2593–2608. [3] D. Mishig, M. Gruner, T. Lübken, C. Ganbaatar, D. Regdel, H.-J. Knölker, *Sci. Rep.* **2021**, *11*, 13740. [4] F. Puls, H.-J. Knölker, *Angew. Chem. Int. Ed.* **2018**, *57*, 1222–1226. [5] F. Puls, O. Kataeva, H.-J. Knölker, *Eur. J. Org. Chem.* **2018**, 4272–4276. [6] F. Puls, P. Linke, O. Kataeva, H.-J. Knölker, *Angew. Chem. Int. Ed.* **2021**, *60*, 14083–14090.

Keynote speaker: Masahiro Yamashita

Tohoku University, Japan

Research interest: Quantum Molecular Spintronics Based on Single-Molecule Magnets, nanoscience, single chain magnets, single molecule magnets, electronic structure, charge transfer

Molecular spintronics for spin qubits and single molecule memory

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Abstract: Spintronics, based on the freedoms of charge and spin of the electron, is a key technology in the 21st century. Magnetic random access memory (MRAM), which uses giant magnetoresistance (GMR), has several advantages compared with electronics, such as non-volatile information storage, high operation speeds, etc. Although conventional magnets composed of transition metals are normally used, in our study, we use single-molecule magnets (SMMs) to overcome “Moore`s Limitation”. SMMs are also available for quantum computer, etc. I will talk about the spin qubits and long coherence for quantum computer as well as highly density memory devices such as single-molecule memory device, SMMs encapsulated into Single Walled Carbon Nanotube (SWCNT), and metallic conducting SMMs with negative magnetoresistances.

Keynote speaker: Cecilia Canessa

Tsinghua University, China
Research interest: Biochemistry, Central Nervous System; Electrophysiology; Kidney; Nephrology; Physiology; Epithelial Sodium Channels

From discovery to molecular structure of epithelial sodium channels (ENac) and acid-sensing ion channels (ASIC)

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Abstract: ENaC is expressed in many epithelial organs and it is crucial for maintaining sodium homeostasis in the body; higher or lower than normal activity leads to hypertension or hypovolemia in humans. Differently, ASICs are expressed in neurons of the central and peripheral nervous systems where they are activated by external protons contributing to membrane depolarization and excitation. I will present an overview of the history of ENaC and ASIC from their discovery almost three decades ago to the present. I will highlight and illustrate with our own experiments many technical innovations that enabled the identification and cloning of these proteins, advances in human genetics that linked human diseases to ENaC, and most recently, breakthroughs in structural biology that led to the elucidation of their molecular structure. Although ENaC and ASICs differ in function, tissue distribution and gating mechanisms, both types of channels conduct primarily sodium ions and share a common structural organization in which three identical or homologous subunits are arranged around the channel pore. Lastly, I will discuss how advances achieved through years of research could be translated into therapeutic treatments to benefit patients, as tools in biotechnology, and to investigate further the physiology and biosynthesis of these channels.

Keynote speaker: Atsushi Shibayama

Akita University, Japan
Research interest: Mineral Processing and Recycling

Metal recovery and recycling towards sustainable mineral and resource development

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Abstract: Nowadays, metallic ore grades are decreasing gradually worldwide due to the long-term mining activity. The deterioration of mineral resource quality leads to the processing of low-grade, complex polymetallic, and refractory ores to meet the increased demands. Despite the natural resources, waste electric and electronic equipment (WEEE) is regarded as a “secondary resource” because it contains various valuable materials, involving metals, glass, plastics, and others. Main metallurgical techniques, including pyrometallurgy and hydrometallurgy have a long history and wide applications. However, the development of these conventional techniques is much required to maintain the sustainable utilization of resources reducing the environmental impacts. Therefore, more attention has been paid to develop alternative processing techniques with significant economic and ecological benefits for low-grade complex natural ores and secondary resources in recent years. Generally, our leading research works correspond to developing novel and advanced mineral processing and metallurgical techniques for complex natural and secondary resources.

Keynote speaker: Kitae Baek

Jeonbuk National University, Republic of Korea
Research interest: Environmental engineering, material science

Role of dissolved organic matter from biochar in interaction of arsenic and biochar in soil

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Abstract: To date, studies on the mobility of arsenic (As) in soil amended with biochar have primarily relied on broad empirical observations, resulting in a gap between the behavior of As in amended soil and the chemical mechanisms controlling that behavior. This study focuses on the influence of abiotic factors in As mobility in As-contaminated soils amended with biochar. In order to understand the leaching of DOC and phosphate across a range of biomass feedstock and pyrolysis temperature, rice straw and granular sludge from an anaerobic digester were pyrolyzed at different temperature. Our results suggest enhanced release of As via the reductive dissolution of iron oxides, including by the chelating-enhanced dissolution of Fe oxides, and competitive desorption by DOC and phosphate from biochar. The results from these experiments further confirm that DOC is a key factor for influencing the mobility of As in the amendment of biochar to As-contaminated soil, which indicates that biochar having low levels of leachable carbon should be amended to As-contaminated soils, and with caution. Based on the result, amounts of lignin in the biochar and pyrolysis reaction media were evaluated to reduce the leaching of DOC and finally to prevent the adverse effect of biochar on stabilizing As-contaminated soil. Lignin-rich biomass is favorable to decrease the DOC leaching from the biochar, and finally has benefit in points of As stabilization. Carbon dioxide instead of nitrogen medium can improve the stability of biochar and minimize the adverse effect.

Keynote speaker: Battsengel Baatar

German-Mongolian Institute for Resources and Technology, Mongolia
Research interest: Industrial chemistry, physical chemistry, advanced physical chemistry, electrochemistry/photocatalysis, nanotechnology, materials chemistry

Applied research development and knowledge generation of the university motivated by the industrial demand

Battsengel Baatar*

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Abstract: Processing mineral resources to extract more valuable material is one of the great achievements in human history. Issues that face modern industry have become more complex and require more "green" initiatives in terms of energy, economy, environment, and human labor. More knowledge and qualification are required from engineers. It is known that University-Industry collaboration is the key to innovation and needs to be strengthened in our country. According to the "Vision 2050 National program", the Mongolian government aims to increase the manufacturing of final products up to 27% of GDP, which means raw material processing trends to the leading economic sector in Mongolia. Also, by 2050 tends to develop international level competitive science and technology and plans to spend 1-2% of the state budget for innovation. GMIT's research mission is to generate, spread competitive knowledge, conduct cutting-edge research in applied science and technology, and create innovative technologies motivated by the needs of industry and society for Mongolian economic and social development. To fulfill our strategic goal, we established Strategic Research Development Fund supported by third funding parties. Our researchers implement many worthwhile projects in different fields in cooperation with Industries such as Erdenet Mining, Oyu Tolgoi, Achit-Ikht copper plant, etc. In my presentation, I will introduce some of our raw material processing-related projects as an example. Also, GMIT has developed a Final study project module for our senior students and an applied research project for our research master students to conduct applied research in close cooperation with Mongolian industries to give students practice-oriented knowledge. During this Final study project, our students deal with real industrial problems that prepare them for their future careers and generate knowledge for the industry and university benefits.

Invited Speaker: Sergey Zherebtsov

Federal Research Center of Coal and Coal Chemistry, Siberian Branch, Russian Academy of Sciences, Russia.

Research interest: Coal chemistry, geochemistry, organic chemistry, green chemistry

Stimulation of low-temperature dissolution of organic matter of brown coal, group and component composition of bitumoids

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Abstract: Brown coals are usually burned to generate heat and electricity, while the colossal chemical potential that is concentrated in them is irretrievably lost. One of the most significant problems in the integrated use of brown coal is coal chemical processing. The most promising method capable of unlocking this potential is extraction using various methods of stimulating low-temperature dissolution of organic matter of brown coal. This makes it possible to extract a number of valuable products from brown coal: humic substances and bitumen (mountain wax), which contain a wide range of biologically active substances (BAS). The study presents data on the yield, group and component composition of bitumen extracted from the brown coal of the Tyulganskoye deposit. Bitumens were extracted from brown coal by the following methods:1) sequential extraction with ethanol, n-heptane, alcohol-benzene according to the Graefe method; 2) low-temperature decomposition of the organic mass of coal (OMC) by alkylation with n-butanol and subsequent extraction of bitumoids; 3) stimulation of the decomposition of OMC by alkylation when exposed to ultrasound and subsequent extraction of bitumoids. The samples were studied using the methods of IR spectroscopy, ^{13}C NMR (CPMAS), gas chromatography-mass spectrometry. It was shown that the alkylating treatment of OMC with n-butanol can significantly increase the yield of bitumoids - up to 44%, which is 28% higher than in the case of sequential extraction according to Graefe (16.0%). The use of an intensifying ultrasonic effect during the O-alkylation process promotes depolymerization of the organic mass of coal, thereby increasing the bitumen yield, which under the conditions of the process being carried out was 52%, which is 8% more than during alkylation under optimal conditions. Intensification of the alkylation process with ultrasound can significantly reduce the duration of the processes. The studied bitumoids are a complex multicomponent mixture of substances of predominantly aliphatic nature. More than 200 individual compounds were identified in the test samples (GCMS, IR, NMR), among which are present in significant concentrations: Betulin (has antiviral activity, analgesic properties, anti-inflammatory and antitumor properties); Ferruginol (has anti-tumor properties, antibacterial activity); Sugiol (has antiviral and antitumor activity); Triacontanoic acid (used in a number of medicines, as well as in cosmetics); Tetracosanoic acid (plant and human metabolite, used in cosmetics); 1-Heptacosanol; n-Tetracosanol-1; and others. Identified biologically active substances can find their application in cosmetics, medicine, veterinary medicine, agriculture. The method can be useful in the complex processing of brown coal.

Keywords: *brown coal bitumen, extraction, o-alkylation, ultrasound, biologically active substances*

Invited speaker: Oksana Ayurova

Baikal Institute of Nature Management SB RAS
Research interest: Polymer chemistry

Utilization of polytetrafluoroethylene waste and obtaining promising materials based on them

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Abstract: The improving the processes of production and use of polymers, as well as the creation of effective technologies for their recycling and return to operation on the basis of modern scientific research is of great importance. The possibility of using the products of processing waste of polyfluoroolefins to obtain composite materials based on it is considered in comparison with the previously known radiation method for processing waste of polytetrafluoroethylene when obtaining powdered material "Tomflon". In the proposed approach, polytetrafluoroethylene wastes were mechanically processed in a designed and manufactured unit. The chopper speed and the cyclone parameters for the separation of the fraction less than 10 microns are established based on the Bernoulli equation for open ventilation systems using the Stokes formula. The obtained results of deformation and strength characteristics of the obtained polymer composites (σ_p = 17.6-23.8 MPa; ε_p = 400.0-415.3%) indicate the possibility of partial replacement of industrial polytetrafluoroethylene by its waste up to 30 wt.% in the production of polymer composites, regardless of the size particles of crushed waste. The powders obtained by abrasion can be used to replace industrial powder in a combined sheet metal-fluoroplastic material up to 50-60 wt.% of the used mass of polytetrafluoroethylene.

Keywords: *polytetrafluoroethylene, fluoropolymer waste, composite materials*

Invited speaker: M.S. Balathanigaimani

Rajiv Gandhi Institute of Petroleum Technology, India
Research interest: Organic chemistry. Renewable energy, adsorbed natural gas, carbon materials, hydrogen storage by adsorption

Natural gas storage by adsorption: a techno-economically feasible solution for mobile application

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Abstract: The well-known alternative fuels for crude oil based liquid products are natural gas and hydrogen. However, these gaseous fuels require a special storage technique for the effective utilization due to their lower volumetric energy density values. Natural gas, more economical and eco-friendly in nature, would be a game changer in the energy sector, as it can be produced through various renewable and non-renewable sources. Nevertheless, the level of current research has to be taken in to an extremely different height to make the storage and utilization of natural gas more economical as well as plausible. The research elated to natural gas storage is presently being looked after highly, since the success of the natural gas usage in mobile/static applications also depends on storage. Unlike gasoline and diesel, natural gas requires compression, liquefaction and adsorption techniques for its storage, as it has very low volumetric energy density. Among all storage techniques, the adsorption-based natural gas (ANG) storage is considered as more economical and relatively safe technology due to its mild temperature and pressure conditions for the storage. The storage targets for the sorbent based gas storage has been set by the Department of Energy (DoE), United States, to make this ANG an effective alternative storage methods for compressed or liquefied form of natural gas storage methods. It should be noted here that the natural gas storage target has been revised multiple times by US DOE (150 V/V: 1995, 180 V/V: 2002) and recently the Advanced Research Projects Agency-Energy (ARPA-E) of US DOE has set the target of 263 V/V, equivalent to the gravimetric value of 0.5 g of CH_4/g of sorbent, for the ANG storage system so that ANG can have the amount of energy density, which is similar to Compressed Natural Gas (CNG). Like all other adsorption processes, the success of ANG mainly depends on the techno-economic design of a suitable adsorbent as well as the storage tank.

Invited speaker: Gantumur Battogtokh

R&D Center, Upexmed Co., Ltd, Republic of Korea
Research interest: Pharmaceutical chemistry, natural product chemistry, biomaterials, biomedical science, drug delivery and nanomedicine

Development of biomacromolecule-based carrier systems for pharmaceutical agents

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Abstract: In the modern world, humans are facing numerous challenges, one of these is an increasing number of chronic disorders including cancer, diabetes, cardiovascular disease, and infectious diseases. In order to treat the diseases, several new technologies have been discovered and applied. But still there are demands to overcome for scientists and engineers. Biomacromolecules are molecules that have high molecular weight and are biocompatible for human usage. We use biomacromolecules such as biopolymers, proteins, and peptides as carrier material to deliver therapeutic and diagnostic agents to the targeted site of the disease by modifying chemically or physically. We developed various nano- and microparticle systems using biopolymer chitosan, protein albumin, poly-lactic glycolic acid, and poly hydroxy methyl acrylamide for delivery of anticancer agents, photoactive molecules, and nucleic acids. The formulations have been analyzed by several physicochemical analysis methods and evaluated biological activity at the cell and animal level. The results demonstrated that the biomolecules have increased the potency of therapeutic agents.

Keywords: *biomacromolecules, carrier system, chronic disorder, therapeutic agents*

Invited speaker: Gunbileg Disan

University of Copenhagen, Denmark
Research interest: Natural product chemistry, chemical ecology

Metabolomics on Australian koala-eucalypt herbivory interaction

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Abstract: Eucalyptus plants are highly diverse in their composition and concentration of formylated phlorglucinal compounds (FPCs) which are specialized metabolites operative as a constitutive defense in response to herbivory feeding. FPCs consider as a first-line defense agent against herbivory attack by koala and is greatly regulated in response to different environmental conditions and climatic changes. Toxic and specialized metabolites e.g. FPCs are the part of daily diet of Australian koala, a specialist herbivore animal feeding exclusively on eucalypt leaves. To gain detailed information on common degradation/detoxifaction pattern of such highly toxic defense chemical in plant feeding animal, the fecal samples of koala (Phascolarctos cinereus) were analyzed against eucalyptus leaves after bulk extraction. An efficient method by LCMS and GCMS for accurate qualitative and quantitative analysis suited for both plant and fecal samples was developed. In the present communication, we aimed to optimize method of analysis by LCMS and GCMS for subsequent analysis of compounds of our interest both in planta and in fecal samples. Therefore, an effective method of extraction suitable for both qualitative and quantitative identification is an essential part to unveil their functions in plant and during environmental interactions. The possibility of using this method in combination of up-to-date metabolomics techniques is discussed.

Keywords: *metabolomics, phlorglucinal compounds, Koala-Eucalypt*

Invited speaker: Chimeddulam Dalaijamts

Texas A&M University, College Station, USA
Research interest: Pharmaceutical chemistry, public health, toxicology

Characterization of population-wide variability in perchloroethylene toxicokinetics in mouse population

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Abstract: Quantification of inter-individual variability in chemical toxicity is a continuing challenge in risk assessment, particularly for compounds with complex metabolism and multi-organ toxicity. Our studies in the utility of a mouse population and Bayesian population physiologically-based pharmacokinetic (PBPK) model have amplified the role of genetic and non-genetic factors in toxicokinetics variability of perchloroethylene (perc) to improve the characterization of the uncertainty in health risk assessment. PBPK model was advanced to include toxicokinetic data on perc and metabolites in blood and tissues of male mice from 45 inbred strains from the Collaborative Cross (CC) mouse population. After identifying the most influential PBPK parameters based on global sensitivity analysis, we fit the model with a hierarchical Bayesian population analysis using Markov chain Monte Carlo simulation. Using inter-strain variability as a surrogate for human inter-individual variability, we calculated dose-dependent, chemical-, and tissue-specific toxicokinetic variability factors (TKVFs) as candidate science-based replacements for the default uncertainty factor for human toxicokinetic variability of 3.16. Overall, we demonstrate how a combination of a population-based mouse model such as the CC with Bayesian population PBPK modeling can reduce uncertainty associated with toxicokinetic human variability by *in silico*-derived chemical-specific adjustment factors and ultimately improve quantitative risk assessment.

Keywords: *bayesian population analysis, glutathione conjugation, oxidative metabolism, perchloroethylene, physiologically based pharmacokinetic model, uncertainty and variability, internal dosimetry*

Invited speaker: Kazunori Abe

Akita University, Japan
Research interest: Nanoscience, material science, environmental Science

Experimental study on the effect of oil recovery and transportability through the rock core using SiO_2 nanoparticles fluid for sandstone

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Abstract: Nowadays, Chemical Enhanced Oil Recovery (CEOR) has been the important method in petroleum operation based on the salinity and temperature tolerance materials innovation. EOR using SiO_2 nanoparticles, which have a less environmental impact, has been widely studied for high oil recovery effect. The mechanism of oil recovery is considered wettability alteration, however, there are some obscure points such as stability, adsorption, and transportability of SiO_2 nanoparticles through a core in reservoir condition to optimize its operation. The aim of this research is to evaluate the effects of oil recovery and transportability of SiO_2 nanoparticles through sandstone cores with the evaluation of material stability of the nanoparticles. The material consists of sandstone core samples, crude oil and SiO_2 nanoparticles in this experiments. The sandstone core samples consist of about 7 to 15% of kaolinite, which has a permeability of 6 to 300 mD, while crude oil is characterized by 10 cP and 0.86 g/cm^3 at a temperature of 20°C. The SiO_2 nanoparticles are negatively and positively charged. Core flooding test used SiO_2 nanoparticles at the condition of the temperature at 60°C and the confining pressure at 2000 psi for oil recovery. Interfacial tension measurement (oil-water), contact angle measurement (oil-water-rock), and zeta-potential test were conducted to evaluate the factors of oil recovery effect. In the evaluation of transportability of SiO_2 nanoparticles through the rock, the measurement of the effluent concentration of the nanoparticles used microwave plasma atomic emission spectrometer (MP-AES). In the core flooding test, additional oil recovery of about 1 to 7% was obtained by injecting SiO_2 nanoparticles fluid. The wettability of rock surface was changed to more water-wet from the contact angle test and no significant change of the displacement efficiency was based on the interfacial tension test. The zeta-potential of all rocks tended to be negative, and it was suggested that the repulsive force was dominant based on the estimated calculation of the interaction between SiO_2 nanoparticles and the rocks. It indicates that SiO_2 nanoparticles support disjoining pressure in confined regions between oil and rock, and the wettability was changed to more water-wet. Concentrations analysis of SiO_2 nanoparticles in the effluent indicated that the most of injected SiO_2 nanoparticles were transported in the pore throats of rock in the core flooding test. However, trace amounts of SiO_2 nanoparticles remain in the core due to adsorption on the rock surface and trapping in micro-pores.

Keywords: *enhanced oil recovery, nanoparticle, silica, wettability alteration*

Invited speaker: Altansukh Batnasan

Akita University, Japan
Research interest: Inorganic chemistry, mineral processing, analytical chemistry

Effect of organic extractants on the extraction of rare earth elements from sulfuric acid leach liquor

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Abstract: Proper organic extractant holds the key to effectively recovering rare earth elements (REEs) from leach liquor after the acid leaching process. In this study, various organic extractants such as di-(2-ethylhexyl) phosphoric acid (D2EHPA), tributyl phosphate (TBP), tributyl phosphine (TBPP), trioctylamine (TOA), trioctylphosphine oxide (TOPO), and 2-ethylhexyl phosphonic acid mono-2-ethylhexyl ester (PC-88A) were examined to extract REEs from sulphuric acid leach liquor of apatite ore. Extraction parameters including the concentration of extractant, aqueous-organic phase ratio, contact time, and pH of the aqueous phase were investigated to determine the effective extractant and optimum extraction conditions. Stripping experiments were conducted using different sulphuric acid solutions ranging from 0.5 M to 6 M. The results showed that the extraction efficiencies for lanthanides into TBP, TBPP, TOA, and TOPO extractants did not exceed 15%. In contrast, these REEs were extracted over 65% into PC-88 extractant. It was revealed that remarkably high (about 90%) yttrium was selectively extracted with D2EHPA from the leach liquor when the other REEs extraction was lower than 15%. The mechanisms of REEs extraction from leach liquor into various organic extractants and precipitation of the REEs from the aqueous phases had been discussed in this study.

Keywords: *apatite, rare earth elements, leach liquor, extractant, solvent extraction*

ORAL PRESENTATIONS

Speaker: Purevsuren Barnasan

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Coal chemistry, petroleum chemistry, organic chemistry, polymer chemistry

Investigation on characterization and pyrolysis of some coals from Mongolia

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Abstract: The technical characteristics, organic elemental composition of coal and inorganic elemental composition of coal ash of 4 selected coals including Tavan tolgoi, Nariin sukhait, Baganuur and Shivee-Ovoo deposits in Mongolia have been determined. The thermal stability of these coal's organic mass have been investigated by thermogravimetric analysis, explained the mechanisms of the thermal decomposition of the coal organic mass and determined the thermal stability indices of each coal ($T_{5\%}$, $T_{15\%}$ and $T_{25\%}$). These coals processed by pyrolysis in different heating temperatures and determined the yields of pyrolysis products such as hard residue, condensed liquid (tar and pyrolysis water) and uncondensed gas products. On the basis of proximate, ultimate, thermogravimetric and FTIR analysis results have been confirmed that the Tavan tolgoi and Nariin sukhait coals are high rank bituminous coals of D mark and Baganuur and Shivee-Ovoo coals are low rank lignite coals of B2 mark. The completely burned 4 coal ashes were tested by FTIR analysis and determined the mineral composition by using of Roentgen fluorescence analysis and also determined that the ashes of high rank coals of Tavan tolgoi and Nariin sukhait deposits have acidic character and ashes of low rank coals of Baganuur and Shivee-Ovoo deposits have alkaline character.The coals of Tavan tolgoi, Nariin sukhait,Shivee-Ovoo and Baganuur deposits processed by pyrolysis in different heating temperatures and determined the yields of pyrolysis products such as hard residue, condensed liquid (tar and pyrolysis water) and uncondensed gas products. The yields of pyrolysis products at different heating temperatures of pyrolysis show that obtained higher yields of hard residue from high rank coals of Tavan tolgoi (78.90% at 800°C) and Nariin sukhait (83.33% at 800°C) than that of low rank coals of Baganuur (55.50% at 800°C) and Shivee-Ovoo (48.31% at 700°C) coal. It means that low rank coals of Baganuur and Shivee-Ovoo coals have given higher yields of tar, pyrolysis water and gas producs during pyrolysis than that of high rank coals of Tavan tolgoi and Nariin sukhait coal. The purified liquid tar product of pyrolysis of 4 coal were investigated by FTIR analysis, the chemical composition in group organic substances determined by chemical analysis and also have been obtained several fractions with different boiling temperature ranges, by room temperature distillation. Also, the pyrolysis hard residues of 4 coals characterized and compared with the same characteristics of initial coal samples.

Keywords: *high rank coal, low rank coal, bituminous caol, thermogravimetric analysis, thermal stability indices, pyrolysis tar, pyrolysis hard residue*

Speaker: Munkhtsetseg Sambuu

National University of Mongolia, Mongolia
Research interest: Coal chemistry

Macromolecular structural features for the brown coal extractions

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Abstract: The tendency of use of coals under the restrictions of environmental safety demands a more detailed understanding of its structure for its various processing. Particularly, processing of brown coals is the most important in the near future, since the brown coal is the most abundant (several hundred million tonnes) and approachable (more than 200 coal occurrences) resource in the country. In the current paper we are aiming to reveal an effectiveness of the solvents, such as pyridine and an ionic liquid, in the treatment with coals. Two extraction products are prepared in the refluxing processing of raw coal in solvents, pyridine and ionic liquid (1-butyl-3-methilimidazolium chloride). Moreover, separated from the extractions, the insoluble coal residues washed with methanol, were analyzed as well. Structural features are determined in the brown coal extraction products after the processing with the solvents such as pyridine and ionic liquid (1-butyl-3-methilimidazolium chloride). Coal extraction characterizations thereafter, are compared to its raw coal functional groups using by FTIR spectroscopy. The difference in spectra is observed even for the used solvents. For example, an extraction FTIR spectrum in the pyridine treatment presents changes mostly in the long wave of the vibrational region. Short wave bands at 3400 and 3000-2800 cm^{-1} are the least affected under the pyridine processing. In contrast, long wave bands were vanished or weakened by intensity, essentially, the mineral bands in 600-400 cm^{-1} region of wave number. An intensity of whole infrared spectrum is low powered in the pyridine used solvent case, but an opposite way for the ionic liquid treatment. In the ionic liquid processing the spectrum is involved wholly, means the short and long wave regions of vibration. Ionic liquid and coal interaction calls stretching bond around 3000-2800 cm^{-1} to be affected and a blue shift of C-O bands at 1600 cm^{-1} and of minerals at 600-400 cm^{-1}. It should be noted that the ionic liquid is still a powerful solvent in the meaning of solving insoluble material like coal. Insoluble coal residues are either analyzed by FTIR spectroscopy and compared to the raw coal infrared spectrum. In both pyridine and ionic liquid cases the residues were well washable from the solvent by methanol. FTIR spectra proves that in both case infrared spectra were renewable by means the original functional groups are similar as its raw coal.

Keywords: *coal, FTIR spectroscopy, SEM analysis, ionic liquid, pyridine*

Speaker: Konstantin Votolin

Federal Research Center for Coal and Coal Chemistry, Siberian Branch of the RAS, Russia
Research interest: Coal chemistry

Production of humic substances with increased biological activity from brown coals

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Abstract: The development of coal chemistry is aimed at improving the efficiency of using solid fuels. A promising direction is the production of humic substances (HS) from brown coals. HS are widely used in various industries. Most often HS is used as plant growth stimulants to maintain soil fertility, rebuilding the soil of disturbed land (revegetation) and for protection against desertification. The development of methods for obtaining HS from brown coals with increased biological activity is a promising direction. There is no doubt that the biological activity of humic acids (HA) depends on their molecular structure. Changes in the conditions for the extraction of HA from brown coals it significantly affect the structural-group (molecular) composition. Optimal conditions for the extraction of HA from brown coals of the Kansk-Achinsk coal basin (Russia) were found. Under optimal conditions (NaOH solution concentration – 3%, temperature – 25 ºC and duration of the process – 0,5 h), the extracted HA have increased values of the structural-group parameters "degree of aromaticity" f_a = 52 and "aromaticity/aliphaticity" $f_{ar/al}$ = 1,5 according to ^{13}C NMR (CPMAS) data. These values of the structural-group parameters of HA provide increased biological activity in relation to wheat seeds (the germination rates of wheat seeds – 9% (wetting with distilled water) and 20% (when using the HA)). The synergistic effect of HA from brown coals of the Kansk-Achinsk coal basin and the introduced mineral additives (urea, superphosphate) in the composition of humic preparations significantly increases the biological activity in relation to wheat (an increase in the germination rates of wheat seeds from 20 (only HA) to 45% (HA with urea or superphosphate)). It has been established that HA from brown coal can reduce the depressing effect of large concentrations to mineral fertilizer solutions on wheat seeds, for example urea. It is experimentally proved it is possible to obtain HA with a necessary structural-group composition and increased biological activity by selecting optimal conditions for extraction from brown coals. It is also shown that it is possible to increase the biological activity of humic preparations by compounding HA with urea or superphosphate additives (synergistic effect).

Key words: *brown coal, humic acids, structural parameters, biological activity.*

Speaker: Arailym Amanzholkyzy

Al-Farabi Kazakh National University, Republic of Kazakhstan
Research interest: Organic chemistry, polymer chemistry

New polymer forms of tamarixidin and their properties

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Abstract: Nowadays, delivery of the drugs has a lot of forms like tablets, gels, injections, and other dozens of types. But the delivery of drugs under the skin and through the skin has a great interest of researchers and in medical sphere, because of its easy to use and painless drug release. By combining and developing hydrogel forms and films as dermal drugs with plant extracts can be solve several problems such as antiviral, antibacterial, local anesthetic effects and so on. Compositions based on organic and inorganic polymers such as polymer- bentonite clay systems have a great interest in medicine and researchers. Using of biological active substances from extracts of plants as natural sources for soft dosage forms are essential for biomedical application. *Tamarix* (comb) of the *Tamaricaceae* (comb) family are plants with a valuable source of various biologically active substances. In this work new polymeric carriers of the biological active complex of *Tamarixidin* (TH-10) from the plant *Tamarix Hispida* were synthesized and investigated. Research results showed that the best solution for separating of BAS from raw materials TH-10 plant extract is ultrasonic extraction with 10% water-alcohol solution and the number of obtained extractive substances was 37.34%, moisture permeability 1.7%. New polymer films and gel ointments of TH-10 based on self-structuring polymers of gelatin (Gel) and bentonite clay (BC) were obtained. The composition of synthesized polymer forms of TH-10 is gelatin, bentonite clay, TH-10, glycerin, potassium sorbate. It was found that the activity is intense in the first 30 minutes and stabilizes after 24 hours. Strength, limit drop force and tensile limit were determined for each sample. To break the composite film with a ratio of TH-10 and gelatin 7:3, a load of 0.1 kg and 5-7 seconds is enough. Other ratios of components showed sufficient stability, so 9:1 and 8:2 was chosen as the optimal composition for gelatin. For gel dosage forms of gelatin (Gel) the quantitative values of sorption and desorption were investigated. The values of sorption are typically in the range from 70 to 85 % for 24 hours. The rheological characteristics of the gel forms are determined for Gel-BC 10% (8:2), Gel-BC 13% (8:2), Gel-BC 15% (8:2). Hydrogel forms based on 13 % Gel-BC are optimal in rheological characteristics and the optimum consistency is 66.717 Pa, 98.79 Pa and 168.87 Pa, correspondingly. In summary, compositions of polymer films of TH-10 based on gelatin, its compositions with BC, plasticizer and preservative are proposed. Films with a content of 10-15% polymer, 1% TH-10, 10-15% glycerol, and 0.2% potassium sorbate preservative are proposed for further study.

Keywords: *hydrogels, tamarixidin, bentonite clay, gelatin, films*

Speaker: Chantsalnyam Bariashir

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Organic chemistry, polymer chemistry, biochemistry

Concurrent improving the catalytic activity and thermal stability of iron pre-catalysts of type 2-(1-(2,4-dibenzhydryl-6-fluorophenylimino)ethyl)-6-(1-alkylphenyl-imino)ethyl)pyridylferrous chlorides

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Abstract: In the mid 1990, α-diimine (Ni^{2+}, Pd^{2+}) and bis(imino)pyridyl metal (Fe^{2+}, Co^{2+}) systems were discovered by Brookhart and co-workers into organometallic chemistry. Since these initial developments, homogenous catalysts are progressively increasing with the fast pace of discovery of new catalysis in present of era. We report here, the unsymmetrical ligand series 2-(1-(2,4-dibenzhydryl-6-fluorophenylimino)ethyl)-6-(1-alkylphenyl-imino)ethyl)-pyridines (Ar = 2,6-$Me_2C_6H_3$ in **L1**; 2,6-$Et_2C_6H_3$ in **L2**; 2,6-$^{i}Pr_2C_6H_3$ in **L3**; 2,4,6-$Me_3C_6H_2$ in **L4**; 2,6-Et_2-4-Me-C_6H_2 in **L5**) and the iron(II) chloride complexes (**Fe1**-**Fe5**) thereof have been synthesized with excellent yields and characterized by FT-IR, ^{1}H NMR, elemental analysis and X-ray diffraction analysis. The molecular structure of **Fe2** determined by single-crystal X-ray diffraction analysis, which revealed a pseudo-square-pyramidal geometry with three nitrogen atoms and two chlorine atoms around the iron center. Upon treatment with either MAO or MMAO as cocatalysts, all iron pre-catalysts (**Fe1**-**Fe5**) exhibited high activities (up to 4.93×10^{7} g(PE) mol^{-1} (Fe) h^{-1}) toward ethylene polymerization with high thermal stability. All produced raw materials were highly linear polyethylenes with low molecular weight, vinyl end groups and narrow molecular weight distributions which was in accordance with high temperature ^{13}C NMR, high T_m values (all around T_m~130°C) and the GPC curves of the obtained polyethylenes. The polymerization parameters were explored to determine the optimum conditions for catalytic activity, which were typically found to be 2250 eq. Al to Fe in presence of MAO and 1500 eq. Al to Fe in presence of MMAO at 80°C. By comparing with catalytic performance of previous bis(imino)pyridyliron analogues and the current iron system which is modified by *ortho* position of strong electron withdrawing group as -F and bulky benzhydryl pairings displayed relatively higher activities and thermal stability at elevated temperatures, especially at 80°C as the industrial operating temperature.

Keywords: *bis(imino)pyridyl, ligand, ethylene polymerization, highly linear and polyethylene*

Speaker: Munkhtsetseg Tsednee

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Natural product chemistry, plant environment interaction

Metabolic features of grazing-tolerant plants in mongolian pasture

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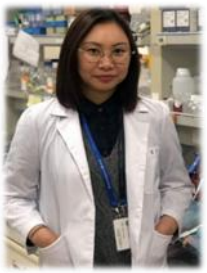
Abstract: Protection of grassland which represents about 66% of the total territory of Mongolia is a critical issue since 80% of the grassland are used for the pasture. However, recent reports have shown that about 70% of the pasture areas have been damaged in the country mainly due to an increase of domestic livestock in those areas. To restore and protect the grassland, it is critical to study the grazing-tolerant plants and understand that how these plants grow under grazing stress conditions. Our ongoing studies have identified several plant species tolerant to overgrazing stress in different biogeographic regions of Mongolia. Using comparative metabolomics analyses with different chromatographic approaches, we aim to study the normal vs grazing-tolerant plants under control and grazing stress conditions. The metabolomics analysis will reveal the specific components and strategies involved in grazing stress tolerance. In addition, we also focus on the comparative physiological analysis, particularly the phenotypical features of plants, to combine with the metabolomics study. Together, these studies have long-term potential for exploring the molecular basis of grazing tolerance mechanisms in plants that eventually be applied for improving the grassland recovery in pasture land. At the conference, we will present our recent results obtained on these studies.

Keywords: *comparative metabolomics, grazing tolerant plants, VOCs*



Speaker: Khandmaa Dashnyam

Monos Pharm Drug Research Institute, Mongolia
Research interest: Nanomaterials,pharmaceutical chemistry

Nanoscale calcium salt-based formulations as potential therapeutics for osteoporosis

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Abstract: Osteoporosis causes severe bone damage, posing potential risks to human health, patient quality of life, and society. Calcium has been widely shown to enhance bone density and prevent osteoporosis-related bone fractures. Here, we focused on calcium salt formulations containing natural substances and their possible therapeutic effects on osteoporosis. In particular, we developed a nanoscale calcium salt of natural origin and formulated nanoscomposite tablets supplemented with vitamin D (Vit D), herb Rhodiola rosea (R. rosea) and natural mineral Shilajit that are known to be antiosteoporotic. The calcium salt nanocomposites exhibited no toxicity, and particularly the formulation containing R. Rosea stimulated osteogenic differentiation. The calcium salt nanocomposites inhibited osteoclastic activity, including RANKL expression, as shown by a decrease in tartrate-resistant acid phosphatase (TRAP)-positive cells. When administered orally to osteoporotic rats for 45 days, the calcium salt nanocomposites reduced bone resorption, as evidenced by the significantly higher bone volume and density, increase in osteoblasts and decrease in osteoclasts compared to those in nontreated control rats. Systemic administration of the nanocomposites caused no severe stomach toxicity or damage over the test period, during which no renal stone growth was observed. On the basis of their significant bilateral effects in stimulating osteoblasts and inhibiting osteoclasts and the resultant efficacy in an osteoporotic model, the nanocomposite tablets composed of a calcium salt and natural products can be considered novel nanotherapeutics for osteoporosis treatment.

Keywords: *natural calcium salt, Rhodiola rosea, shilajit, osteoporosis, natural biomaterial*

Speaker: Nergui Uranbileg

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest:Nanoscience, material science

Fabrication and characterization of copper phthalocyanine-based field effect transistors

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Abstract: Future generations of electronic products will be enabled by flexible electronic circuits, displays, and sensors based on organic active materials, which could eventually reach the mainstream electronics industry. One of such devices is organic field effect transistor (OFET), which are three terminal devices that are comprised of a gate, source and a drain electrode. Here, we fabricated bottom-gate bottom contact OFET device using copper phthalocyanine (CuPc) as semiconducting layer. CuPc is a commercially available metal complex, a known p-type semiconducting material. Au/Ti electrode is sputtered on Al gated silicon substrate with thermally grown SiO_2 dielectric layer. CuPc films were then deposited over the substrate with patterned electrodes by physical vapor deposition at a rate of 0.35 nm/s, recorded by a quartz crystal microbalance at room temperature under a background pressure of 1.21×10^{-3} Pa. A thin layer of organic material was also deposited on glass slides and the optical properties of films with different thicknesses were determined by UV-Visible spectroscopy and the optical band-gap energy of CuPc thin film was determined to be 1.64 ± 0.01 eV. The thermal annealing effect on thin-film crystallization morphology was studied with atomic force microscopy (AFM), in which the CuPc thin-film devices were annealed in a drying oven, and the electrical properties were measured with a Keithley 236 source measure unit.

Keywords: *field effect transistor, organic semiconductors, optical band gap*

Speaker: Lkhagvasuren Damdindorj

National University of Mongolia, Mongolia
Research interest: Biochemistry, molecular biology, medical technology

The characterization of acid soluble collagen from sheep tail tendon

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Abstract: The sheep (*Ovis aries*) tail tendons are the major by-products after slaughtered for food consumption. A tendon is a powerful band of fibrous connective tissue that is composed of parallel bundles of collagen fibers and connects muscle to bone, due to the transmit forces and tolerate tension during muscle contraction. The tendon collagen structure is found as the main molecule of dense fibrous tissue and forms approximately 70% of dry weight. The collagen type, it is largely composed of Type I (60%) and other types. Type I collagen is by far the most abundant molecules in vertebrates, and it is particularly mechanical scaffold in bone, skin, and connective tissue. A number of studies have characterized the interactions among collagen and other proteins of primary stem cells and it is important for three-dimensional matrix to the culturing in which the particular collagens exist. In this study was conducted to extract and characterize acid soluble collagens (ASC) from sheep tail tendon. The tendon collagen was confirmed as collagen by different physico-chemical techniques such as: sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE), Zeta Potential Analyzer and Fourier transform infrared (FTIR) spectra analysis. The yield of type I ASC from sheep tail tendon was about 9.7% on a dry weight of raw material. The collagen's α1, α2 and β chain bands are observed in SDS-PAGE for both ASC and pepsin soluble collagen. The zeta potentials of ASC had positive charge when pH from 2 to 4.5, while negative charge in pH range from 6 to 11. But electric potential of ASC was zero at the pH 5. The results of FTIR spectra analysis detected the present of triple superhelical structure in acid soluble collagens, presenting isolation procedure did not interrupt the triple helical structure from the sheep tail tendon. Therefore, the study showed that it is a potential reference for collagen extraction and application of sheep tendon tail.

Keywords: *tendon, collagen, acid soluble collagen*

Speaker: Asem A. Rakhimova

Al-Farabi Kazakh National University, Republic of Kazakhstan
Research interest: Natural product chemistry

Investigation of natural pigments from *Tamarix hispida* flowers

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Abstract: Anthocyanins are polyphenolic glycosides related to flavonoids, which are natural pigments widely used in medicine and the food industry. Compounds are known to exhibit antioxidant, anti-inflammatory, and bactericidal properties. Among the plant sources containing anthocyanins, the genus *Tamarix* of the family *Tamaricaceae* is of interest. About 13 species of *Tamarix* growing in Republic of Kazakhstan, which has been proven to be rich source of polyphenols. Previous investigations of different extracts of aerial part *Tamarix hispida* led to the isolation and identification of several polyphenolics including tannins, flavonoids and phenolic acids. In the present work, we investigated a natural anthocyanin pigment from the flowers of *Tamarix hispida*. Water-alcohol extracts of the pigment with the addition of citric acid of various concentrations were obtained. The optimal conditions (raw material-reagent ratio, extraction time, number of macerations) for the extraction of the anthocyanin complex with the maximum yield of extractive substances have been developed. The concentration of citric acid varied from 0.1% to 2%. The extraction time was 3, 6, 12 and 24 hours, the raw reagent ratio was from 1:4 to 1:10 and twice maceration. As a result, an anthocyanin complex of violet-red color, soluble in water and polar solvents, was obtained. For the natural pigment, the following physical and chemical dates were determined: the density of the dye (0.9437 g/cm^3), dry residue content (9.04%), pH (4.13). Based on UV spectrometry, the maximum absorption was detected in the region of 520 nm, which indicates the anthocyanin nature of the pigments. The quantitative content of anthocyanins by photocolorimetry was 4.31%. The nature of the anthocyanin pigments is established by chromatography, and the use of specific reagents (10% CH_3COOPb, 10% NaOH, vapour NH_3) and solvents system (acetic acid – hydrochloric acid - water (3:1:8), n-butanol - acetic acid - water (4:1:2). The comparing the experimental data and the literature, 3 substances that belonged to cyanidin glycosides were identified. The thin structure of substances is established on the basis of spectral analysis methods. For further practical use of the dye, a gel form of anthocyanin pigment based on gelatin has been developed. According to the rheological characteristics and stability of the pigment, it was found that the optimal conditions for obtaining the gel form are pH=5, the concentration of gelatin is 9.00% and the content of dry coloring substances in the resulting gel was 0.11%.

Keywords: *Tamarix hispida, anthocyanins, chromatography, UV-spectrophotometry, gelatine*

Speaker: Bayarmaa Barkhuu

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Nutrition and food chemistry

The physicochemical composition of Sea buckthorn (*Hippophae Rhamnoides* L) oil and its treatment characteristics

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Abstract: Sea buckthorn (*Hippophae rhamnoides* L.) is a unique oil source, emphasizing its potential as a dietary and medicinal supplement. Many studies have shown that sea buckthorn pulp and seed oil are rich in saturated and unsaturated fatty acids and fat-soluble vitamins. Also, it has a wide range of biological and pharmacological functions to improve the immune system, stimulating metabolism, anti-inflammation and are also used for internal anaemia, digestive ulcers, diabetes, high blood pressure, and various cancers. In the present study, we have determined refractive index, acid value, iodine value and peroxide value by standard analytical method, and fatty acid was analyzed chromatographically. According to the result of the study, contents of the physicochemical parameters were contained that refractive index 1.47%, acid value 16.2 mg/KOH, iodine value 123.5 mg/KOH, and peroxide values were conducted 1.31 meq/kg, which indicates the oil is pure. The dominating fatty acids in seed oil were oleic, linoleic, and linolenic. The oil contained 14 fatty acids, of which 22.8% were saturated fatty acids, 32.29% were unsaturated fatty acids, and 44.91% were polyunsaturated fatty acids. Unsaturated fatty acids were dominated by oleic acid 26.87%, linoleic acid 33.02%, linolenic acid 11.89%, and palmitoleic acid 5.19%. Saturated fatty acids were found to contain 14.84% palmitic acid and 5.83% stearic acid, respectively. According to K.K, the acute toxicity performed in laboratory white mice by the accelerated method of V.B. Prozorovsky (1978) showed that LD50 is 81.5 g/kg or non-toxic. Sidorov's classification, and the active dose is ED = 1630 (815-3260) mg/kg. In addition, we carried out the chronic toxicity and the pharmacological effect of pure sea buckthorn oil on indomethacin-induced gastric ulcers in rats. It has been shown that sea buckthorn oil positively affects the regeneration of stomach tissues in experimental rats in case of stomach ulcers. However, the bacterial mass in the mucous membranes of the stomach in some rats was increased.

Keywords: *sea buckthorn, fatty acids, acute and chronic toxicity*

Speaker: Ganchimeg Yunden

Mongolian University of Sciences and Technology,, Mongolia
Research interest: Mineral processing, inorganic chemistry

Cu(II), Pb(II) and Cr(VI) adsorption on the modified activated carbon

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Abstract: In this study, the sorption of Cu(II), Pb(II), and Cr(VI) on amine-functionalized activated carbon were investigated. Coal from the Tavantolgoi deposit of Mongolia was used as a precursor for the modification. After the coal carbonization, the char was activated with heated steam at different times (120, 180, and 240 min) and several temperatures (800°C and 850°C). The activated carbon at 850°C for 240 min was used for the treatment with 3-aminopropyltriethoxysilane (APTES). The interactions between metal ions and functional groups on the sorbent surface were confirmed by Fourier transform infrared (FT-IR) spectroscopy, scanning electron microscopy (SEM) coupled with X-ray energy dispersive spectroscopy (EDS). The influence of various parameters such as pH (2-7), contact time (0.5-6 hours), temperature (25°C, 35°C, 45°C, and 55°C), initial concentration of heavy metals ions (10, 25, and 50 mg/L), and common cations (Na^+, K^+, Ca^{2+}, Mg^{2+}) was investigated. The optimum pH for Cu(II), Pb(II), and Cr(VI) sorption on the modified activated carbon was chosen as 4, 3, and 3, respectively. The sorption capacity was increased from 6.15 to 9.88 mg/g and 17.1 mg/g to 19.0 mg/g when increased the temperature from 25°C to 55°C for Cu(II) and Cr(VI) adsorption, respectively (initial concentration of metal ions were 50 mg/l). But the sorption capacity was decreased from 3.13 mg/g to 2.69 mg/g when increased the temperature from 25°C to 55°C for Pb(II) adsorption. The thermodynamic parameters such as enthalpy (ΔH°), entropy (ΔS°), and Gibb's free energy (ΔG°) were estimated, and the results confirmed that all sorption processes are spontaneous and thermodynamically favorable. The sorption capacity was decreased when the amount of Na^+, K^+, Ca^{2+}, or Mg^{2+} increased from 0 to 200 mg/L, and a remarkable decrease in sorption capacity was observed for Pb(II) adsorption. The order of adsorption capacity of modified activated carbon for metal ions was Cr(VI)>Cu(II) > Pb(II). The sorption mechanism was discussed for the processes.

Keywords: *modified activated carbon, heavy metals, sorption thermodynamics*

Speaker: Otgonjargal Enkhtur

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Research interest: Mineral processing, inorganic chemistry

Study on beneficiation of lithium ore using flotation

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Abstract: This study demonstrates the importance of flotation reagent and parameters for the separation of lithium concentrate from Lepidolite and, also Zinvaldite which has lithium less than Spodumene has. The crystal structure is similar to that of Muscovite and has a purple color. The ore consists of 0.4% lithium oxide, silicon, aluminum and 0.4% rubidium. Flotation is a principal method for beneficiation of lithium minerals from various ores. Several parameters, such as the reagents, content of the flotation pulp optimal dosage, pulp pH, grinding fineness and flotation time are investigated to optimize the recovery and increasing the grade of the concentrate products. The flotation conditions for selective lithium oxide separation from Lepidolite are tested in a 1.5 L flotation cell using oleate acid as a collector. Sodium silicate and Li_2SO_4 are tested as activators. In the flotation test, the appropriate grinding fineness is tested and between 60-90% of -0.074 mm. Results from the flotation tests revealed that the increased size of Grinding fineness to an increase in Lithium recovery with a corresponding decrease in grade. The results show that the Li_2O content in the ore is increased from 0.4% to 5%.

Keywords: *lithium, lepidolite, flotation, sodium silicate, sodium carbonate, oleic acid*

Speaker: Amarsanaa Badgaa

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Ecological chemistry, analytical chemistry, natural product chemistry

Chlorophyll catabolites in senescent leaves of Lima bean (*Phaseolus Lunatus*) and in the frass of *Spodoptera littoralis* after defecation

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Abstract: Chlorophylls (Chls), the green pigments responsible for photosynthesis in plants, algae and bacteria, are also part of the daily diet of herbivorous feeders. Chl degradation occurs during leaf senescence and fruit ripening, but is also noticed as a response to biotic and abiotic stresses. Besides the programmed degradation during senescence different factors such as high temperature, extreme pH values, enzymatic actions, molecular oxygen and light initiate the degradation of Chl. To gain more information on Chl degradation in the gut of plant-feeding insects, regurgitate and frass of Spodoptera littoralis caterpillars were analysed for late Chl catabolites by using LC-MS, UV, Fluorescence and NMR spectroscopy. The major metabolites were determined in fresh leaves of the food plant lima bean (Phaseolus lunatus), and were compared with digestive products. The observed spectrum of metabolites can be attributed to the combined action of esterolytic gut enzymes and the strongly alkaline milieu in the digestive tract. Interestingly, linear Chl catabolites was not detected in the gut of the larvae of Spodoptera littoralis. Substantial amounts of Chl catabolites were found to be macrocyclic rings opened in the senescent food plants, but also in the aged frass. We studied two primary fluorescent chlorophyll catabolites in senescent leaves of lima bean. The one of primary fluorescent chlorophyll catabolites have been found in frass of S.littoralis might be generating opened tetrapyrroles of Chl, only after exposed to the air and light.

Keywords: primary fluorescent chlorophyll catabolites, lima bean, spodoptera littoralis, late chlorophyll catabolites, opening macrocyclic tetrapyrroles

Speaker: Bolormaa Oyuntsetseg

National University of Mongolia, Mongolia
Research interest: Analytical chemistry, environmental chemistry

Vertical profile of water and sediment in lake oigon

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Abstract: Determining vertical variation of water quality parameters is contributed to a better understanding of the true nature of lakes. Lakes are classified into holomictic and meromictic lakes by their mixing mode; the former occurs physico-chemical mixing between the surface and deep waters, while the latter layers of lake water occur unmixed for years, decades, or centuries. Lake Oigon is the only Meromictic Lake identified in Mongolia. Few Mongolian lakes have been studied in different seasons but not in the vertical directions. Therefore, we studied the vertical profile of water and sediment parameters in Lake Oigon for two years. Physico-chemical parameters in water were measured on-site, while sediment parameters were determined off-site. Salinity in lake water ranged from 21.3 to 65.9 g/L which represented mesosaline to hypersaline. In oxic, sub-oxic, and anoxic zones, the physico-chemical parameters of Lake Oigon were varied a lot in longitudinal ways lake and seasonal variation observed as well. However, most parameters were stable in the anoxic zone, regardless of seasons, indicating that no water movement was at the bottom of the lake. Layered sediments with salt indicating hardly exchange with lake water at the anoxic zone. The statistical correlation and principal component analysis between the various physico-chemical parameters of lake water and lake sediment were computed. This study provides the basic information for future research on the characteristic of the vertical profile, impact on the ecosystem, and environmental assessment for Lake Oigon.

Keywords: *vertical profile, water, sediment, physico-chemical parameters, seasonal variation*

Speaker: Enkhtuul Surenjav

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Inorganic chemistry, nanoscience, material science

The contamination of persistent organic pollutants in environmental, food, and human milk samples

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Abstract: Persistent organic pollutants (POPs) are chemicals of global concern due to their hazardous effect on humans and the environment. Globally they are regulated in the Stockholm Convention on Persistent Organic Pollutants. The present study had Mongolia as a partner in a multinational project funded and coordinated by the United Nations Environment Programme with the aims to monitor the levels of POPs in environmental media, including air (with passive samplers), water, and soil. In addition, food samples of national interest and one pooled human milk sample were included. Project implementation and all sampling were undertaken by the Institute of Chemistry and Chemical Technology and the analysis was performed in laboratories abroad. The Brominated and chlorinated POPs were analyzed by gas chromatography/mass spectrometry, PFOS, PFOA and HBCD by liquid chromatography/mass spectrometry. The monitoring results, in general, showed comparatively low POPs levels in the air and the human milk sample. Very low concentrations were found in water, which was analyzed for PFOS, PFOA, and PFHxS only. In brief, toxic equivalents (TEQs) for PCDD/PCDF were very low in national samples (<<1 pg TEQ/g lipid) and very low but slightly higher for PCB-TEQs. Also in the air, TEQs were low but had a larger share of PCB-TEQs than air samples from other countries. PFHxS was not detected in any air or the human milk sample and PFOS and PFOA levels were in the range as found elsewhere. One fish sample had a high concentration of PFOS. OCPs in the air was often below the limit of quantification, but as average had higher levels for HCHs (11.2 ng/PUF), HCB, and PeCBz and also for PCB (11.4 ng/PUF). Very high concentrations were found for HBCD (average=28.1 ng/PUF). The human milk sample confirmed this for HCHs and HCB but not for DDTs. In soil, HCHs and DDTs had high levels. Contamination with chlorinated paraffins was the highest (SCCPs 170 ng/g lipid; MCCPs 540 ng/g lipid) countries. It is recommended to continue POPs monitoring programs in the future, especially for those where high concentrations were found.

Keywords: *persistent organic pollutants, chlorinated paraffins, hexachlorocyclohexane*

Speaker: Khwaja Naweed Seddiqi

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Research interest: Organic chemistry, petroleum chemistry

Primary recovery of Angot oil reservoir in the north part of Afghanistan by water drive based on Buckley-Leverett theory

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Abstract: The surface water injecting technique is used to increase the oil production rate and recovery factor from a petroleum reservoir. The main idea of this technique is to inject water into the oil reservoir and it can be used when the reservoir pressure decreases and oil production rate started to drop. Increasing the primary recovery of oil reserves is an important issue for petroleum engineers and researchers. In this paper, the primary recovery of Angot oil reservoir located in the northern part of Afghanistan by surface water injection has been evaluated. The water injection is stand based on the Buckley-Leverett graphical calculation of water saturation front theory. First, the theory has been studied by a laboratory experiment, and then the BL graphical calculation was applied for the same experimental model. The idea of conducting a laboratory experiment and application of BL theory in the same model was evaluating the applicability of the theory to the actual field. After appraisal of the experimental and graphical calculation result, the BL graphical calculation of water saturation front theory applied to the Angot oil reservoir. In the last part of this paper, the recovery of the Angot oil reservoir by water injection calculated by Computer Modeling Group, CMG numerical simulator software. Based on the evaluation of laboratory experiment and application of Buckley-Leverett theory in the same model it is cleared that the BL frontal displacement theory clearly calculated to advance of water saturation profile. In addition, it is possible to apply it in the actual field. Based on BL graphical calculation of Angot oil reservoir it is determined that the breakthrough occurred after 2800 days and approximately 70% of the reserve has been recovered until the mentioned time. However, the breakthrough of the under studied field calculated by CMG numerical simulation occurred after 3300 days, and about 80% of the reserve has been recovered. Finally, the oil recovery results came from Buckley-Leverett graphical calculation theory and CMG numerical simulator has been comparatively studied, at the end of this paper, some suggestions have been proposed.

Keywords: *reservoir engineering, petroleum production engineering, cmg, water drive, buckley and leverett theory, recovery factor*

Speaker: Zabihullah Mahdi

Akita University, Japan
Research interest: Organic chemistry, material science

Waterflooding technique to the Kashkari oilfield in the north part of Afghanistan

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Abstract: Waterflooding technique is a well-known theory and developed by many researchers but, it is the first time it was used for oil recovery in the Kashkari oilfield in the northern part of Afghanistan. In this paper, the technique is applied to the Kashkari oil field (which has four formations of Albian XIa, Aptian XIIa, Aptian XIIb and Hauterivian XIV) in the Amu Darya basin of northern Afghanistan, and the expected oil production by Waterflooding from the oil field was evaluated. The relative permeability of water and three kinds of oil were determined by laboratory experiment by steady-state method, and then the oil displacement by water was evaluated. The one-dimensional oil displacement by water was studied by numerical simulation through FEM (Finite Element Method) and FDM (Finite Difference Method), based on Buckley-Leverett theory. The methodology for this research is divided into three sections: 1. Experimental investigation; 2. Graphical analysis; and 3. Numerical analysis of one-dimension fluid flow through porous media that have been studied based on Buckley-Leverett frontal displacement theory. In this research, first, the relative permeability of water and three kinds of oil were determined by laboratory experiment by steady-state method (SS). Then the oil displacement by water was evaluated by laboratory experiments. Two different experimental setups were applied for this purpose i.e. 1) vertical oil displacement and 2) horizontal oil displacement by water through porous media. The displacement of oil by water was analyzed through the graphical calculations based on Buckley-Leverett's frontal displacement theory. First, the graphical calculations were applied in the laboratory apparatus, assumed as an artificial petroleum reservoir and the results were compared with the experimental investigation. Then graphical calculations were applied in a real petroleum reservoir located in the northern part of Afghanistan. The one-dimensional oil displacement by water was studied by numerical simulation through FEM and FDM, based on Buckley-Leverett frontal immiscible displacement of oil by water theory. To apply waterflooding technique to Kashkari reservoirs, a rate of q_T = 1,000 m^3/d of water injection was assumed with a horizontal linear flow. The Albian group XIa reservoir, the amount of oil produced up to breakthrough is 5.39 MMbbl. Aptian group XIIa, the oil produced up to breakthrough was 19.5 MMbbl.For the Aptian XIIb breakthroughs, total oil production is 7.1 MMbbl. The total oil production is estimated to 36.8 MMbbl.

Keywords: *waterflooding, buckley-leverette, petroleum reservoir, relative permeability*

Speaker: Narandalai Byamba-Ochir

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Inorganic chemistry, nanoscience, material science

Supercritical hydrothermal synthesis of new materials

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Abstract: Silver nanoparticles (AgNPs) and silver nanoparticles doted activated carbon (AC-Ag) composite materials were synthesized by hydrothermal processes in supercritical water conditions /29MPa and 400°C/ using batch reactor. We studied the influence of the precursor solution concentration, reaction temperature under the hydrothermal conditions, and synthesis time on the properties of synthesized materials. The properties of plain AgNPs and AC-Ag composite materials synthesized in supercritical water, including crystallinity, particle size, and molecular interactions between AC and Ag were investigated, comprehensively. Compared to the plain AgNPs, the activated carbon-supported Ag nanocomposite was synthesized faster due to the active functional groups of activated carbon. Furthermore, the FTIR results reveal that the silver nanoparticles are attached to the activated carbon surface in the presence of oxygen bonded carbonyl and carboxyl groups. The metal silver particles of around 30-80 nm in size were observed on the AC surface when analyzed by TEM and XRD. All results imply that the supercritical water condition allows the formation of silver particles less than 100 nm either in the form of plain particles or deposited on the activated carbon surface using the silver acetate precursor solution. This environmentally benign supercritical hydrothermal process can replace the conventional method and become a novel synthesis method for preparing various new materials.

Keywords: *supercritical hydrothermal synthesis, activated carbon, silver nanoparticles*

POSTER PRESENTATIONS MINERAL PROCESSING , INORGANIC AND ANALYTICAL CHEMISTRY

Speaker: Nyamdelger Shirchinnamjil

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Inorganic chemistry, analytical chemistry

Removal of antimony, arsenic and bismuth from polymetallic sulfidic concentrate by alkaline leaching

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Abstract: This study was investigated the removal of antimony, arsenic, and bismuth from Cu-As-polymetallic sulfidic concentrate by alkaline leaching with sodium hydroxide and sodium sulfide. The polymetallic concentrate was obtained from polymetallic sulfide ore, which is located in Bayan-Ulgii province in Mongolia, by the froth flotation process. The concentrate contains 0.91% of silver (Ag), 19.2% of copper (Cu), 19.4% of antimony (Sb), 2.03% of arsenic (As), 1.67% of bismuth (Bi) and a minor amounts of accompanying elements determined Inductively coupled plasma optical spectrometer (ICP-OES) and atomic absorption spectrometer (AAS) analysis. According to the X-ray diffraction (XRD), scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDS) analysis, the main mineral compositions in the concentrate were three different types of tetrahedrite containing various elements such as bismuth, chalcopyrite, arsenopyrite, and pyrite. Effects of various leaching parameters, namely sodium hydroxide (NaOH) concentration (40-80 g/L), sodium sulfide (Na_2S) concentration (60-200 g/L), leaching temperature (40-90°C), leaching time (4-24 hours), solid-liquid phase ratio (1:100-1:250 and agitation speed (300-500 rpm) were investigated at different conditions. Results showed that about 99.25% of antimony, 89% of arsenic, 44.5% of bismuth were removed from the concentrate by alkaline leaching under the optimized conditions, which were NaOH concentration of 60 g/L, sodium sulfide concentration of 140 g/L, S:L phase ratio of 1:200, leaching temperature of 97°C, agitation speed of 400rpm and leaching time for 24 hours. XRD and SEM-EDS analysis showed that the solid residue from the leaching contained chalcopyrite ($CuFeS_2$), covellite (CuS), chalcocite (Cu_2S), albite ($Na_2[AlSi_3O_8]$), and argentite (Ag_2S).

Keywords: *removal, polymetallic ore, polymetallic sulfidic concentrate, tetrahedrite*

Speaker: Azzaya Tumendelger

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Research interest: Inorganic chemistry, mineral processing, environmental chemistry

The possibility of increasing for the content of rare earth elements in concentrate by leaching with hydrochloric acid

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Abstract: The total rare earth oxide (∑REO) content in the investigated concentrate from Khotgor deposit, located in southern Mongolia, is 34.1%, of which 96.22% are light (La, Ce, Pr, Nd, Sm) rare earth oxides, and remained 3.8% accounts for heavy rare earth oxides and yttrium group. Of the yttrium group oxides, Eu_2O_3, Gd_2O_3, Dy_2O_3, and Y_2O_3 were determined to have a relatively high content with 0.16%, 0.35%, 0.11%, and 0.53%, respectively. About 61.7% of the concentrate is composed of base metal oxides and the main useful components are estimated as P_2O_5-20.15%, CaO-11.2%, SiO_2-21.07% and SrO-4.03%. The content of uranium and thorium oxide, which has negative consequences during deep processing of the concentrate was low with 0.08%, 0.05% for U_2O_3 and ThO_2. Experiments to increase the ∑REO content in the concentrate to 40% by leaching method were carried out under following conditions such as concentration of hydrochloric acid 2.5-4.0 mol/L, temperature 90°C, dissolution time 3h, stirring speed 300 rpm and solid to liquid ratio with 1:5. As a result, the ∑REO content reached 40.7%, increasing by 6.59% from initially determined value in the concentrate at 3.0 mol/L acid concentration as optimum concentration. When the acid concentration increases, the content of ∑REO in the liquid phase dissolves from 0.162 g/L to 0.614 g/L, and the base metal compounds dissolve from 5.98 g/L to 6.90 g/L. As for the content of ∑REO in the solid phase, it is increased from 38.4% to 40.7%, and the ∑REO was yielded about 93.9% -98.3%. It is concluded that if optimal conditions can be found for the treatment of concentrates with hydrochloric acid, it is possible to increase the ∑REO content and remove impurities that may adversely affect further processing.

Keywords: *rare earth oxides, acid dissolution, optimal condition*

Speaker: Baasanjav Dashtseren

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Mineral processing, inorganic chemistry

Study on beneficiation of manganese from low-grade manganese ore using flotation

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Abstract: The ore sample was selected from a low-grade area of the manganese deposit of Khuren Tolgoi in Umnugovi aimag for this study. The content of manganese in the primary ore is 4.2%. The characterization of the samples was determined by mineralogy, mineragraphic analysis, induction-coupled plasma optical emission spectrometer (ICP-OES) and X-ray diffraction (XRD). Samples with a grinding grade of 0.074 mm and 60-90% of contents were enriched. The process of enrichment of the samples is carried out the following method. The flotation was carried out by changing the consumption of 570-770 g/t of sodium silicate. As a result of the experiments, 4.8% yield, 10.84% grade and 12.39% metal recovery concentrate were obtained. The concentrate is proper to use for cleaning smelting furnaces of iron reduction.

Keywords: *manganese, flotation, reagen*

Speaker: Bayaraa Batnasan

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Research interest: Organic chemistry

Chemical composition of peloid from Lake Khyargas, Mongolia

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** deceased

Abstract: The purpose of the study was to determine chemical and organic matter compositions of peloid from Lake Khyargas in Uvs province by chemical and instrumental methods, including X-ray, ICP-OES, and GS/MS. Based on our results, it was identified that the peloid from Lake Khyargas belongs to hydrogen sulfide mud. The content of microelements ranged from 0.5-480 ppm. The peloid contains humic substance 18.08%, lipid 6.56%, and carbohydrate 15.95% in total organic matter (TOM). In addition, organic matters extracted by non-polar and polar solvents counts for 1.83% of TOM. The organic extracts were analyzed by gas chromatography-mass spectrometry (GC/MS) and identified 110 organic compounds in peloid from Lake Khyargas. There were compounds hydrocarbons and their derivatives (16.27%), carboxylic acid (12.94%), dialkyl phthalate (6.52%), element sulfur (4.53%), alcohol (17.65%), halogen bearing hydrocarbons (2.26%), nitrogen-containing compound (12.19%), cyclic hydrocarbons (0.41%), steroids (0.49%), and ketone (14.52%); respectively.

Keywords: *organic matter, humic substance, lipid, carbohydrate*

Speaker: Bayardulam Jamiyansuren

German-Mongolian Institute for Resources and Technology, Mongolia
Research interest: Mineral processing, inorganic chemistry

Chemical characterization of crud in solvent extraction - copper electrowinning process

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Abstract: One of the cost-effective, low-impact methods of extracting copper from low-grade ore is a dump or heap leaching. The leaching process is followed by the separation, which is the solvent extraction electrowinning process. Most solvent extraction operations of electrowinning in mining have difficulty with a stable solid suspension, predominantly called crud. The formation of crud can worsen phase separation time, lowers the mixing efficiency, loss of a large number of extractant, diluent, and copper-containing solutions. This study is to investigate the crud's chemical composition and its formation in the pregnant leach solution of the copper electrowinning process. Additionally, to study the crud formation, the constituent of the crud - aqueous and organic phase-, and the total dissolved solids and total solid suspension in pregnant leach solution were determined. The elemental analysis of aqueous solutions was conducted by the Inductively Coupled Plasma-Optical Emission Spectroscopy. The composition of dried crud after treating by flottweg tricanter centrifuge was conducted by X-ray Fluorescence and Powder X-ray diffraction. The residual of organic phases in the crud was determined by Fourier-Transform Infrared Spectroscopy.

Keywords: *copper solvent extraction, crud, solid suspension, pregnant leach solution*

Speaker: Bolormaa Chimeddorj

National University of Mongolia, Mongolia
Research interest: Environmental chemistry, analytical chemistry

Hydrogeochemical and geothermometry of Otgontenger hot springs in Mongolia

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Abstract: This study determines the properties of of Otgontenger hot spring waters and associated rocks, calculates reservoir temperatures and depths and in the hot spring constructs a conceptual model for geothermal water based on these results. The chemical compositions of the hot springs revealed that the springs contain HCO3-Na, SO4-Na, and HCO3-SO4-Na types of water with low TDS values in the alkaline pH range, and their temperatures ranged from 33.3–51.7°C. Reservoir average temperatures of hot springs were 120–144°C according to quartz and chalcedony geothermometry, and reservoir water circulation depths were 2420–2810 m. Otgontenger hot spring water in the Zavkhan province has the potential to be used in heating systems. Corrosion and mineral accumulation in heating systems based on these hot springs would be low, based on their alkaline properties and low TDS concentration. This type of hot spring resource could thus be used directly for heating households, greenhouses, and swimming pools.

Keywords: *hydrogeochemistry, geothermal energy, water–rock interaction*

Speaker: Khureldavaa Otgonbayar

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Environemtal chemistry, analytical chemistry

Assessment of groundwater quality in the Khan-uul district, Ulaanbaatar, Mongolia

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Abstract: In the present study groundwater quality of the Khan-Uul district in Ulaanbaatar city were taken for under investigations by one hundred thirty four drinking and irrigation groundwater samples collected from entire districts and evaluated for their suitability for human consumption. The water samples were analyzed for physical and chemical parameters. The results of analysis carried out showed the following concentration ranges: pH (6.28-8.39 or slightly acidic to slightly alkaline), EC (14.68-201 mS/m), TH (0.9-19.4 mg-eq/L), NO_3^- (0-170 mg/L), SO_4^{2-} (1.65-269.12 mg/L), Cl^- (0.82-271.07 mg/L) and Ca^{2+} (12.01-228.1 mg/L), Mg^{2+} (2.43-97.28 mg/L), Na^+ (1.45-133.2 mg/L). For the quality assessment, values of analyzed parameters of the water samples were compared with the Mongolian drinking water quality standards (MNS 0900:2018). Determinates of water quality parameters were exceeding the permissible limits in some places of the region of interest. Nineteen physical, chemical and radioactive parameters were selected to calculate water quality index (WQI) to promote the quality of water bodies. The calculated WQI values range from 7.62 to 91.66 with an average value of 24.44. Among all the groundwater samples, 94.7% were classified in the excellent water class, 5.3% were good water class for drinking purpose class based on WQI. The some indicators exceeded the standard values in the several groundwater samples of the Khan-Uul district indicate that the water is not potable and it required sustainable treatment before its utilization.

Keywords: *drinking water, groundwater, water quality index, Khan-Uul district of Ulaanbaatar*

Speaker: Narangarav Tumen-Ulzii

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Analytical chemistry, mineral processing, inorganic chemistry

Leaching kinetics of copper and iron from molybdenite concentrate in acidic nitrate solution

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Abstract: Molybdenite is the most widely used concentrate in the production of high purity molybdenum disulfide (MoS_2). Molybdenite concentrate usually contains some sulfide minerals such as chalcopyrite ($CuFeS_2$), covellite (CuS), pyrite (FeS_2), and gangue minerals. The removal of copper and iron impurities from the molybdenite concentrate is important to the grade of MoS_2. In this study, the removal of copper and iron from molybdenite concentrate with sodium nitrate ($NaNO_3$) in sulfuric acid (H_2SO_4) leaching were carried out in order to improve the amount of MoS_2 in the concentrate. The effects of the leaching temperature, leaching time, solid:liquid ratio, and concentration of leaching agents on the Cu and Fe dissolution from the concentrate were investigated. Under optimal conditions, the dissolution rate of Cu and Fe were 81.44% and 74.10%, respectively. Subsequently, copper leaching was confirmed to be controlled by a mixed kinetic model using a shrinking core and was calculated activation energy between the temperature range of 70-97°C as 35.77 kJ/mol. The thermodynamic probability of the main mineral leaching reaction in the concentrate was estimated by standard Gibbs free energy. Moreover, the results of XRD and SEM-EDS analysis observations of the solid residue were proved the formation of insoluble MoS_2 during leaching.

Keywords: *lithium, lepidolite, flotation, sodium silicate, sodium carbonate, oleic acid*

Speaker: Sukhbat Sandag-Ochir

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Mineral processing

Beneficiation and sulfuric acid leaching of manganese ore

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Abstract: In this study, the beneficiation of low-grade manganese ore was investigated using applied magnetic separation, MGS (Multi Gravity Separator), shaking table, flotation methods, and sulfuric acid leaching. The first aim is to determine the detailed characteristics of the primary material, using mineralogy, mineragraphic analysis, elemental analysis, and X-ray diffraction. The manganese content in the ore sampled from the Unagad deposit is 17.31%. Mineragraphic analysis is presented the mineralogical compositions are hydro goethite, manganese minerals, and magnetite, the gangue minerals are quartz, albite, orthoclase, microcline in manganese ore. Metal recovery of flotation and magnetic separation process of the samples is low and the content of manganese is less than 36% in the concentrate of the sample. The results are observed using an MGS to enrich manganese and the concentrate of the manganese is 38.3% and metal recovery is 58.3% for manganese ore of the Unagad deposit. The best option and high result among beneficiation experiments is the use of a Multi gravity separator. In terms of the divalent manganese (Mn^{+2}) which is soluble in water, manganese salts are generally obtained directly by acid leaching. If the manganese is insoluble in water (Mn^{+4}), reducing agents are necessary to shift from Mn^{4+} to the soluble (Mn^{+2}) compounds. Manganese leaching from the concentrate is investigated using leachate and as a reducing agent. The effects of agitation rate ranged 100, 200, 300, 400, 500 rpm, reaction temperature at 20, 30, 40, 50 and 60, leaching time range from 30 to 150 min, concentration range 1–5 M, concentration (0.4 0.6 0.8 1.0 1.2 mole/L) and liquid/solid mass ratio (10:1,15:1, 20:1, 25:1, 30:1) were studied. The optimal leaching conditions were determined as 4.0 M and 1.0 M using a liquid/solid mass ratio of 20:1 for 90 min at 40. Under these conditions, the leaching efficiency was 86.79% for manganese.

Keyword: *manganese ore, flotation, gravity, aacid leaching, reductive leaching*

Speaker: Unursaikhan Buyannasan

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Mineral processing

Technological study of reduced iron from standard concentrate

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Abstract: Optimization of the pure iron extraction from undesired ore contents is of great importance. In this study, we elaborated experiments on extracting reduced iron from low-sulfur iron concentrate selected deposit of Tumur-Tolgoi, Mongolia. As a result of the preliminary enrichment experiments, the iron content increased to Fe=66.2% from Fe=48.15%, the sulfur content decreased to S=0.4% from S=5.01%. The results of the X-ray diffraction analysis of the iron concentrate revealed magnetite and microcline phases. To perform the iron reduction experiment, the powder iron concentrate needed to be pelletized and the binder agent were used molasses, bentonite. Physical and chemical properties such as water absorption, particle size, angle of inclination of the pelletizer, and consumption of binding reagents are studied during the pelletization process in the laboratory. The strength of the binders increased with rising bentonite content, but the bentonite was a negative effect on iron content after the reduction process. So the optimum binder agent has molasses that was consumption of 3%, strength was 10 kPa. The identically shaped concentrate pellets were tested in a laboratory reduction furnace using carbon monoxide as a reduction gas. The content of the reduction gas is CO = 99.99% and the gas flow rate is 2.5 L/min - 5 L/min. The influence of temperature and time is investigated. The results of the reduction are confirmed by determining the content of the reduced iron element obtained by the study using the ICP-MS instrument and the hardness by the Vickers method. As the result of the reducing experiment at the 1050°C temperature and for 120 minutes, the reduced iron content was 85.6% and hardness was 115.5 HV which meets the requirements of the reduced iron standard. The reduced iron properties were the silvery-white shiny color, hard and dense state, good magnetic indication.

Keywords: *direct reduction, iron content, concentrate, pellet, reducing gas*

POSTER PRESENTATIONS NATURAL PRODUCT AND PHARMACEUTICAL CHEMISTRY

Speaker: Ganbaatar Jamsranjav

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Natural product chemistry, synthetic chemistry

Composition of extractive compounds of *Rheum Rhabarbarum* L. collected in Mongolia: Methods for isolation of stilbenes and anthraquinones and study of pharmacological properties

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Abstract: The composition of the extractive compounds of the roots and rhizomes of the *Rheum rhabarbarum* L. collected from Mongolia has been investigated. The presence of various groups of compounds in the extracts was identified by various chemical tests: the reagent of Dragendorf, Liebermann-Burkhard, Molish, Shinoda, Worntiger, by the absorption and fluorescence spectra, ferric chloride, ammonium hydroxide. These tests showed the presence of terpenoids, fatty acids, flavonoids, anthraquinones, polyphenols, glycosides, sugars and saponins. For phytochemical study and separation of components, the extraction of plant material was carried out using solvents of increasing polarity. The yield of compounds extracted with petroleum ether, tert-butyl methyl ether, ethyl acetate, and methanol was 1.2, 5.5, 2.6, 6.8%, respectively. The components extracted with methanol were subjected to partition extraction in the ethyl acetate - water system, which made it possible to separate the reserve sugars and additionally isolate the glycoside-containing stilbenes and anthraquinones, constituting an additional 1.8%. The total yield of extractable compounds (low molecular weight metabolites) was 17.9%. Compounds extracted with petroleum ether, tert-butyl methyl ether, and ethyl acetate, as well as ethyl acetate extraction (only 17.9% of the mass of raw materials were subjected to column chromatography on silica gel). Trans-stilbenes and stilbene glycosides were isolated from the fraction extracted with tert-butyl methyl ether: rapontigenin 1 (yield 0.9% of the fraction weight), deoxyrapontigenin 2 (4.5% yield of the fraction weight), isorapontigenin 3 (3.2% yield of the fraction weight), deoxyraponticin 4 (yield 6.8% of the mass of the fraction), isoraportin 5 (yield of 5.2% of the mass of the fraction), piceid 6 (yield of 3.7% of the mass of the fraction). The structure of deoxyraponticin 4 was proved on the basis of X-ray structural analysis data. From ethyl acetate and the EA part of the methanol extract were combined (according to NMR spectra) and subjected to column chromatography on silica gel with a gradient elution with $CHCl_3$-MeOH. obtained 9 fractions from which anthraquinones were isolated: chrysophanol 7 (yield 4.2% of the fraction weight), fiscion 8 (yield 5.0%), rhein 9 (yield 2.4%), and anthraquinone glycosides: fioscinin 10 (yield 3.0%), chrysophaenin 11 (yield 2.5%) and dimeric anthraquinone sinoside A 12 (yield 1.6%) we isolated. Thus, the composition of the underground organs of the rhubarb *Rheum rhabarbarum* L. growing in Mongolia was studied for the first time. The use of solvents of increasing polarity for extraction made it possible to separate the biologically important target components of the extracts. Data on the cytotoxicity of stilbene compounds against human tumor cells (MTT test) were obtained. The antitumor activity of several stilbenes is due to the induction of apoptosis (breast cancer cells MCF-7, GI50 <10 μM). This work was supported by joint RFFI project (project no. 19-53-44003).

Keywords: *Rheum rhabarbarum L, stilbenes , anthraquinones*

Speaker: Bolor Tsolmon

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Natural product chemistry

Structure–activity relationships for antioxidant activities of flavonoids from *Landolia punctata* in vitro and in vivo

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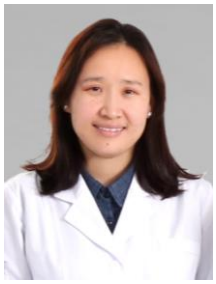
Abstract: *Landoltia punctata*, a widely distributed duckweed strain, was used as a traditional medicine in South Asian countries. Duckweeds contain high content of flavonoids with diverse structures, which are important constituents in pharmacy. The flavonoids of the duckweed *Landoltia punctata* was investigated, which led to the isolation and identification of five flavonoids apigenin 6-*C*-[*β*-D-apiofuranosyl-(1→2)]-*β*-D-glucopyranoside (1), luteolin 6-*C*-[*β*-D-apiofuranosyl-(1→2)]-*β*-D-glucopyranoside (2), quercetin 3-*O*-*β*-D-apiofuranoside (3), apigenin 6-*C*-*β*-D-glucopyranoside (4) and luteolin 7-*O*-neohespirodise (5). Compound (1), a new compound, and compound (3), previously detected by LC-MS, were identified by 1D and 2D NMR as well as chemical derivations. In the *in vitro* DPPH and ABTS assays, quercetin 3-*O*-*β*-D-apiofuranoside exhibited the most significant antioxidant activities with IC_{50} of 4.03 ± 1.31 *μ*g/mL and 14.9 ± 2.28 *μ*g/mL, respectively. In the *in vivo* antioxidant activity assay, apigenin 6-*C*-[*β*-D-apiofuranosyl-(1→2)]-*β*-D-glucopyranoside significantly increased the survival rate of *C. elegans* by 2-3 folds exposed to juglone and 75% to thermo damage. Furthermore, the compounds 1–5 showed moderate scavenging capacity of intracellular reactive oxygen species of *Caenorhabditis elegans* exposed to H_2O_2. In our case, glycosylation of the flavonoid effects on the antioxidant activity *in vitro* differ from that seen *in vivo*. With in vitro treatment, flavonoid monoglycosides showed higher antioxidant than their flavonoid diglycosides. Whereas flavonoid diglycosides have higher antioxidant activity than those of monoglycosides *in vivo*.

***Keywords**: duckweeds, Landoltia punctata, flavonoid c-glycoside, antioxidant activity, caenorhabditis elegans*



Speaker: Nomin Munkhbat

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
Research interest: Natural product chemistry

Acetylcholinesterase inhibition activity of *Aquilegia sibirica* L.

Nomin Munkhbat, Purevdorj Erdenetsogt, Odontuya Gendaram*

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Abstract: One of the methods for the cure of Alzheimer's patients is to use acetylcholinesterase (AChE) inhibitors which because enhance a cholinergic neurotransmission. Currently, for the treatment mostly use alkaloids, such as the synthesized donepezil, tacrine, as well as herbal galantamine, physostigmine, and huperzine A. But they have many side effects including liver damage, nausea, emesis, diarrhea, abdominal pain and excessive urination. Therefore, it is urgent to find new and efficient non alkaloid inhibitors from natural sources, highly bioavailable with low or no toxicity. In our study, the AChE inhibitory activity of the extracts and some isolated pure compounds from aerial parts of *Aquilegia sibirica* L. was determined by Ellman's mehod using spectrophotometer. The present research resulted in the ethylacetate fraction (IC_{50} 102.17±0.39 µg/mL) from the aerial parts of *Aquilegia sibirica* L. moderately inhibited the AChE activity, whereas the ethanol extract exhibited a weak activity (IC_{50} 245.50±0.45 µg/mL). Another dichloromethane, *n*-butanol and aqueous extracts were not active. In plant extracts, the AChE inhibitory activity is considered if IC_{50}<20 µg/mL is good, 20< IC_{50} <200 µg/mL is moderate, and 200< IC_{50} <1000 µg/mL is weak. The main flavonoids isolated and identified from aerial parts of *Aquilegia sibirica* L. including isocytisoside (IC_{50} 0.110±0.005 mM), apigenin (IC_{50} 0.440±0.090 mM), quercetin (IC_{50} 0.098±0.011 mM), kaempferol (IC_{50} 0.505±0.054 mM) and astragalin (IC_{50} 0.187±0.013 mM) exhibited the weak activity against AChE. There is criteria about the AChE inhibitory activity of pure compounds, if IC_{50} <0.015 mM is good, 0.015< IC_{50} <0.050 mM is moderate, and 0.050< IC_{50} <1 mM is weak. Therefore, quercetin, which is the popular flavonol in medicinal plants, is active, by following isocytisoside, which is the main compound in *Aquilegia sibirica* L. Only one screening method results for a certain biological activity can provide inadequate information. Therefore, it is necessary to conduct other methods for the acetylcholinesterase inhibition activity of crude plant drugs and isolated pure compounds to guarantee their activity.

Keywords: *Aquilegia sibirica, aerial parts, achetylcholinesterase, extracts, pure compounds*

Speaker: Nomuun Tsevegsuren

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Research interest: Natural product chemistry

Biological activities of *Heracleum dissectum* L.

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Abstract: Antioxidant activity of root, aerial parts and flower from *Heracleum dissectum* L. examined by DPPH radical scavenging assay compared to rutin (IC_{50} 22.66±0.3 μg/mL) and Ferric reducing antioxidant power assay (FRAP assay) compared to ascorbic acid (IC_{50} 2146.91±4.73 μM/L) was determined. In the DPPH, the ethyl acetate (IC_{50} 184.49±0.42 μg/mL) and the *n*-butanol (IC_{50} 160.10±0.57μg/mL) fractions of aerial parts showed a weak activity, while alkaloid fractions (pH=8 and pH=10), 96% and 80% EtOH extracts, dichloromethane fractions of root and aerial parts, as well as all the same extracts and fractions of flower was inactive. Results of the FRAP assay showed the *n*-butanol fraction (416.27±1.36 μM/L) of aerial parts, the alkaloid fractions (pH=8) of root (543.79±5.99 μM/L) and aerial parts (560.86±5.21 μM/L), the ethyl acetate fraction of root (406.01±6.84 μM/L) and aerial parts (445.39±3.41 μM/L) weak activity. Whereas, all other extracts and fractions of three crude drugs were not active. Anti-inflammatory activity of 96% and 80% EtOH extracts (IC_{50} 22.21 μg/mL) and (IC_{50} 9.56 μg/mL), the dichloromethane fraction (IC_{50} 58.42 μg/mL) of root, the dichloromethane fraction (IC_{50} 119.95 μg/mL) and water residue (IC_{50} 108.68 μg/mL) of aerial parts, 96% and 80% EtOH extracts (IC_{50} 292.65 μg/mL) and (IC_{50} 248.48 μg/mL) of flower were active by the human red blood cell membrane stabilization method. The other polar fractions of both crude drugs were not active. AChE inhibition activity is considered active when percentage is more than 50% at 200 μg/mL. Then the ethyl acetate and alkaloid (pH=10) fractions (61.21±0.5%) and (59.27±0.5%) of root, *n*-butanol fraction (58.13±1.3%) of aerial parts were active in this concentration. Whereas, all other extracts and fractions of both crude drugs were not active. By results, the ethyl acetate and *n*-butanol fractions of aerial parts, including the ethyl acetate and alkaloid fractions of root exhibited anti-oxidative and AChE inhibition activities. Whereas, the dichloromethane fractions of aerial parts and root, ethanol extracts of root can be considered as an anti-inflammatory active parts. These results could guide us to isolate and identify biologically active compounds from crude drugs of this plant species.

Keywords: *DPPH, FRAP, anti-inflammatory activity, AChE inhibition activity*

Speaker: Javzmaa Namshir

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Research interest: Natural product chemistry

Evaluation antimicrobial activities, synergistic effects of combinations and essential oils from *Pinus sylvestris, Picea obovata* and *Thymus gobicus* in Mongolia

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Abstract: Infections caused by bacteria have a significant impact on public health. They have resisted most, if not all, currently available and affordable antibiotics, resulting in worldwide socioeconomic calamity. As a result, there is of utmost importance to discover new or modify currently available antibiotics. This study aimed to evaluate the combined antibacterial effect of essential oils obtained from Mongolia pine (*Pinus sylvestris* var. mongolica), Siberian spruce (*Picea obovate* Ldb) and Thyme (*Thymus gobicus* Czern). The essential oils were obtained from dried needles of the two conifer species and aerial part of Thyme using hydrodistillation and analyzed by GC-MS. The antibacterial activities of Mongolian pine, Siberian spruce, and Thyme essential oils, individually and in the combination of them, were also determined. The interactions of the essential oils toward *Escherichia coli, Staphylococcus aureus*, and *Bacillus subtilis* were evaluated using the microdilution checkerboard assay in combination with chemometric methods. Mongolian pine was rich in monoterpenes including a-pinene, camphene, while oxygenated monoterpenes were the most abundant compound class in the Siberian spruce and Thyme oil, with bornyl acetate (29.8%) and thymol (29.33%) as the major compounds. The essential oils exhibited in vitro antimicrobial activity against all tested microbial strains. Interestingly, a combination of Siberian spruce and Thyme, both essential oils were dominated by monoterpenoids, produced the lowest synergistic action (FIC indices in the range 0.75–1.02) against the three strains. The highest synergistic effects are revealed by the combinations of different compound class (monoterpene and oxygenated monoterpene) which are Mongolian pine: Siberian spruce and Mongolian pine: Thyme toward *S.aureus* with 0.52-0.58 FIC index. The mixture of Mongolian pine: Siberian spruce showed the highest gain of 12-fold, especially against *S.aureus*, more than that found testing the essential oils separately. These findings should be taken into consideration for a possible application in the pharmaceutical.

Keywords: *Mongolian pine, Siberian spruce, Staphylococcus aureus, Bacillus subtilis*

Speaker: Odnyam Renchindorj

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Research interest: Natural product chemistry

Flavonoids from *Lactuca tatarica* (L.) C.A.Mey

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Abstract: Many species in the *Lactuca* L. genus (Compositae family) are medicinal herbs and wild vegetables. Scientists focus their research interest on the search for some promising compounds with high physiological effects and low toxicity for the benefit of human health. More than 100 species of the *Lactuca* genus are distributed across the northern hemisphere and also in temperate and warm regions of the world. In the Mongolian flora, four species of *Lactuca*, *L.undulata* Ledeb. *L. tatarica* C.A.M, *L.serriola* L. and *L.sibirica* L. Benth ex Maxim., are found. Their chemical constituents and biological activities have not been thoroughly studied yet. Four flavonoids and one phenolic compound were isolated from the aerial parts of *Lactuca tatarica* using thin layer chromatography, column chromatography and HPLC separation of its ethylacetate fraction. Their structure were identified by ^{1}H and ^{13}C NMR, including Mass spectrometry methods to be luteolin-7-*O*-*β*-*D*-glucopyranoside **(1)**, quercetin-3-*O*-*β*-*D*-glucopyranoside **(2)**, methyl caffeate **(3)**, apigenin-7-*O*-*β*-*D*-glucuronide-6”-methyl ester **(4)** and apigenin-7-*O*-*β*-*D*- glucopyranoside **(5)**. Luteolin-7-*O*-*β*-*D*-glucopyranoside **(1)** was isolated for the first time from *Lactuca tatarica,* while methyl caffeate **(3)** and apigenin-7-*O*-*β*-*D*-glucuronide-6”-methyl ester were isolated and identified from the genus *Lactuca* for the first time. The antioxidant activity of *Lactuca tatarica* was investigated by measuring the radical scavenging results of the DPPH radical and the $ABTS^{+}$ cation radical. The ethylacetate and 80% ethanolic extract of aerial parts of *Lactuca tatarica* showed a strong scavenging activity. Isolated compounds were tested for their antioxidative activity by above two methods. In DPPH scavenging, luteolin-7-*O*-*β*-*D*-glucopyranoside **(**IC_{50} 13.30 *μM***)**, quercetin-3-*O*-*β*-*D*-glucopyranoside (IC_{50} 13.51 *μM*) exhibited higher activity in comparison to the reference rutin (IC_{50} 38.7 *μM*). In case for $ABTS^{+}$ scavenging, luteolin-7-*O*-*β*-*D*-glucopyranoside **(**IC_{50} 77.14 *μM***)**, quercetin-3-*O*-*β*-*D*-glucopyrano-side (IC_{50}=12.12 *μM*) exhibited the same higher activity as previous in comparison to the reference trolox (IC_{50} 99.79 *μM*). Consequently, the antioxidative activity of the herb of *Lactuca tatarica* can be explained by the presence and quantity of different flavonoid derivatives in it.

Keywords: *Lactuca tatarica, flavonoid,phenolic compound, antioxidant activity*

Speaker: Purevdorj Erdenetsogt

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Research interest: Natural product chemistry

Alkaloids of some *Aconitum* and *Delphinium* species grown in Mongolia

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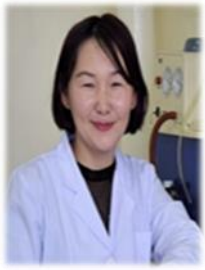
Abstract: Plants are the main raw material for food, industry, and medicine. Natural compounds of plant origin are complex and a vast knowledge base is being created by researching the structure of these compounds. Discovery of new compounds of plant origin and knowledge about their biological activity allows many new preparations to be created for use in medicine, agriculture and industry. Percentage of alkaloids among medicinal compounds of plant origin is growing due to their biological activity. On the other hand fundamental research of plant compounds, search for new efficient medicines, discovery of new natural compounds, elucidation of their structure are of the great theoretical value. There are 2823 plant species that are naturally growing in Mongolia, more than 860 of which are medicinal plants. Plant species of *Aconitum and Delphinium* genera (*Ranunculaceae* family**)** are rich sources of diterpene alkaloids. Due to their complex structure with several condensed rings diterpene alkaloids exhibit complex physiological activity, therefore they are an attractive research object for chemists, pharmacists and pharmacologists. 18 species of *Delphinium* and 10 species of *Aconitum* occur in Mongolia. Plants containing diterpene alkaloids were used by humans since ancient times; they are mentioned in works of Ibn Sina (Avicenna) as a remedy for skin infections such as scabs. In Tibet, China, Mongolia, India, Japan, Central Asia and Europe, plants containing diterpene alkaloids were used in different forms of extracts, tinctures and ointments in cases of rheumatism, radiculites, and neuralgia. *Delphinium* and *Aconitum* plants were used in Mongolian and Tibetan traditional medicine for treatment of acute infections, dysenteria and typhoid. Since 1986 we started investigating diterpene alkaloids from Aconitum and Delphinum species in Mongolia. Alkaloid composition of some 11 species of Aconitum and Delphinum of Ranunculaceae family and 56 individual compounds were isolated and identified. Among them, 8 were newly found naturally-occurring compounds and structures of these alkaloids were elucidated completely. High resolution Mass-spectrometry, ^{1}H and ^{13}C NMR, 2D NMR techniques such as COSY, HMQC, HMBC were employed to elucidate structure of new compounds. Structure of altaconintine was elucidated and confirmed by applying X-ray crystallographic analysis in addition to above- mentioned techniques. This research work was financed by supporting of joint RFFI project.

Key words: *diterpene alkaloids, aconitum, delphinium, mass-spectrometry, NMR*



Speaker: Solongo Amgalan

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Research interest: Natural product chemistry

Fractions and their biological activities of *Leptopyrum fumarioides* (L.) Reichenb.

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Abstract: *L.fumarioides* (L.) Reichenb., is a plant of species, which chemical composition and biological activity analysis are not studied comprehensively. *L. fumarioides* is used in Mongolian traditional medicine for the treatment of various diseases such as fever and the treatment of various intoxication and dropsy, it is mainly used to treat liver diseases. In Mongolian traditional medicine, its dosage and usage are accounted similar to *Hypecoum erectum* (U.Ligaa, 2006; Ch.Sanchir et al., 2005). *L. fumarioides* extract is also a component of an anti-tumor drug in traditional Chinese medicine (*S.* Abdula, 2013). Based on the use of traditional medicine, the aim is to test the antioxidant, hepatoprotective, and antiproliferative effects of extract and fractions of *L. fumarioides*. We have obtained ten extracts and fractions from *L. fumarioides* and seven of them are being done the preliminary screening for hepatoprotective, antiproliferative and antioxidant activities. By the screening in DPPH radical scavenging antioxidant activity the ethylacetate (IC_{50} 168.58±0.68) and crude alkaloid mixture (IC_{50} 97.84±0.39) were effective by comparison with rutin standard. It is not enough to screen one of the biologically active methods. Therefore, it is necessary to conduct other methods for the antioxidant activity of crude plant drugs. In further active fractions will be done with three various methods such as DPPH radical scavenging antioxidant activity, ABTS antioxidant and Ferric reducing antioxidant power assays. The preliminary screening study of antiproliferative effects of 7 extracts and fractions of *L. fumarioides* in HepG2 has been done. The data showed the concentration of survival cells were at 95% ethanol extract (21.7%), crude alkaloid mixture (12.6%) and dichloromethane fraction (40.2%) were active with comparison positive control 5-Fluorouracil (51%). Further IC_{50} will be determined at the active fractions. Hepatoprotective activity of extracts and fractions from *L. fumarioides* has been done. The hepatoprotective effect of the extracts and fractions were tested in *tert*-butylhydroperoxide (*t*-BHP) treated HepG2 cells. *t*-BHP is an organic peroxide, which generates reactive oxygen species in the cells. According to the screening data ethanol extracts, ethyl acetate and butanol fractions showed a protective effect against t-BHP induced cell toxicity in the cell culture assay. To concluding these screening results that the more polar compounds of *L. fumarioides* are relatively less toxic and have antioxidant effects and the nonpolar compounds may have a higher ability to inhibit toxic cells. Further research is needed in more detail.

***Key words**: previous phytochemistry, alkaloids, antioxidant, antiproliferative effects, hepatoprotective effect*

Speaker: Bayanjargal Lkhagvasuren

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Research interest: Natural product chemistry

Study of antioxidant activity of *Pedicularis flava*. Pall

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Abstract: This research work presents the antioxidant activity of *Pedicularis flava* Pall which grow in Mongolia with claimed a lot of therapeutic effects. Mongolian medicinal plants still offer great potential for the discovery of new drugs because most of them have not been studied in detail. Only a few investigations focused on *Pedicularis flava* Pall. The flowers and leaves of this plant have been used for the treatment of joint inflammation and poisoning. Moreover, *Pedicularis flava* Pall. has been applied to wound healing. DPPH assay method was carried determine antioxidant activities respectively. The results showed that ethyl acetate fraction IC_{50} 3.35 ± 0.209 µg/mL was the most active in the study of antioxidant activity while chloroform fraction is IC_{50} 7.74 ± 0.179 µg/mL and the butanol fraction is IC_{50} 10.95 ± 0.312 µg/mL. The hexane fraction was weakly active at IC_{50} 125.59 ± 0.114 µg/mL. The existence of some phenolic compounds in ethylaceate extract, such as phenylethanoids and flavonoids (found in other species of Pedicularis), which cause both antioxidant activities, is probable. Antioxidant activity of the ethylacetate extracts supports further studies related to phytochemical investigation and bioassay of different fractions to isolate pure compounds of plants.

Keywords: *Pedicularis flava, antioxidant activity, DPPH, ethylacetate extract*

Speaker: Sarangerel Oidovsambuu

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
Research interest: Natural product chemistry

Dracocephalum foetidum extract attenuates a nonalcoholic steatohepatitis in rats with methionine and choline deficiency

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Abstract: Nonalcoholic hepatosteatosis is a type of nonalcoholic fatty liver disease, in which excessive fat is accumulated in liver cells. Nonalcoholic steatohepatitis is characterised by liver inflammation and liver cells damage, which could progress to advanced scarring. *Dracocephalum foetidum* has been used in Mongolian traditional medicine for treatments of various liver related disorders. This study examined the effect of *Dracocephalum foetidum* extract in a rat model of nonalcoholic steatohepatitis. Before this examination, the toxicity of *Dracocephalum foetidum* extract was evaluated as non-toxic to experimental animals. Then *Dracocephalum foetidum* extract was administered orally to rats fed with methionine choline deficient diet for four weeks. The rats fed with methionine and choline deficient diet developed characteristics of human nonalcoholic steatohepatitis including fat accumulation in liver, elevated levels of AST, ALT and ALP enzymes in blood serum, increased lipid peroxidation and altered expression of a proinflammatory cytokine. However, administration of *Dracocephalum foetidum* extract reduced hepatic fat accumulation, decreased levels of hepatic cell damage marker enzymes in blood serum, increased hepatic GSH level, and decreased TNF-α cytokine expressions in liver. The histopathological study showed the treatment of *Dracocephalum foetidum* decreased fat droplet formation and necrosis in liver tissue. Therefore, *Dracocephalum foetidum* could be effective for treatment of nonalcoholic steatohepatitis.

POSTER PRESENTATIONS NUTRITION AND BIOCHEMISTRY

Speaker: Altantogos Myagmar

National University of Mongolia, Ulaanbaatar, Mongolia
Research interest: Biochemistry, analytical chemistry

Study of Mongolian natural zeolite as a modified delivery carrier for cephalosporins

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Abstract: Mongolia has a rich source of natural zeolite that is expected to be developed in the biomedical field. Nowadays, modified zeolites have been trying to use as a drug carrier and they can form controlled release drug delivery systems connected with their low toxicity, high porosity, good capacity and other unique characteristics. Natural zeolites are studied to investigate their ability to release drugs that can improve the bioavailability of the drug by preventing its premature degradation, maintaining its concentration within the therapeutic range, and ultimately reducing the potential side effects. In this study, kinetic and equilibrium studies were carried out to evaluate the cephalosporins' loading capacity of the thermally activated Mongolian natural zeolite. Cephalosporins were first encapsulated into activated natural zeolite by a soaking procedure, and then its release was assessed at different pH conditions in simulated body fluids. Pseudo first order, pseudo-second order, and Elovich kinetic equation were used to estimate the adsorption behavior in this study. The Langmuir, Freundlich, and Dubinin–Radushkevich isotherms were considered to describe the adsorption of cephalosporins on activated Mongolian natural zeolite. After thermal activation, the porosity and Si/Al ratio of zeolite are increased significantly. The adsorption of cephalosporins onto zeolite is fitted to the pseudo-second-order kinetic model through the time-dependent concentration at different temperatures. The equilibrium study shows that the cephalosporins adsorption onto Mongolian natural zeolite is favorable and the equilibrium is reached with few hours. Both zeolite and drug-loaded zeolite matrix has been characterized by scanning electron microscopy, X-ray diffractometry, X-ray fluorescence spectroscopy and Fourier transform infrared spectroscopy. Adsorbent dosage plays an important role in adsorption and drug carrier systems. The results presented in this study confirm the effectiveness of Mongolian natural (activated) zeolites. The results proved Mongolian natural zeolite has a good potential as a drug carrier and high drug loading efficiency and release.

Keywords: *zeolite, X-ray diffraction, drug carrier, drug loading capacity*

Speaker: Bayarjargal Munkhuu

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Biochemistry, protein chemistry

Antioxidant and antihypertensive activity of collagen and elastin hydrolysate at the different molecular weight

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Abstract: The angiotensin-converting enzyme (ACE) inhibitory activity and antioxidant property of collagen and elastin hydrolysates, and their peptide fractions (< 5 kDa, 5-10 kDa, 10-100 kDa) were compared. The bovine raw-hide and paddywhack (Ligamentum nuchae) were used for the preparation of collagen and elastin hydrolysates, respectively. Unfractionated collagen and elastin hydrolysates (4 mg/mL) could reduce ACE activity by 61% and 58%. As a result of fractionation, ACE inhibitory activity of collagen hydrolysate was increased up to 85%, while this effect was not observed on elastin hydrolysate. Elastin hydrolysate showed intense radical scavenging abilities through 2,2-diphenyl-1-picrylhydrazy (DPPH) and 2,2′-Azinobis-(3-Ethylbenzthiazolin-6-Sulfonic Acid (ABTS) assay. The collagen hydrolysate obtained from the bovine rawhide has more perspective for the bioactive food additive having ACEI activity in comparison with the elastin hydrolysate.

Keywords: *raw-hide, ligamentum nuchae, hydrolysate, ultrafiltration, peptides, angiotensin-converting enzyme inhibitor, antioxidant activity*

Speaker: Bayarmaa Jambalsuren

National University of Mongolia, Mongolia
Research interest: Biochemistry, enzyme chemistry

Screening of superoxide dismutase activity in some plants of Mongolia

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Abstract: Compared to the population of other eastern countries, Mongols consume fewer types of plant food in their diet. For us, this is the cause of many diseases. In addition to many biologically active compounds, plants also contain antioxidant enzymes that protect cells from damage. One of them is superoxide dismutase (SOD). It is an enzyme (EC1.15.1.1) that alternately catalyzes the partitioning of the superoxide (O^{-}_{2}) radical into ordinary molecular oxygen (O_2) and hydrogen peroxide (H_2O_2). Within a cell, the superoxide dismutase constitute the first line of defense against superoxide, therefore acts as a good therapeutic agent against reactive oxygen species-mediated diseases such as cancer, inflammatory diseases, ischemia, aging, rheumatoid arthritis, neurodegenerative diseases, and diabetes. The enzyme activity in plants varies with the growing environment. In the condition of the continental climate of our country, the activity of enzymes may change. Therefore, the objective of this study was to a screening of superoxide dismutase activity in plants, traditionally used for food and medicine. The activity of SOD was measured by Marklund and Marklund assay procedure and the activity was expressed in units (U/g). One unit of SOD activity was defined as an amount of enzymes required causing 50% inhibition of pyrogallol autoxidation. The following species showed SOD activity as: in *Urtica dioica* L.137.3±6.5 U/g, *Allium victoralis* L. 263.1±12.8 U/g, *Rosa acieularus* Linde. flowers 260±11.2 U/g, *Rosa acieularus* Linde. leaves 360±15.2 U/g, *Plantago major* L. leaves 134±4.8 U/g, *Pulsatilla flavescens* 240±12.1 U/g, *Pulsatilla turczaninowii* 90.7±4.4 U/g and in *Rheum undulatum* L. stem 82±4.4 U/g. To date, this study is ongoing.

***Keywords**: antioxidant, reactive oxygen species, superoxide dismutase*

Speaker: Enkh-Amgalan Lkhagvajav

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Research interest: Nutrition and food chemistry

Nutritional value and antioxidant activities of Mongolian edible mushrooms

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Abstract: Mushrooms are an important natural source of food for their nutritional characteristics. Edible mushrooms are highly nutritious foods, having high amounts of protein, equivalent to meat, eggs and milk, much higher than fruits and vegetables. The present study was aimed to determine the nutritional value and antioxidant properties of *Agaricus silvaticus, Agaricus arvensis, Lentinus edodes, Pleurotus ostreatus* and cultivated *Pleurotus ostreatus* grown in Mongolia. Antioxidant properties of methanol extracts were studied by 1,1-diphenyl-2-picryllhyadrazyl (DPPH) free radical scavenging method. The results have shown that the investigated mushrooms showed an excellent source of protein and carbohydrates, and it is contents ranged from 14.3-32.4 and 31.2-64.9% of dry weight, respectively. These edible mushrooms are considered suitable for food as well as for protein and carbohydrate supplements. The mineral contents vary according to species. *A. silvaticus* had the highest concentration of Zn (755 mg/kg), Pb (14.8 mg/kg) and As (5.5 mg/kg), while cultivated *Pleurotus ostreatus* had the lowest content. The content of macro and micro elements in wild mushrooms depends on factors like human action, soil type, pollution, climate and annual precipitation volume that directly influence the concentration. In contrast, cultivated mushrooms it depends on cultivation surroundings, conditions, and mushroom species and substrate types. These results show that the investigated edible mushrooms can be a useful component for human diets because of their high content of many essential minerals and trace elements and low content of toxic metals. The methanol extract of *Agaricus silvaticus* and *Agaricus arvensis* showed the highest scavenging activities (86.2 and 88.6%).

Keywords: *A.silvaticus, A.arvensis, P.ostreatus, L.edodes, DPPH, free radical scavenging activity, edible mushrooms, heavy metals*

Speaker: Khaliunsarnai Tsogtbaatar

Monos Pharm Drug Research Institute, Mongolia
Research interest: Natural product chemistry, pharmaceutical chemistry

Effect of shikonin extracts from *Onosma hookeri* for wound healing process

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Abstract: In this study, the optimal shikonin derivatives ethanol extract from the roots of Onosma hookeri was obtained. In vivo wound healing activities of shikonin derivatives, ethanol extract was investigated by creating artificial third-degree burns on rats' surface epidermal part. Shikonin consisting gel was applied twice a day for 21 days and data was collected on 0, 3, 7, 14, 21 days, respectively. The result was optimized by measuring the index of the wound and morphological structure. As a negative control distilled water is used, Calvasin is used as a positive control. Comparing to positive control shikonin consisting gel was healing the wound 50% more. Also, the epidermal part showed consistency in decreasing the inflammation. This result provides a rational basis for the clinical use of shikonin derivatives and shows the possibility of its use in medicinal treatment as a wound-healing gel.

Keywords: *shikonin derivatives, wound healing gel, onosma hookeri*

Speaker: Khishigjargal Tserendug

National center for zoonotic disease
Research interest: Biochemistry, biotechnology

Development o rapid and sensitive PCR DNA chromatography for *Yersinia pesti*

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Abstract: *Yersinia pestis* bacteria is the causative agent of plague. The highly contagious epidemic is a widespread zoonotic disease in all continents, except the Oceania. One of the biggest plague-endemic areas of Central Asia are located in 137 soums of 17 provinces covered 28.3% (443.3m^2) of Mongolian territory. The study aimed to develop a rapid, highly sensitive and specific DNA chromatography diagnostic test that could be read naked eyes for analysis of plague bacteria. *Yersinia pestis* bacteria DNA was identified by gene-specific polymerase chain reaction, agarose gel electrophoresis, DNA dot blotting assays. We are designed oligonucleotide tagged forward and biotin tagged reverse primers for specific genomic, plasmid sequence of *Yersinia pestis* and 525bp, 220bp amplicons were amplified by two-step polymerase chain reaction (PCR) condition. The PCR amplification products were confirmed by gel electrophoresis in 1.5% agarose gels and visualized with ethidium bromide staining. Genomic DNA detecting forward YP-mod F (Biotin-ACT CAA TGT TGT GAC GAG GAT G)/reverse YP-mod R (Biotin-ACT CAA TGT TGT GAC GAG GAT G) primers and plasmid DNA identifying forward mof-Pla F (Biotin-CAT TAT GTG GAT CTG CCT GGC)/reverse mof-Pla R (Tag1 [C3 spacer] ATC CTG TTT GCT TCG CTG ACC) primers successfully amplified 525bp, 220bp amplicon from inactivated suspension and DNA template, respectively. The amplicons were incorporated with blue latex beads through a biotin-avidin interaction and then hybridized oligonucleotide tag complementary on the nitrocellulose membrane. 2.5ng/mL (40 time diluted) antiTag1 immobilized dot was showed the highest intensity when PCR amplicon hybridized and detected by avidin conjugated blue latex bead. The labeled PCR products are visualized on the membrane a blue dot that is easy to detect with the eyes. The assay spent less than 3 hours. The method has great potential to quickly developing any other diagnostic chromatography test for new and recurrent infections.

Keywords: *plague, diagnosis, oligonucleotide tag, biotin, streptavidin*

Speaker: Munkhtsetseg Byambaa

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Nutrition and food chemistry

Bioactive compounds microencapsulation using inulin as encapsulating agent

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Abstract: Due to high lipophilicity and low solubility in water, the application of many bioactive compounds as additives to food is limited. In addition, poor solubility causes lower absorption and limited bioavailability in the gastrointestinal tract. Today, the food industry requires food-safe delivery systems to encapsulate, protect and release biologically active compounds. Inulin is a fructooligosaccharide that acts as the dietary fiber, increasing the benefits of bifidobacterias and, consequently, improving the overall health of the gastrointestinal system. Thus, inulin could be applied in food and pharmaceutical industries for the production of functional food, nutritional compounds and medicines. The main goal of this research work was to encapsulate bioactive compounds using inulin as encapsulating agents, extracted from *Inula helenium* L roots. In this study, gallic acid (GA), as a core material, was microencapsulated with native and acetylated inulin at a ratio of 1:30 (core:wall). Oil in water nano-emulsion was prepared by ultrasonic liquid processing and transformed in a freeze dryer to encapsulate the powder. The dried powder was determined for its moisture, encapsulation efficiency and morphology property by SEM. Results showed that acetylation of inulin remarkably improved the GA encapsulating respect to native inulin with a percentage high above 86% in all the systems.

Keywords: *oligosaccharides, microsphere, Inula helenium, encapsulation*

Speaker: Nyamsuren Erdenetsogt

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Natural product chemistry

Antioxidative activity of phenylethanoid glycosides from the whole plants of *Pedicularis resupinata* L. and their structure activity relationship

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Abstract: Phenylethonoid glycosides are the major biological active constituents of the genus *Pedicularis L*. The basic structural parts of these compounds are hydroxyphenylethanoid and β-glucopyranosides, the latter are attached by the glycosidic bond. They possess a high antioxidative activity due to the fact that it contains a hydroxyl group in its molecular structure. According to our study four phenylethanoid glycosides named as decaffeoylverbascoside, verbascoside, dolihandroside A, and permethylverbascoside were isolated from the whole plants of *Pedicularis resupinata* L. and their molecular structures were identified by one and two dimensional spectroscopic analysis. Amongst them, dolihandroside A, permetylverbascoside, and decaffeoylverbascoside were identified for the first time from this species, while dolihandroside A was identified from the genus for the first time as well. The antioxidative activity of the isolated compounds was tested by DPPH radical scavenging and FRAP methods. Verbascoside showed the best activity amongst others with IC_{50} of 25.58±2.07 µg/mL, and followed by decaffeoylverbascoside and dolihandroside A with IC_{50} 35.42±1.45 µg/mL and 48.08±0.2 µg/mL, respectively, compare to rutin IC_{50} 22.66±0.29 µg/mL. The ferric ion reducing values by the FRAP method resulted following orders activity as verbascoside, decaffeoylverbascoside, dolihandroside A, and permethylverbascoside with 456.72±6.64 µM/L, 404.54±6.46 µM/L, 353.59±3.18 µM/L, and 300.79±4.63 µM/L, respectively, compare to ascorbic acid 600.32±26.94 µM/L at 250 mkM/L. Chemically, verbascoside has two ortho-dihydroxyl groups located at positions 3, 4 and 3'', 4'', dolihandroside A, decaffeoylverbascoside have one ortho-dihydroxyl at positions 3, 4 and two methoxyl groups at 3'', 4'', whereas permethylverbascoside possesses only four methoxyl groups at the same positions 3, 4 and 3'', 4''. Results of molecular structures peculiarities and antioxidative activity of isolated compounds, confirm that numbers and positions of hydroxyl groups strongly influence on the antioxidative activity. Consequently, verbascoside, which contains 4 hydroxyl groups at two ortho-positions of its molecular structure demonstrated the most activity, while permethylverbascoside with 4 methoxyl groups was the least active.

Keywords: *Pedicularis resupinata L, phenylethonoid glycosides, antioxidant*

Speaker: Oyundari Ganzorig

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Research interest: Nutrition and food chemistry

Phenolic content and anti-microbial activity of *Helianthus tuberosus* L cultivated in Mongolia

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Abstract: *Helianthus tuberosus L* (Jerusalem artichoke) family Asteraceae, is a potential source of inulin and phenolic compounds. The polyphenol compounds play an essential role in plants' growth development and protection against infection by plant pathogens and insects. Within the past years, the secondary metabolites of Jerusalem artichoke have attracted significant interest because of their several potential health benefits. These compounds possess a broad spectrum of chemical and biological activities including radical scavenging properties. The primary purpose of this study was to determine the total phenolic and flavonoid contents and anti-microbial activity of the aerial parts and tuber of Jerusalem artichoke in aqueous and ethanol extracts. The content of total phenolic and flavonoid compounds of extracts were analyzed by Folin-Ciocalteu and aluminum chloride colorimetric method, respectively. The total phenolic compounds of the aqueous and ethanol extracts of the aerial parts of Jerusalem artichoke expressed as gallic acid equivalents (GAE/g dry weight) were 2-7.3 fold higher than the tubers. Also, the ethanol extracts of these two parts possessed the highest total flavonoid content 926.46 ± 0.16 and 33.36 ± 0.2 mg QE/g dry weight, respectively. It has demonstrated that the aerial parts of Jerusalem artichoke are a rich source of phenolic and flavonoid compounds. The anti-microbial activity has been tested on *Bacillus subtilis, Saccharomyces cerevisiae, Aspergillus niger, Escherichia coli*, and *Staphylococcus aureus*. The ethanol extract of the aerial part has shown anti-microbial activities slightly against *B.subtilis, S.aureus* (3 and 2.5 mm respectively), and while aqueous extract of the tuber showed activity against *A.niger* (4 mm). These results are suggesting that the Jerusalem artichoke contain the active constituents responsible for eliminating the bacterial pathogens.

Keywords: *anti-microbial activity, phenolic compounds, tuber, Jerusalem artichoke*

POSTER PRESENTATIONS NANOSCIENCE AND MATERIALS

Speaker: Ariunzaya Tsogoo

National University of Mongolia, Mongolia
Research interest: Nanoscience

Cu doped ZnO nanoparticles with enhanced photocatalytic and antibacterial activity

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Abstract: This work reports a doping effectiveness of copper (Cu) doped zinc oxide (ZnO) nanoparticles synthesized through surfactant-free organic phase route. The structural and photocatalytic properties were studied TEM, UV-vis spectroscopy, as well as the antibacterial activity, was tested on *Escherichia coli* (*E. coli* ATCC 25922) and *Staphylococcus aureus* (*S. aureus* ATCC 25923) bacteria by broth dilution method and nanoparticle free solutions were used in antimicrobial tests against *E. coli* and *S. aureus*. The band gap of the nanoparticles was decreased from 3.32 to 3.28 eV depending on the doping concentration. Photocatalytic degradation of MB (Methylene blue) dye reaction rate was changed from $1.2x10^{-4}$ M/min to $10.9x10^{-3}$ M/min. These results indicate that interactions between sp and d orbitals of host matrix (ZnO) and dopant (Cu), respectively, lead to the conduction band and valence band narrowed also Cu ions substituting in ZnO matrix and increase the separation of photogenerated electron-hole pairs. The synthesized $Zn_{1-x}Cu_xO$ nanoparticles showed increasing inhibitory effects on the growth of each bacteria type as the concentrations of Cu doping increased. Significant antibacterial inhibition founded from 7M% Cu doped ZnO nanoparticles for 98.9% and 97.4% for *E. coli* and *S. aureus*, respectively.

Keywords: *copper doped zno nanoparticle, photocatalytic activity, antibacterial activity, Escherichia coli, Staphylococcus aureus*

Speaker: Bayarzul Uyat

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Research interest: Material science

Comparative study of porous materials obtained from kaolinite clay by various treatment

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Abstract: Kaolinite is a clay mineral, an important industrial mineral for aluminosilicate clay. Selective leaching has been developed to prepare nanoporous γ-Al_2O_3 and SiO_2 from kaolinite clay. In this work, the natural kaolinite, from Khongor-Ovoo deposits of Mongolia, was treated by the various method such as calcination of natural kaolinite (metakaolin), metakaolin addition of carbon nanotube (CNT), and metakaolin addition of carbon nanotube (CNT) then it was mechanochemically activated with dilute sulfuric acid at 90°C. All results of treated samples compared with the natural clay.The properties of the porous materials were analyzed by XRD, XRF, FTIR, and BET adsorption methods. All parameters of metakaolin addition of carbon nanotube (CNT) then mechanochemically activated with dilute sulfuric acid at 90°C kaolinite clay were the highest. A maximum of 92.8% of the total aluminum was dissolved from the clay, which increased the specific surface area to 187.2 m^2/g. The formation of four-dimensional silicon at an intensity of 946.36 cm^{-1} was confirmed. In natural kaolinite, the spectral ranges of Al-OH bond are 3620.36, 3689.65, and 3853.53 cm^{-1}, while on metakaolin addition carbon nanotube (CNT) then mechanochemically activated with dilute sulfuric acid at 90°C kaolinite clay it ranges from 923.37 cm^{-1} - 946.36 cm^{-1} and the formation of four-dimensional silicon was confirmed by FTIR.

Keywords: *porous material, kaolinite clay, mechanochemical activation*

Speaker: Darhijav Burenhangai

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Material science

Removal of cationic dye from wastewater using coal ash as a low-cost sorbent

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Abstract: This research aimed to study coal ashes from gher district as a potential adsorbent to remove the dyes. Coal ash from the gher district is rarely utilized for solid waste. In this study, adsorption of two reactive dyes which were Methylene Blue as cationic, Lanasol Red as anionic from aqueous solution to remove colored dyes from industrial wastewater. The adsorption material from coal ashes was investigated by the coal combustion process at lower temperatures (600-700°C). The results showed a higher ability for the removal of organic pollutants from industrial waste water. Methylene Blue (MB) is a typical dye and has been widely used in many textile finishing industries in Mongolia. The prepared composite of coal ash was characterized by X-ray diffraction (XRD), X-ray fluorescence (XRF), gamma-spectroscopy, BET, scanning electron microscope (SEM) and adsorption analysis. The results displayed that the adsorption rate of granulated coal ash was 50-70% for MB in 300 min.

Keywords: *coal ash, characterization, adsorption isotherm, methylene blue dye*

Speaker: Tamiraa Ganbold

National University of Mongolia, Mongolia
Research interest: Nanoscience, material science

First-principles study of adsorption of hazardous atoms on the silica surface

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Abstract: In this study, the adsorption of hazardous atoms including lead on silica supercell was investigated using the first-principles method within the framework of density functional theory (DFT). The supercell of silica was formed by 2×2×1 along the x, y, and z axes, respectively, and it is taken by [001] surface. We performed the full structural optimization and found the most stable configuration. Four different sites were considered for the surface of silica, as well as four different sites for the surface of silica with an Al atom, and the adsorption energy along with the equilibrium geometry was determined. When the absorption energy was calculated at the four positions, the surface of silica and the surface of silica with Al had the same higher absorption at the first site (-6.66 eV and -9.11 eV). The value of the absorption energy indicates that a strong chemical bond has been formed between the lead and the surface. The maximum values for the absorption energy of lead atoms were -6.93 eV for the silica supercell and -9.11 eV for the supercell of silica with the Al atom. Furthermore, the structure added by aluminum with ratio of 1:5 in order to build a similar structure of a zeolite crystal. Which provided more absorption energy. The value of the absorption energy indicates that a strong chemical bond has been formed between the lead and the surface. The DOS graph also shows that the bandgap was 2.78 eV for the silica surface and 2.65 eV for the silica surface with Al atoms. The addition of the lead atom reduced the width of the bandgap due to the creation of a trapping layer within the bandgap.

Keywords: *silica, lead adsorption, DFT, PW, GGA*

Speaker: Mandakhsaikhan Luvsandagva

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Material science

Synthesis of montmorillonite clay and multi-walled carbon nanotubes for nanocomposite

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Abstract: In this study, nanocomposite material was synthesized using Mongolian montmorillonite clay and multi-walled carbon nanotubes (mont-MWCNT). The montmorillonite clay is from Khumuultei deposit located in Bayanjargalan sum, Tuv province, Mongolia. At first the montmorillonite was autoclaved using 10% HCl at 120°C for 10 hours, then it has been modified to get $–NH_2$ bonding, while the MWCNT was treated to functionalized –COOH bonding. The mont-MWCNT was prepared as 4 g of treated montmorillonite mixed with 120 mL dimethylformamide and sonicated for 40 minutes, afterwards 0.4 g of functionalized MWCNT were added and heated to 90°C for 24 hours. The main characterization of samples was determined by Fourier-transform infrared spectroscopy (FTIR), specific surface area (SSA), X-ray fluorescence (XRF), Thermogravimetry/differential thermal analyzer (TG/DTA) and X-ray diffraction (XRD). The main mineral SiO_2 of raw montmorillonite was increased by approximately 14.36% after acid leaching, while the other main minerals such as Al_2O_3, CaO, and Fe_2O_3 were decreased by 3.79, 0.88 and 6.33%, respectively. The specific surface area of raw montmorillonite, acid leaching montmorillonite, and mont-MWCNT were 1939, 3073, 11826 cm^2/g, respectively, by FBT-9 Fully Automatic Specific Surface Area Tester based on Blaine's method. The specific surface area of mont-MWCNT was increased 6 and 3.85 times than natural montmorillonite and acid leached montmorillonite, respectively. The mont-MWCNT could be used as adsorbent materials for hazardous materials.

Keywords: *montmorillonite, multi walled carbon nanotube, nanocomposite*

POSTER PRESENTATIONS PETROLEUM, COAL, AND ORGANIC CHEMISTRY

Speaker: Ariunaa Alyeksandr

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia
Research interest: Coal chemistry

Thermal dissolution of Mogoin gol coal with hydrogenated phenanthrene

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Abstract: Coal processing in a solvent medium, instead of high-temperature coking, can be promising alternative for the production of aromatic substitutes. Therefore, dissolution of coal by different solvents at various conditions was a topic of numerous studies in the past. The studies confirmed advantages of the process for obtaining of valuable products such as polycyclic aromatics, ash free coal etc. from coal under mild condition compared with direct coal liquefaction. Hydrogenated phenanthrene is typically produced from coal tar distillates and one of the widely used commercial product with hydrogen donating ability. This paper reports the of thermal dissolution of Mogoin Gol coal, Mongolia using hydrogenated phenanthrene. Experiments were carried out with and without catalyst using a batch-type autoclave at 435°C for 2 h under H_2 initial pressure of 3 MPa. Commercial $NiMo/Al_2O_3$ catalyst (3 wt.% Ni, 15 wt.% Mo) was used for the experiments. Fractional distillation of soluble products was performed by using glass tube oven under vacuum. The light (<220°C) and middle (220-350°C) distillates were separated into aliphatics, aromatics and polar compounds by column chromatography. Chromatographic solvents were hexane, toluene and methanol-dichloromethane mixture (1:1 by volume). GC-MS was used to identify individual compounds in each fractions. Results showed that yield of solid products reduced to 24.5 wt.% in experiments with catalyst. Meantime the yield was relatively high or 62.8 wt.% for the experiments without catalyst. It shows that hydrogenation and hydrocracking capacity of $NiMo/Al_2O_3$ catalyst highly contributed to the conversion of coal organic matter into liquid and gaseous products. Yield of the products was 3.6 times high than that of the products obtained from experiments without catalyst. Hydrogenated phenanthrene also plays important role in a preventing of the coke formation during dissolution of coal.

Keywords: *bituminous coal, thermal dissolution, catalyst, distillation, light and middle distillates, gas chromatography*

Speaker: Battsetseg Erdenee

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Research interest: organic chemistry, polymer chemistry

Potential of VFAs for microbial lipid production

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Abstract: A major issue in biodiesel commercialization is finding an inexpensive and sufficient alternate feedstock to improve the long-term sustainability of biodiesel production. Therefore, low-cost carbon sources should be investigated, thereby reducing production costs. One of the essential parameters determining the price of microbial lipids is the cost of the carbon source. Therefore, low-cost carbon sources should be investigated, thereby reducing production costs. For example, glucose is an efficient carbon source for cell growth and high productivity, the cost of glucose is estimated to be about 80% of the total medium cost, which contributes to over 60% of the total production costs in a typical fermentation process. As a carbon source for oleaginous yeasts, volatile fatty acids (VFAs) could be economically produced from the anaerobic fermentation of common organic materials. VFAs can be biotransformed by oleaginous yeasts into high value-added microbial lipids, thereby reducing the lipid production cost. The present review discusses the origin of acetic acid and VFAs, issues, potential application, also microbial lipid, and acetic acid and VFAs assimilation by oleaginous species. The relative metabolic pathway (lipid biosynthesis in oleaginous yeast), culture modes and novel oleaginous microorganism ever used, VFAs platform, and the strategy to improve lipid production from acetic acid and VFAs are reviewed.

Keywords: *microbial lipid production, cryptococcus curvatus, acetic acid, volatile fatty acids (VFAs)*

Speaker: Anudari Dolgormaa

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Material science

Adsorption of Methylene blue from aqueous solution by using the gelatin modified magnetic nanoparticles

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Abstract: Methylene blue, a water-soluble heterocyclic aromatic compound, is a useful cationic dye, which is used as common cationic industrial organic dye for wood, silk, cotton, insect killers, and medicines. In addition, this dye is toxic for humans and could lead to several health problems, such as vomiting, nausea, cancer, and eye problems. In this work, magnetic nanoparticles (MNPs) were synthesized by the co-precipitation method and further modified by gelatin (gel) for adsorption of Methylene blue from an aqueous solution. MNPs and MNPs/gel were characterized by TEM, DLS, XRD, FTIR, VSM, and TGA. The size of synthesized MNPs and MNPs/gel was 14.02 and 22.63 nm, respectively. The magnetization value of the MNPs/gel was 56.382 emu/g. The adsorption of Methylene blue on the MNPs/gel was indicated with the influence of pH, adsorption kinetic, adsorption isotherm, and determined the regeneration of MNPs/gel. The adsorption kinetics was investigated by pseudo-first and pseudo-second order models, while the adsorption isotherm was determined by the Langmuir, Freundlich, Sips, and Dubinin-Radushkevich models. The results demonstrate that the kinetic data was well fitted pseudo-first order model (R^2=0.979) and isothermal data was well described by the Freundlich model (R^2=0.999). Moreover, the maximum adsorption capacity of the MNPs/gel was calculated as 48.162 mg/g using Freundlich model. The adsorption behaviour was multilayer and physical adsorption. The MNPs/gel nanocomposite is eco-friendly and can be used as an adsorbent material for the removal of cationic dyes from an aqueous.

Keywords: *magnetic nanoparticles, methylene blue, adsorption, gelatin*

Speaker: Byambajav Ganbold

Germany Mongolian Institute for research of Technology, Mongolia
Research interest: Organic chemistry, petroleum chemistry

Hydrocracking of atmospheric residue from Tsagaan-els oil, Mongolia

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Abstract: Now day's global development is moving towards a clean energy but petroleum still plays an important role in transportation, heating and raw materials of chemical industry. Unfortunately, the world's light crude oil production approaches limit and resource is decreasing rapidly so the attention focused on refining of heavy crude oil. The cracking technology is necessary to convert the paraffinic residual oil to lighter distillates for the production of transportation fuels and chemicals. The aim of this study was to characterize physical and chemical properties of Tsagaan-Els oil of Mongolia, its atmospheric residue (>350°C) and hydrocracking products. The hydrocracking experiment was carried out with and without catalyst at temperature 450°C for 1h-3h under hydrogen pressure of 5kPa. Commercial Ni-Mo/Al_2O_3 catalyst (Ni 3%, Mo 15%) was used in the hydrocracking experiments for 1 and 2 h. Tsagaan-Els deposit has a conventional crude oil with a high paraffin content. The paraffin obtained from the residue of Tsagaan-Els oil contained n-alkanes of 92.12% with carbon atoms C_{17}–C_{31}. The contents of asphaltenes and resins in the residue were low (15.48%). Fractional distillation showed that the yield of light distillate is 11.64 wt% and the yield of middle distillates is 14.73 wt %. The yields of light and middle distillates obtained by hydrocracking of the atmospheric residue for 3h without catalyst were 15.8 and 17.7 wt% respectively. Effect of catalyst was tested in the experiments for 2h. By the hydrocracking with catalyst the yield of light distillate has increased 4.5 wt % in comparison with the yield of light distillate obtained from experiment without catalyst. GC-MS analysis showed that light and middle distillates contain very low amounts of hetero-atomic compounds and high amounts of aliphatic hydrocarbons suitable for production of gasoline and diesel feedstock.

Keywords: *crude oil, residue, cracking, distillation, fraction*

Speaker: Nomin Tamir

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Research interest: Photo-responsive oxide nanomaterial

Photodemirization mechanism of *Trans*-4-(trifluoromethyl)-cinnamic: A study by infrared spectroscopy

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Abstract: A cinnamic acid, specifically trans-4-trifluoromethyl cinnamic acid (TriFCA), has been synthesized and structurally changed by irradiation, namely, photodimerization, studied spectroscopically by powder X-ray diffraction, infrared spectroscopy, and optical measurements. For crystallization experiments, TriFCA was dissolved in acetone and left at ambient temperature to allow slow evaporation of the solvent until the crystal appeared. The crystal structure of TriFCA reveals that it fulfills Schmidt's topochemical rules for [2+2] photodimerization and the infrared spectroscopy has been used to monitor the photodimerization molecules, confirming TriFCA to be an 4,4'-di-trifluoromethyl-truxillic acid. The principal changes observed in the spectra upon dimerization are the decay of a band around 1633 cm^{-1}, which is assigned to *v*(C=C) of the ethene bond of the monomer, changed to v(C-H) of saturated carbon atoms of the dimer. We have carried out preliminary kinetic experiments of photodimerization by optical absorption. The changes in the optical absorption spectra during the photoreaction found that the intensity of the monomer band with an absorption maximum at 268 nm decreases 1.80 oD to dimer band 1.14 oD.

Keywords: *cinnamic acids, X-ray diffraction, dimerization reaction*

POSTER PRESENTATIONS ENVIRONMENT AND ECOLOGICAL CHEMISTRY

Speaker: Bayarjargal Bayartsengel

National University of Mongolia, Mongolia
Research interest: Environmental chemistry

Characterization of biochars produced from various biowastes

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Abstract: Biochar is a product of the thermal degradation of organic materials in the absence of air. Slow-pyrolyzed biowaste-derived biochars show excellent adsorption properties. Studies on biochars produced from pine nut shells, sawdust, and cow dung have been carried out in Mongolia determining the technical characteristics and applying for improvement of soil quality. However, a thorough characterization of biochars is still in lack. In this study, we produced 10 biochars from animal bones and dungs, and firewoods and compared their characterization properties. Physico-chemical parameters of biochars such as moisture, ash, volatile matters, fixed carbons, pH, redox potential, electrical conductivity, total dissolved solids, cation exchange capacity, base saturation were determined and SEM-EDX, FTIR, XRD, main elements and trace metals analysis were obtained. Methylene blue and iodine absorption tests were carried out in terms of surface porosity. All biochars showed high electrical conductivity and base saturation indicating that they were rich of cations. The highest values of pH, EC, TDS, and CEC were found in biochar produced from sheep dung. Among bone chars, biochar produced from sheep spine bone showed the highest CEC. High Ca content in bone biochars resulted from the nature of the raw material. Biochars hardly contained trace metals. XRD analysis showed that the firewood biochar had amorphous, whereas the bone biochars and dungs had crystal structures. Biochars produced from animal and forestry biowastes have shown great values of adsorbent characteristics, thus application of such biochars can simultaneously reduce waste and be an environmentally-friendly valuable product.

Keywords: biochar, characterization, animal bone, firewood, animal dung

Speaker: Dolgorjav Rentsendavaa

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Research interest: Environmental chemistry, material science

Fabrication of flat tubular clay-based porous support filters

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Abstract: Mongolia has few freshwater resources. It is therefore important to conserve water resources. One possibility is to purify water and reuse it. Therefore, the scientists from the Material Science Center of the Mongolian University of Science and Technology together with the researcher from the Korean Institute for Material Science carried out a project between 2017-2020. In the early stages of the project, flat tubular clay-based porous support filters were investigated. For this reason, low-cost and abundantly accessible Mongolian raw materials such as kaolin and natural zeolite were used. We used primary kaolinite from Mandal-Ovoo and zeolite from Urgun and, their chemical and mineralogical composition and physical and mechanical properties were determined. Zeolite from Urgun contains SiO_2 - 65.98%, Al_2O_3 - 13.70%, TiO_2 - 0.36%, CaO - 1.44%, Fe_2O_3 -2.25, K_2O – 2.68%, Na_2O - 2.99%, P_2O_5 - 0.09% and MgO - 0.96%. As a result of X-ray data processing, it was revealed that the Urgun zeolite consists of clinoptilolite, quartz and feldspar. An offset of 62.07% zeolite and 37.93% kaolin was obtained and flat tubular porous support was produced with an extruder. The proportion of organic binders was between 10-35% and water content was 35-40%. The flat tubular porous supports were burned at 800 and 1000°C for 1 hour and the properties such as pore distribution were determined. The results of the investigation show that Mongolian natural raw materials can be used to obtain supports for flat tubular porous filters with a pore size of 150 µm.

Keywords: *zeolite, kaolin, ceramic membrane*

Speaker: Dulamsuren Ganpurev

Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences, Mongolia

Research interest: Microbiology, environmental chemistry

Microbiological and hydrochemical parameters of deep wells used for drinking water in Ulaanbaatar, Mongolia

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Abstract: Groundwater is not a nutrient-rich environment for microorganisms to grow and thrive, but it is polluted by many environmental factors. These nutrients can exceed the permissible levels in drinking water and can be reason for spreading highly infectious diseases in the population. Therefore, there is a need to monitor the quality of water from deep wells in ger areas, to study certain correlations, to prevent people from various infectious diseases, to protect the environment, to use water resources properly, and to provide citizens with accurate information on drinking water. Within the framework of the study, samples were taken from 135 deep wells used for drinking and household purposes in Bayanzurkh, Bayangol and Sukhbaatar districts of the Ulaanbaatar city. The water quality was analyzed for some hydrochemical (NO_3^-) and six main microbiological parameters. Due to microbiological parameters 42 samples (30.6%) from the surveyed deep wells did not meet requirements of MNS 0900:2018, the national drinking water standard of Mongolia, and 31 samples (21.9%) exceeded the nitrate ion content described in above standard. In Bayangol district, 88% of the surveyed sources found that the number of bacterial contaminants in 100 ml of water exceeded the limit. But in the Sukhbaatar district's summer camp region which is relatively low populated area was shown relatively low level of microbiological contamination and nutrient pollution compared to the permissible level in water samples. According to correlation studies, the nitrate ion concentrations of 12.6% samples over the permissible value (more than 50 mg/L) and high level of bacterial contamination in drinking water, showed a weak correlation.

Keywords: *deep wells, drinking water, microbiology, pollution indicators, pathogens*

Speaker: Narmandakh Dambajamts

National University of Mongolia, Mongolia
Research interest: Environmental chemistry

Chemical composition of atmospheric fine particulate matters (PM2.5) in Ulaanbaatar, Mongolia

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Abstract: This study assesses the seasonal variations, potential sources, and health risks of fine particulate matter, PM2.5. Samples (n=83) were collected at two urban sites of Ulaanbaatar. Inorganic ions, organic/elemental carbon, and metals were analyzed. Results exhibited a distinctive seasonality for all chemical compositions with sulfate being the dominant species of PM2.5 in winter. Comparably high concentrations of sulfate, nitrate, and ammonium were measured in winter, while concentrations of calcium and magnesium were higher in spring and summer rather than in other seasons. The results revealed that dominant sources of atmospheric PM2.5 are mainly due to emissions of coal combustion in the heating period, and soil dust resuspension is in the non-heating period.

Keywords: *fine particle, PM2.5, chemical composition, seasonal variation*

Speaker: Narandalai Byamba-Ochir

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Research interest: Inorganic chemistry, nanoscience

Removal of Cu(II) and Pb(II) ions from aqueous solutions by KOH-activated carbons

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Abstract: This article presents the copper and lead ions adsorption process using KOH- activated carbons (PPMAC3). The adsorption of heavy metals onto the adsorbents was carried out in static conditions and the factors affecting the adsorption capacities of Cu and Pb were investigated, such as initial metals concentration, adsorbent dosage, pH of the solution, and contact time were studied. The X-ray photoelectron spectroscopy (XPS) results reveal the activated carbons were containing oxygen bonded functional groups to effective removal of heavy metals from aqueous media. The maximum sorption capacities obtained were 91.5 mg g^{-1} of lead at pH 2 and 26.6 mg g^{-1} of copper at pH 4 from dilute solutions containing 100 mg L^{-1} of metal (adsorbent dosage, 2 g L^{-1}), respectively. The removal percentage was found to be higher for Cu (II) when compared with Pb (II). The adsorption isotherm studies revealed that data was confirmed with both the Langmuir and Freundlich isotherm models. Kinetic adsorption data were analyzed by the pseudo-first-order model, the pseudo-second order model, respectively.

Keywords: *KOH-activated carbon, heavy metals, surface characterization, adsorption isotherm*

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