
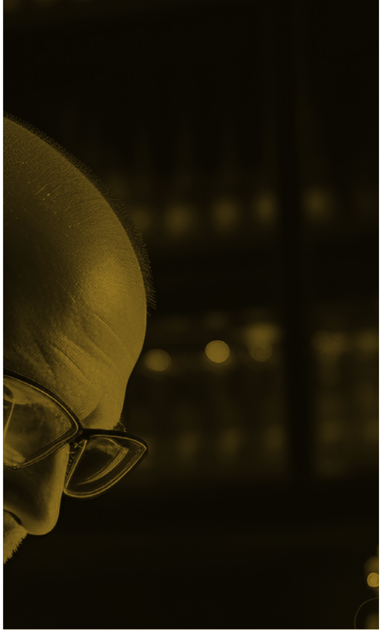
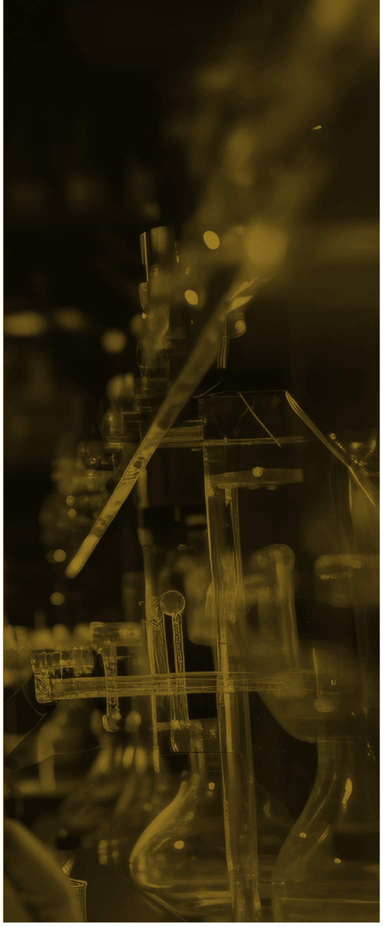
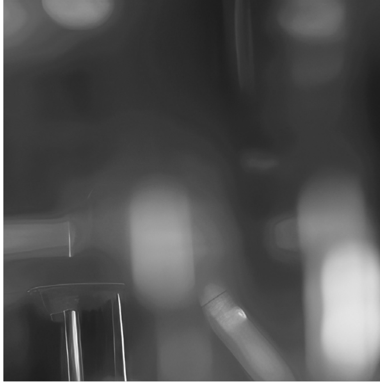

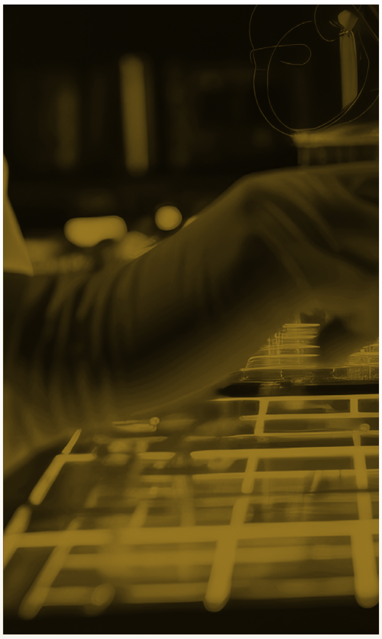

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18th Edition of International Conference on

Catalysis, Chemical Engineering and Technology &

4th Edition of International Conference on

Green Chemistry and Renewable Energy

Venue:

Hotel CIS Paris Ravel, 6 Av. Maurice Ravel, 75012, Paris, France

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JUNE
17-19

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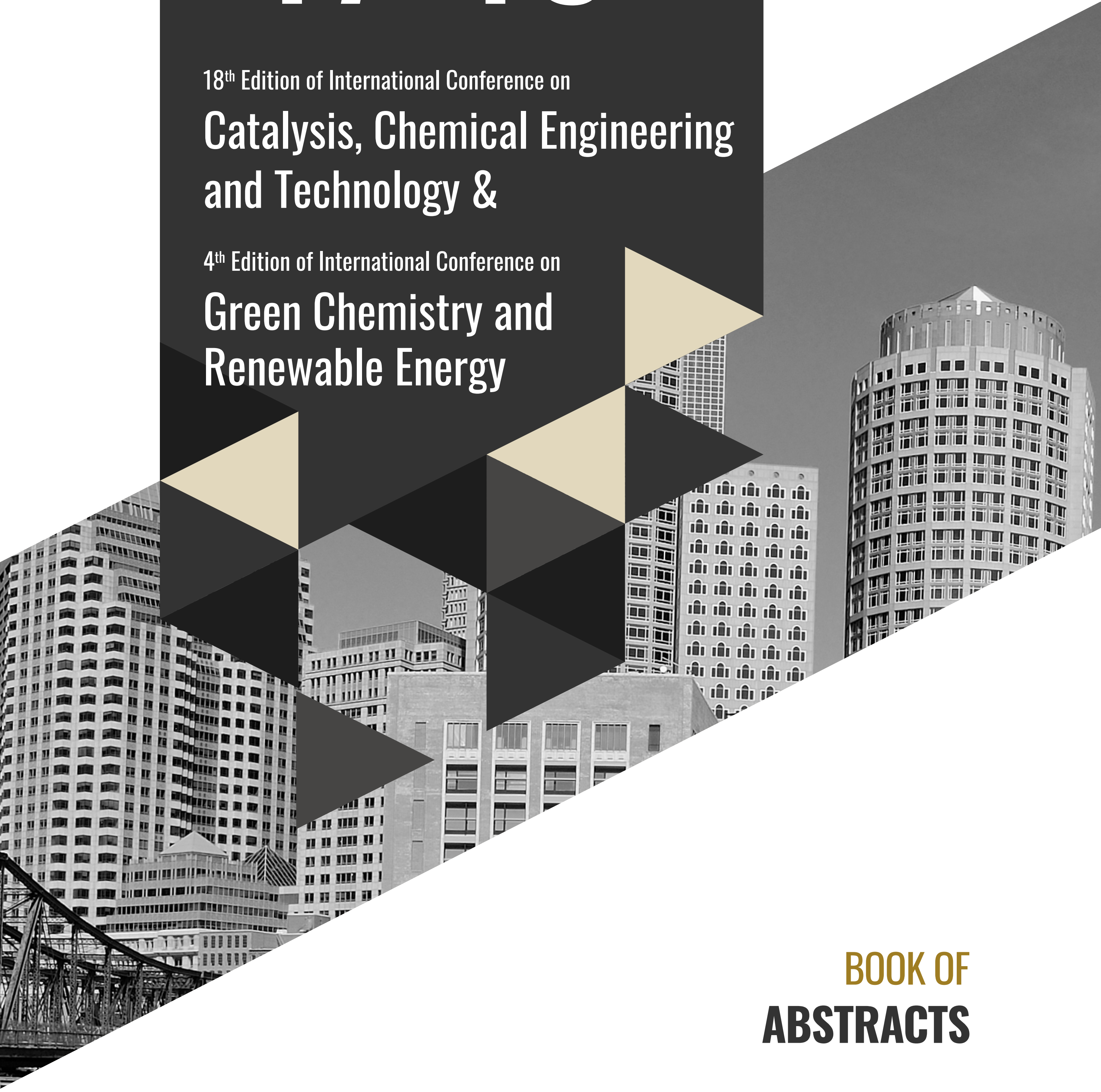

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Keynote Speakers

Alexander A Kamnev
Institute of Biochemistry and Physiology of Plants and Microorganisms, Saratov FSC of the Russian Academy of Sciences, Russia

Cristian Ravariu
Universitatea Politehnica Bucuresti, Romania

Dai Yeun Jeong
Asia Climate Change Education Center, South Korea

Helena Belchior Rocha
Iscte-University Institute of Lisbon, Portugal

Hossam A Gabbar
Ontario Tech University, Canada

Ichiro Imae
Hiroshima University, Japan

Kevin Kendall
Hydrogen United in Birmingham, United Kingdom

M A Martin Luengo
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Patrick Martin
Unite Transformations & Agroressources, France

Sergey Suchkov
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Stanislaw Dzwigaj
Sorbonne University, France

Venko Beschkov
Bulgarian Academy of Sciences, Bulgaria

Victor Cerda
University of the Balearic Island, Spain

Thank You
All...

Speakers


Abdulaziz Alghamdi
King Fahd University of Petroleum,
Saudi Arabia


Aditi Singhal
Ahmedabad University, India


Alami Soufiane
Mohammed V University, Morocco


Alena B Kharissova
UANL – Universidad Autonoma de
Nuevo Leon, Mexico


Alexey Tsyganenko
St. Petersburg State University,
Russia


Alexis Spalletta
Unite Transformations &
Agroressources, France


Amarta Kumar Pal
North-Eastern Hill University, India


Amru Alghamdi
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and Minerals, Saudi Arabia


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Anne Clements & Associates Pty
Limited, Australia


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Università di Pavia (IT), Italy


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Mohammed V University,
Morocco


Cemil Koyunoglu
Yalova University, Turkey


Choong Kil Seo
Howon University, Korea,
South Korea


Chung Yu Guan
National Ilan University, Taiwan


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Traitement des
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Tecnologico de Monterrey, Mexico


Danuta Olszewska
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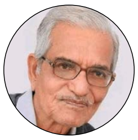
Dario Bove
University of Genoa, Italy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Africa


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MirMohammadmakki**
Islamic Azad University,
Iran


Fabre Jean Francois
LCA-ENSIACET/INPT-INRAE, France


Jana Pisk
University of Zagreb,
Croatia


Jane Mueller
Almac Sciences,
United Kingdom


Janus Louw
Stellenbosch University, South Africa

Janusz Lasek
Institute of Energy and Fuel
Processing Technology, Poland

Jenifer Robinson
Indian School Al Wadi Al Kabir,
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Jinsong Wu
Guilin University of Electronic
Technology, China

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University of Warsaw, Poland

Sung Chyr Lin
National Chung Hsing University,
Taiwan

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Paher University, India

Tangka Julius Kewir
University of Dschang, Cameroon

Tirath Raj
University of Illinois Urbana Chaimpaign, United States

Tokeer Ahmad
Jamia Millia Islamia, India

Vanessa Wegat
Fraunhofer IGB, Germany

Parfenova Maria
Siberian Branch of the Russian Academy of Sciences, Russia

Wei Zhou
Qilu University of Technology, China

Wilmar osorio viana
Universitat de Lleida, Spain

Xia Li
Tianjin Key Laboratory for Prevention and Control of Occupational and Environmental Hazards, China

Yangyang Guo
Chinese Academy of Sciences, China

Yitong Duan
King's College London, United Kingdom

Yoshinori Mishina
Individual Researcher, Japan

Young Sang Cho
Korea Institute of Science and Technology, South Korea

Yousef Alqahs Alanezi
College of Technological Studies, PAAET, Kuwait

Zoubida Belmahi
Institute Agronomic & Veterinary IAV HASSAN II/MAROC, Morocco

Thank You
All...

Welcome Message

Kevin Kendall

Hydrogen United in Birmingham, United Kingdom

Dear congress visitors, It is a privilege to invite you to the Green Chemistry Conference 2024. Green Hydrogen is a wonderful new material which is most likely to change our clean energy storage and application massively in the next decades. Although hydrogen has been a biproduct from the chlor-alkali industry for more than a century, it has often been made from fossil fuels and burned in power stations. Today, that is changing rapidly because green hydrogen is now viewed as an energy carrier that can economically replace natural gas in buildings and gasoline/diesel in transportation. Green Chemistry is key to making this profitable across the supply chain.

Welcome Message

Hossam A Gabbar

Ontario Tech University, Canada

Dear congress participants, visitors, and attendees, I am delighted and honored to welcome you all to the unique and special event of Green Chemistry 2024. Climate change and environmental stressors pose an urgent and increasing mandates upon all of us to promote green chemistry with advanced and clean biotechnologies. The emerging area of green chemistry includes key and potential areas such as green nanotechnology, clean energy sources, hydrogen and alternate fuel, environmental and pollution control, green polymer and materials, green agriculture, renewable energy, clean nuclear and energy technologies, waste management, computational methods, modeling and simulation techniques, and their applications in industries and communities. The event will provide great opportunities to discuss and adapt modern methods, science, systems, and technologies to support the emerging mandates of climate change with cleaner communities, higher productivity, safer products, and improved quality of life. I am confident that the sessions, presentations, and discussions will bring great benefits to all participants with takeaway strategies and technologies to deploy around the world. Together will make the transition to a cleaner and brighter future.

Welcome Message

Patrick Martin

Unite Transformations & Agroressources, France

Dear Delegates, Dear Colleagues, it is an honor and a real pleasure to welcome you with these few words.

Green Chemistry has been developing steadily for several decades now, thanks to a wealth of academic and industrial work and results. It is therefore important for us to meet on a regular basis to highlight not only the latest advances but also, and above all, to exchange ideas with players from the socio-economic world, and thus make applications. All areas of green chemistry are being "cogitated" to move as quickly as possible towards sustainable solutions for future generations. More and more, Green Chemistry is positioning itself at the interfaces of different fields, in order to innovate for direct applications.

I wish you all an excellent Congress, and may it lead to fruitful field applications and/or interdisciplinary collaborations.

Welcome Message

Stanislaw Dzwigaj

Sorbonne University, France

Dear congress visitors, It is my honor and great pleasure to write a few welcome notes to you. Through centuries people were fascinated with the possibilities of synthesis of new materials with extraordinary properties. New materials are practically needed in all domains of life. Design and synthesis of new materials is one of the most important and interesting part of material sciences. Particularly a synthesis of new active and selective catalysts is a very important challenge. Our main aim concentrates on the new methods of the synthesis of single-site hierarchical porous zeolite catalysts with acid-base and redox properties. Such zeolite catalysts with active sites formed by incorporation of heteroelements in their framework are perspective as catalysts of protection of environment and biofeedstock conversion into valuable chemicals.

Welcome Message

Sergey Suchkov

The Russian University for Medicine & The Russian Academy of Natural Sciences, Russia

Dear Colleagues, Partners and Friends,

On behalf of the Conference Organizing Committee, it is my pleasure to invite all the world famous/leading and outstanding researchers, academic people and industrialists from all over the world to attend the “18th Edition of International Conference on Catalysis, Chemical Engineering and Technology” (CCT 2024), to be held in June 17-19, 2024, in Paris as a Capital of France, and the historical and cultural Centre of Europe as well.

This Global and Unique Event will be one of the great platform is to share our thoughts and ex-change ideas on how to chart our journey forward to reach new heights in the areas unveiling the secrecy of Chemical Engineering and Technologies. And thus the Conference will bring together the different communities to discuss new materials concepts and their spatial patterning, modelling and simulation, biological and biomedical functions, and finally applications of bioinspired designs, chemical and bioengineering and technologies of the next step generation.

Industrialization being promoted from the 19th century has improved material affluence, and also has deteriorated the original quality of nature. This implies that humans are beneficiaries and victims of industrialization because nature can exist without humans, but humans can’t survive without nature. In this context, chemical engineering is a field that continues to thrive, making significant contributions towards improving catalysts, which, in turn, are aimed for more efficient alternative energy, personalized & precision medicine, more inexpensive material synthesis, improving the environment, faster process reactions, and so much more. And great and rapid progress in those areas of fundamental, translational and applied fields of science and engineering of chemical products is obviously needed to solve the environmental and healthcare problems.

The Program is focused on ideas that involve breakthroughs in design-inspired biomaterials, technologies and engineering science, translation of basic research to applications, and content that explores standards development, regulatory issues, and commercial realities. The Conference will provide the ideal forum to stimulate ideas and establish collaborations as well as to initiate intense discussions to secure projects of the newest generations and to feature a highly interactive, stimulating and multidisciplinary Program including workshops, plenary sessions and panel discussions.

I hope you enjoy your stay in Grand Paris as the magnificent city, making use of your pre- and post-conference times to enjoy the many wonderful sites. We sincerely look forward to welcoming you and wish you to enjoy the Conference!

Welcome Message

Dai Yeun Jeong

Asia Climate Change Education Center & Jeju National University,
South Korea

Dear Congress Visitors

On behalf of the Conference Organizing Committee, it is my pleasure to invite all the world famous/ leading and outstanding researchers, academic people and industrialists from all over the world to attend CCT 2024 to be held in Paris, France on June 17-19, 2024.

Industrialization being promoted from the 18th century has improved material affluence, and also has deteriorated the original quality of nature. This implies that humans are beneficiaries and victims of industrialization because nature can exist without humans, but humans can't survive without nature. This means that humans have committed a self-contradiction.

In order to solve the self-contradiction, the Earth Environment Summit 1992 has adopted sustainable development as the ideology and practice of the present and future socio-economic development toward the coexistence between humans and nature at a global level. Nonetheless, environmental problems caused by human intervention in nature are still challenging us. This is evidenced from climate change being got worse, ozone depletion, and natural disasters, etc.

In such a context, it is no doubt that CCT 2024 will be a significant and important platform not only advancing the knowledge of this field through presentation and discussions, but also contributing to sustainable development at a global level through providing the advanced knowledge applicable to the field.

Welcome Message

Helena Belchior Rocha

Iscte-University Institute of Lisbon, Portugal

Dear congress participants, welcome to Green Chemistry 2024 Conference. It's the third time I've taken part and I'm very motivated to do so because it's a conference of excellence, whose contributions to the scientific community and to society are undeniably enriching. Green Chemistry approach makes safer, more sustainable choices for your products and process chemistry with solutions that help identify potentially hazardous chemicals and take action to protect people and environment. This year's conference is being held in Paris (City of Light), one of the most beautiful cities we can visit. I therefore hope that you enjoy your participation and I look forward to being with you.

Welcome Message

Cristian Ravariu

Universitatea Politehnica Bucuresti, Romania

Dear visitors to Green Chemistry 2024 Congress, it is an honor for me to write a few welcome notes. Despite the expansion of different types of biosensors and the widest range of receptors, transducers, including OECT transistors, there are still no neurotransmitter biosensors on the market. Possible causes would be: too much diversity of biosensors and materials distracts the attention of industry and marketing companies, lack of standardization, lack of cohesion between transistor manufacturers and biosensor manufacturers. The solution must be a stable and standard technology, at low price that means a large series production, extending the expiration time, ideally creating recyclable testers. In 2024 the use of an ultra-large pallet of nano-bio-materials coincided with the moment of reaching sub-20 nm dimensions for transistors. Your solutions are very expected at this International Event! Welcomes to Green Chemistry 2024!

ABOUT
MAGNUS GROUP

Magnus Group, a distinguished scientific event organizer, has been at the forefront of fostering knowledge exchange and collaboration since its inception in 2015. With a steadfast commitment to the ethos of "Share, receive, grow," Magnus Group has successfully organized over 200 conferences spanning diverse fields, including Healthcare, Medical, Pharmaceutics, Chemistry, Nursing, Agriculture, and Plant Sciences.

The core philosophy of Magnus Group revolves around creating dynamic platforms that facilitate the exchange of cutting-edge research, insights, and innovations within the global scientific community. By bringing together experts, scholars, and professionals from various disciplines, Magnus Group cultivates an environment conducive to intellectual discourse, networking, and interdisciplinary collaboration.

Magnus Group's unwavering dedication to organizing impactful scientific events has positioned it as a key player in the global scientific community. By adhering to the motto of "Share, receive, grow," Magnus Group continues to contribute significantly to the advancement of knowledge and the development of innovative solutions in various scientific domains.

ABOUT

CPD Accreditation

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Continuing Professional Development (CPD) credits are valuable for Green Chemistry 2024 & CCT 2024 attendees as they provide recognition and validation of their ongoing learning and professional development. The number of CPD credits that can be earned is typically based on the number of sessions attended. You have an opportunity to avail 1 CPD credit for each hour of Attendance. Some benefits of CPD credits include:

Career advancement: CPD credits demonstrate a commitment to ongoing learning and professional development, which can enhance one's reputation and increase chances of career advancement.

Maintenance of professional credentials: Many professions require a minimum number of CPD credits to maintain their certification or license.

Increased knowledge: Attending Green Chemistry 2024 & CCT 2024 and earning CPD credits can help attendees stay current with the latest developments and advancements in their field.

Networking opportunities: Green Chemistry & CCT Conference provide opportunities for attendees to network with peers and experts, expanding their professional network and building relationships with potential collaborators.

Note: Each conference attendee will receive 24 CPD credits.

PUBLISHING PARTNER

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OPEN CHEMISTRY

Peer-reviewed open access journal

www.degruyter.com/view/j/chem

CCT 2024 and Green Chemistry 2024 is collaborated with Open Chemistry which is a peer-reviewed, open access journal that publishes original research, reviews, and communications in the fields of chemistry in an ongoing way. Our central goal is to provide a hub for researchers working across all subjects to present their discoveries, and to be a forum for the discussion of the important issues in the field. There are no submission charges. In order to sustain the production of our fully-refereed open access journal, each article accepted for publication in Open Chemistry is subject to Article Processing Charges (APC).

Note: We offer 20% discount on APC for the CCT 2024 & Green Chemistry 2024 conference participants. For more details about the journal, please visit: https://www.degruyter.com/journal/key/chem/html

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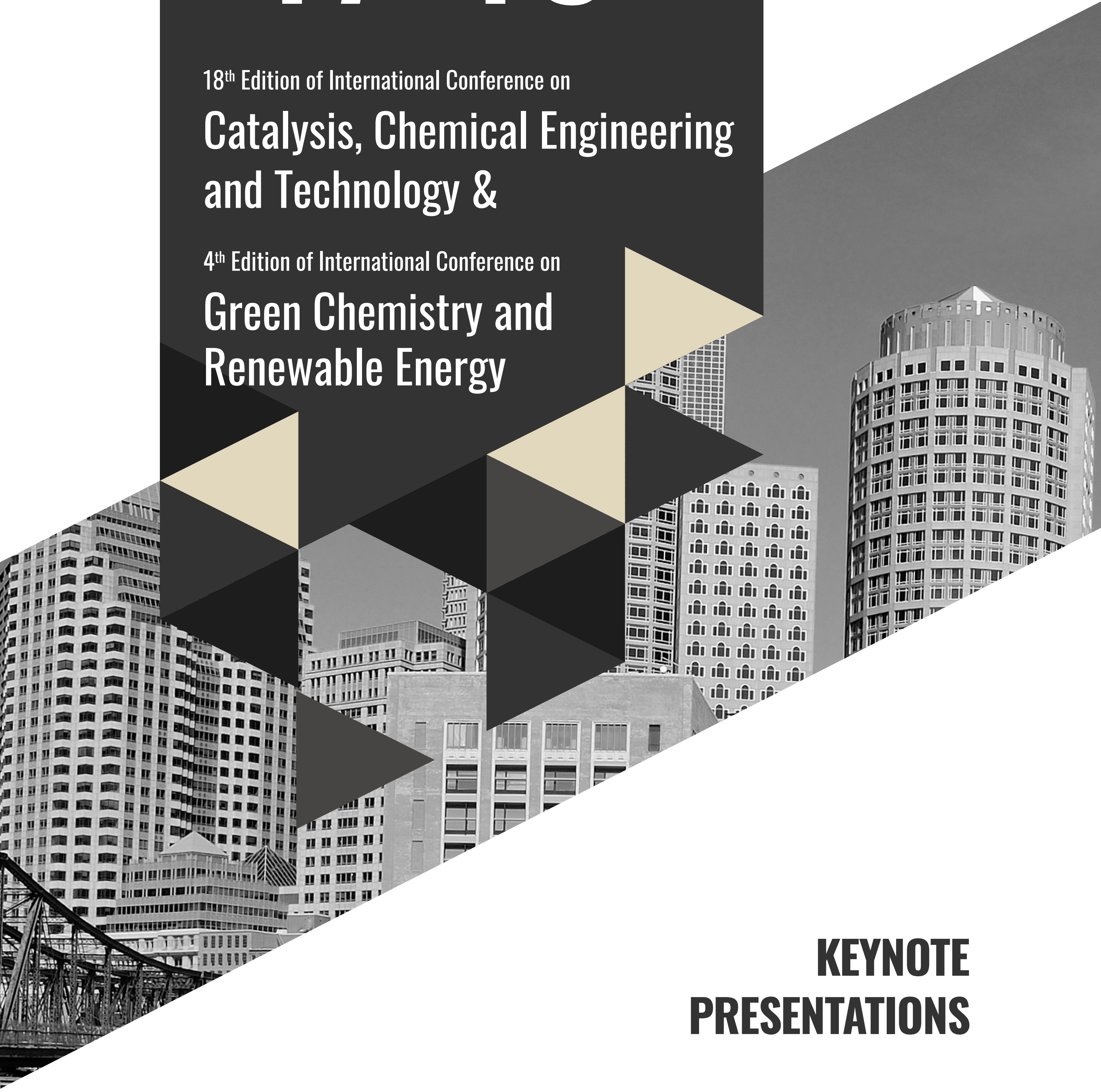

KEYNOTE PRESENTATIONS

Molecular spectroscopic in-situ monitoring of biotechnologically significant processes in agriculturally important bacteria

The rapidly developing field of “green chemistry” has significantly facilitated advancements in a wide range of biotechnological and agricultural fields, so this progress is highly multidisciplinary. This talk illustrates the advantages of using two spectroscopic techniques, each of which has become a widely applicable tool in materials science, for molecular-level investigations in the fields related to microbial biotechnology and agricultural microbiology. One of them is Mossbauer spectroscopy (based on recoil-free nuclear γ-resonance – the Mossbauer effect) which has been shown to be extremely informative in bioanalysis (see, e.g., recent reviews) and particularly for in-situ and often in-vivo monitoring of fine structural and redox transformations of iron species (represented by the Mossbauer-active 57Fe stable isotope) in bacterial cells. Besides the basic scientific interest of such studies, the observed transformations are valuable for explaining and understanding the redox status of iron, one of the most important microelements, in bacterial preparations widely used and stored in the dried state (e.g., lyophilised cell biomass) in various biotechnological and agricultural applications, including biofertilisers.

Fourier Transform In Frared (FTIR) spectroscopy is another highly informative modern instrumental technique which has long become routine in materials science but is yet under development in microbiology. It is highly sensitive to macromolecular composition and structural transformations in microbial cells and biofilms, providing a wealth of information on metabolic changes induced by external factors, stress conditions, etc. One of highly important microbiological applications of FTIR spectroscopy is rapid in-situ monitoring of the accumulation and properties of intracellular granules of storage biopolymers such as polyesters of hydroxyalkanoic acids (polyhydroxyalkanoates). These biopolymers are of importance for bacterial survival in unfavourable conditions and, as isolated materials, per se represent a valuable ecologically friendly biodegradable substitute for traditional synthetic plastics.

This study has been supported by the Russian Science Foundation (Grant no. 24-26-00209).

Alexander A Kamnev

Laboratory of Biochemistry, Institute of Biochemistry and Physiology of Plants and Microorganisms, Saratov Federal Scientific Centre of the Russian Academy of Sciences, Saratov, Russia

Biography

Professor Kamnev studied chemistry at Saratov State University (SSU), Russia, and graduated as a MS in 1980. He investigated physicochemical/electrochemical properties of 3d-metal hydroxides in alkaline media at SSU and received his Cand.Sci./PhD degree in 1992 from SSU. After that, he moved to the title Institute (Russian Academy of Sciences) and has been leading domestic and international projects at the Laboratory of Biochemistry, developing molecular spectroscopic approaches in biochemistry/microbiology. In 2002, he obtained a DSc in physical chemistry from SSU. He has published over 140 articles in SCI(E)/Scopus journals, serves in Editorial/Advisory Boards of four international journals (of quartiles Q1).

Audience Take Away Notes

- Applications of molecular spectroscopic techniques are useful in analysing both a wide variety of ‘green chemistry’ products and processes of their synthesis, providing information at the molecular level
- Various experts could learn how to apply the techniques to be discussed in this talk in their own research or practice
- The knowledge on the capabilities of the discussed techniques could be widely used to expand the scope in both research and teaching

Biosensors for dopamine - receptors, transducers and nano-scale configurations

Neurotransmitters are an important category of substances used inside the nervous system, whose detection with biosensors has been seriously addressed in the last decades. Dopamine, a neurotransmitter from the catecholamine family, was recently discovered to have implications in cardiac arrest or muscle contractions in addition to other neuro-psychiatric implications, being able to be detected in blood, urine and sweat. This review highlights the importance of biosensors as influential tools for dopamine recognition. The first part of this article is related to an introduction in biosensors for neurotransmitters, with focus on dopamine. The regular methods in their detection are expensive and require high expertise personnel. A major direction of evolution of these biosensors have expanded with the integration of active biological materials, suitable for molecular recognition, near to electronic devices. Secondly, for dopamine in particular, the linear detection ranges correspond to the clinical demands, while the biosensors offer an excellent sensitivity and specificity, easier than conventional methods like spectrometry. Thirdly, the applications of novel nanomaterials and biomaterials to these biosensors are discussed. Older generations of metabolism based or enzymatic biosensors could not detect concentrations below the micro-molar range. But new generations of biosensors combine aptamer receptors and Organic Electro Chemical Transistor OECT, as transducers. They have pushed the detection limit to pico-molar and even femto-molar range, which fully corresponds to the usual ranges of clinical detection of human dopamine in body humors that cover 0.1, 10 nM. In addition, if ten years ago the use of natural dopamine receptors on cell membranes seemed impossible for biosensors, the actual technologies allows co-integrate transistors and vesicles with natural receptors of dopamine, like G protein-coupled receptors. The technology is still complicated, but the uni-molecular detection selectivity is promising.

Audience Take Away Notes

- How electrochemical biosensor can detect one of the most important neurotransmitters - Dopamine (DA)
- Specific Enzymes, Antibodies, Aptamers, Tissue slice, Membranar receptors can be used as DA receptors
- The presented technique can be used to expand the research field of biosensors
- The issue provide a practical solution to co-integrate biomaterials near electronic devices

Cristian Ravariu

UPB-University "Politehnica" of
Bucharest, Faculty of Electronics
ETTI, Dept. of Electronic Devices
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Splaiul Independentei 313, Sect.6,
060042, Bucharest, Romania

EduSciArt SRL Company, Str,
Iovita nr. 2, Bucharest, Romania

Biography

Prof. C. Ravariu studied Microelectronics at the Polytechnic University of Bucharest, Romania and graduated as MS in 1993. He worked as scientific researcher first 5 years at Institute of Microtechnology, Bucharest, then joined the Polytechnic University of Bucharest. After multiple foreign stages in Bioelectronics (Patras, Greece), Nano-devices (EPFL, Switzerland), Organic Electronics (LAAS, France), he received PostDoc degree in 2012 in Romania. Since 2013 he obtained the position of Full Professor at the Polytechnic University of Bucharest, Faculty of Electronics, Romania. He has published more than 250 research articles. Since 2014 he is Chairman of the Romanian IEEE Electron Devices Chapter and his main interest is in nano-bio-devices for electronics and biomedical research.

The limitations inherent in sustainable development and how to overcome them

Sustainable development is the ideology and practical strategy of the present and future socio-economic development in harmony with nature. A wide range of policies and practical activities have been launched at a global, national and regional level in order to achieve sustainable development since WCED suggested its concept and implication in 1987. In 2015, United Nations adopted a set of sustainable development goals to be achieved over the next 15 years as a follow-up action plan of millennium development goals. However, it is true that sustainable development is not achieved as successfully as planned. Its evidences are the facts that we are still faced with serous climate change and natural disasters, all of which are the challenges to humans. This would mean that sustainable development has limitations in its concept and implication. Nonetheless, it is quite rare to conduct a research on the limitations inherent in sustainable development. In such a context, this presentation aims at exploring the limitations inherent in sustainable development and how to overcome them.

This presentation will first examine the emergence process of sustainable development, and followed by its concept and implication, the critical debates on its concept and implication in the late 1990s and early 2000s, and the concept and implications of sustainable development goal launched in 2015. Based on the findings from the above review, this presentation will draw the limitations inherent in the concept and implications of sustainable development and examine what and how to overcome the limitations.

The conclusion of this presentation will focus on what the existing concept and implications of sustainable development should be supplemented. The significance of this presentation lies in proposing a new direction of the coexistence between humans and nature for achieving sustainable development.

Audience Take Away Notes

- The concept and implications of sustainable development
- The historical process through which the concept and implications of sustainable development emerged
- The limitations inherent in the concept and implications of sustainable development
- How to overcome the limitations in order to achieve sustainable development in the way proposed in its concept and implications

Dai Yeun Jeong

Asia Climate Change Education Center, Jeju-si, Jeju Special Self-Governing Province, South Korea

Emeritus Prof. at Jeju National University, Jeju-si, Jeju Special Self-Governing Province, South Korea

Biography

Dr. Dai Yeun Jeong is presently the Director of Asia Climate Change Education Center and an Emeritus Professor of Environmental Sociology at Jeju National University (South Korea). He received BA and MA Degree in Sociology from Korea University (South Korea), and PhD in Environmental Sociology from University of Queensland (Australia). He was a Professor of environmental sociology at Jeju National University (South Korea) from 1981 to 2012. His past major professional activities include a Teaching Professor at University of Sheffield in UK, the President of Asia-Pacific Sociological Association, a Delegate of South Korean Government to UNFCCC and OECD Environmental Meeting, etc. He has published 13 books including Environmental Sociology, and has conducted 95 environment-related research projects funded by domestic and international organizations.

The link of green chemistry with community sustainable intervention

Green chemistry, also known as sustainable chemistry, focuses on designing chemical processes and products that minimize environmental impact, reduce the use of Hazardous substances, and promote sustainability. When combined with community intervention, it can contribute to achieving sustainability goals in a broader context like environmental protection, public health, education and outreach, collaboration and partnership, economic development and policy advocacy.

The aim of this presentation is to show how these dimensions can be put into practice to achieve community sustainable intervention when linked with green chemistry. By integrating green chemistry principles into community intervention efforts, communities can drive sustainable practices, raise awareness, foster collaboration, and promote the long-term well-being of both the environment and the community in collaborative projects, local regulations, research and innovation (partnership with universities), urban planning and interdisciplinary collaboration. This approach supports the transition towards a more sustainable and environmentally conscious society. By working together, these groups can identify sustainability challenges, develop solutions, and implement green chemistry practices that benefit the community as a whole.

Audience Take Away Notes

- By illustrating the practical applications of green chemistry in community interventions, we are giving the audience actionable insights and tools to make a tangible difference. This approach not only enhances their learning but also empowers them to contribute to a more sustainable and environmentally-friendly community
- Provides networking opportunities for the audience to connect with experts, practitioners, and other community members who have experience with green chemistry interventions. Networking can lead to collaborative projects and shared learning
- Also we can collaborate with universities and research institutions to develop green chemistry education programs and research projects that benefit the community
- By presenting specific examples of how green chemistry interventions have successfully addressed environmental challenges in other communities, helps the audience envision how they can apply similar solutions to their own context
- Sharing case studies of communities that have successfully implemented with green chemistry in community interventions, the challenges faced and the strategies they used to overcome obstacles, lead to more accuracy of design strategies

Helena Belchior Rocha[1]*, Ph.D, Serdar Yener[2]

[1]Department of Political Science and Public Policy, Iscte-University Institute of Lisbon, Lisbon, Portugal

[2]International Trade and Management Department, Sinop University, Sinop, Turkey

Biography

Helena Belchior Rocha has Ph.D in Social Work, Professor in the Department of Political Science and Public Policy, Deputy Director of the Soft Skills Lab and researcher at CIES-ISCTE. Pioneer in Social Work research in the area of the Environment and Sustainability, developed the Ecosocial model for community intervention. Has been in national and international projects, author of articles, books, chapters and communications at national and international scientific events, in the areas of ecological sustainability, community intervention, ethics, human rights, social policies and well-being, education and soft skills. Member of the editorial and scientific boards of national and international journals.

Advances in plasma-based waste treatment for sustainable communities

This talk presents advanced approaches for plasma-based waste treatment. Different designs of plasma torches and generation systems are discussed, including RF, DC, and microwave plasma, are analysed and compared for waste-to-energy applications. Novel plasma torch design is proposed to support different scales of waste treatment. Process engineering techniques for gasification and pyrolysis process are illustrated with waste characterization. The proposed approaches showed reduced greenhouse gas emissions and improved lifecycle performance. Plasma systems are utilized for nuclear waste treatment for low, intermediate, and high radioactive waste. Process design is discussed for plasma torch that can reduce the volume of Radioactive waste. Potential approaches are explored for mass separation that could be utilized for high-level Radioactive waste. Simulation methods and experimental setups demonstrate lab-scale process technologies for plasma-based waste treatment.

Audience Take Away Notes

- Understand plasma technologies for waste treatments
- Understand ways to reduce GHG from waste treatments
- Learn practical solutions and technologies for waste treatment
- Understand ways to handle Radioactive waste
- Understand potential jobs for waste management

Hossam A Gabbar

P. Eng., Distinguished Lecturer IEEE NPSS, Director of Advanced Plasma Engineering Lab (APEL, Department of Energy and Nuclear Engineering, Faculty of Engineering and Applied Science, Ontario Tech University, Oshawa, Ontario, Canada

Biography

Dr. Hossam A.Gabbar studied systems engineering at Alexandria University. He obtained PhD degree in process systems engineering from Okayama University, Japan. He joined Japan Chemical Innovation Institute (JCCI) and Tokyo Institute of Technology. Dr. Gabbar is a full Professor in the Department of Energy and Nuclear Engineering, in the Faculty of Engineering and Applied Science, at Ontario Tech University (UOIT). He leads the Smart Energy Systems Lab (SESL), and Advanced Plasma Engineering Lab (APEL). He is the recipient of the Senior Research Excellence Aware for 2016, UOIT. He is among the top 2% of worldwide scientists in energy. He is a Distinguished Lecturer of IEEE NPSS.

Green synthesis of graphene/silicon composite and its application to lithium-ion battery

Lithium-Ion Batteries (LIBs) using silicon as the anode have a higher charge-discharge capacity than those using graphite, but the repeatability of their charge-discharge cycles is extremely low. Recently, composites of silicon with graphene have been used for LIBs, but their synthesis method is complicated and needs to be improved to realize industrial applications. Previously, we succeeded in synthesizing GO/silica composites in a simple and environmentally friendly method by simply adding Tetraethyl Orthosilicate (TEOS), a precursor of silica, to Graphene Oxide (GO), which is obtained from inexpensive natural graphite as a starting material. The GO/silica composite was then heat-treated to convert GO to reduced Graphene Oxide (rGO) to form rGO/silica composite, which was applied to high-strength transparent conductive films (I. Imae et al., Synthetic Metals, vol.224, pp.33-35, 2017). Furthermore, we succeeded in reducing not only GO but also silica by heat treatment of GO/silica composite in the presence of metallic magnesium, and synthesized rGO/silicon composite. The resulting composite is identified through Raman spectroscopy, X-ray photoelectron spectroscopy, and thermogravimetric analysis. It is confirmed that the atomic ratio between silicon and carbon in the composite is consistent with that of the starting materials. Lithium-ion batteries are manufactured using the obtained composites as the anode material, and their charge/discharge properties are investigated. The manufactured batteries show a higher charge-discharge capacity than a graphene-anode-based battery as well as superior charge-discharge cycle characteristics as compared to a silicon-anode-based battery (I. Imae et al., Ceramics International, vol.48, pp.25439-25444, 2022).

Ichiro Imae

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Chemistry, Graduate School
of Advanced Science and
Engineering, Hiroshima
University, 1-4-1 Kagamiyama,
Higashi-Hiroshima, Hiroshima,
Japan

Biography

Dr. Ichiro Imae received the Bachelor, Master and Doctor degrees (Engineering) from Osaka University in 1992, 1994, and 1997. Then, he joined with Japan Advanced Institute of Science and Technology (JAIST) as an Assistant Professor. Since 2006, he is an Associate Professor of Hiroshima University. Also, he worked as an Adjunct Lecturer of Muroran Institute of Technology and a Visiting Professor of Huazhong University of Science and Technology in 2018. He has published more than 110 research articles in SCI(E) journals.

Green hydrogen by economic electrolysis

This paper describes research on the chemistry of green hydrogen made by electrolysis from renewable energy sources. Manufacture of green hydrogen by electrolysis is rapidly rising worldwide but cannot yet compete with fossil fuels used in transportation and housing. The reasons for this are explained and experiments are shown to overcome this problems of profitability in the green hydrogen supply chain.

Audience Take Away Notes

- This presentation shows how profits can be made from Green Hydrogen chemistry
- Green Hydrogen research is expanding worldwide and this paper explains how
- The key issue is making Green Hydrogen that competes with natural gas and gasoline

Kevin Kendall FRS

Research. HydrogenUnited.org,
Birmingham United kingdom

Biography

Dr. Kevin Kendall, installed the first UK green hydrogen station in Birmingham University during 2007-8, refuelling 5 fuel cell battery cabs for the 50 PhD chemical engineering students that started in 2009. Only 10kg/day were required, contrasting with the first UK large ITM Power station delivering 800kg/day green hydrogen opened in July 2021. The key problem is proving that green hydrogen can compete with fossil fuels like diesel and natural gas. Prof Kendall was elected Fellow of the Royal Society in 1993 and has studied hydrogen and fuel cells for 35 years, both at Keele University and University of Birmingham. Currently he is trustee of the only hydrogen charity in the UK, HydrogenUnited.org.

Catalysis, chemical engineering and technology catalysis for renewable sources green chemistry

Sub-products from agroindustrial industries are being employed as renewable low cost raw materials in the design of Ecomaterials and substances for use in a number of processes of great interest. These materials can compete with conventional ones since a sustainable cycle is closed, in which the low (or null) cost residues of one industry are used as raw materials in the same or others.

This work is based on a multidisciplinary collaboration among several research groups and companies interested in the transformation of their residues into “value added materials and substances”.

On these premises Various Research Projects have been and are being sponsored and Patents, Congresses and Publications presented.

Patent “Preparation of biocompatible materials from beer production waste and their uses”, PCT/ES2009/070475. Patent: Procedure to obtain multifunctional materials from sunflower oil productyion wastes. 201130303. Patent “Procedure to obtain an immobilised enzyme on a renewable support derived from agricultural residues”. 201330114. Renewable fine chemicals from rice and citric subproducts: Ecomaterials. Appl. Catal. B: Env. 106 (2011) 488. Preparation, characterization and in vitro osteoblast growth of waste-derived biomaterials. RSC Adv., 2014,4, 12630. Multivalorization of apple pomace towards materials and chemicals. Waste to wealth. Journal of Cleaner Production 143 (2017) 847. Three pathways to cleaner platform chemicals: Conventional, microwave and solar transformation of a by-product from the orange juice manufacturing process. Journal of Cleaner Production, 168 (2017) 746. Beverage waste derived biomaterials for tissue engineering. Green Chemistry 19 (2017) 4520. Environmentally friendly catalysts for improved cleaning of toluene-containing gaseous effluent. Arabian Journal of Chemistry 14(2021):103268.

M A Martin Luengo

Institute of Materials Science of Madrid, Spain

Biography

M A Martin Luengo, graduated in Chemistry in the Autonoma University of Madrid (UAM, Spain), presented her Master on oxidation catalysts and ph.D on supported metal catalysts in the institute of Catalysis (CSIC, Spain). She then worked with an Overseas Spanish Fellowship of the CSIC in England and Belgium. Afterwards was appointed by the Scientific Engineering Research Council to develop Fischer Tropsch processes for fuels design. In 1992 she gained a permanent position of Research Scientist in the CSIC of Spain. Nowadays she carries out research on environmental issues, has ca. 100 papers and patents and is member of several scientific societies, amongst them American Chemical Society (EEUU), Society of Catalysis (Spain), Platform of Sustainable Chemistry (SUSCHEM, Spain), Royal Society of Chemistry (UK).

Bioeconomics & bioactive compounds from plants for material or biological applications

Four major challenges present themselves to us for this 21st century. First, an increase in the world's population, leading to an increase in food and energy needs, all coupled with global warming. By 2050, the population is expected to increase by more than 50%, which will imply a demand of more than 70% in food needs and more than 100% in energy. Oil has allowed an explosion in technological and human development, so we need to prepare for after oil. The challenge now is to ensure economic development with renewable resources while limiting the impact on the environment and people. Plant chemistry, the pillar of green chemistry, can answer this. This context has the direct consequence of the development of the use of renewable resources to replace those of fossil origin. This is particularly the case for plant resources, such as plants whose use is motivated by their great abundance, their diversity, their renewable nature and their richness in compounds of interest.

Three major axes are emerging for plant chemistry:

1. The challenge of natural reserves with the widening supply of renewable raw materials for the chemical industries,
2. Integration towards a bio-based economy with the creation of bridges between the different sectors and a balance between economy, environment and social component,
3. Consumer expectations with the improvement of current properties of formations and materials and the improvement of life cycle analysis.

The supply of raw materials is a challenge. We must ensure the secure supply of biomass, the lower cost of renewable raw materials and also the development of supply chains. This requires mobilizing additional areas and biomass, increasing agricultural areas and profitability per hectare, and improving the efficiency of the systems. Plant chemistry uses around 30 million tonnes of crops, or 6 million hectares, which represents less than 0.5% of the total arable land.

Within our research unit, we are exploring ways to enhance plants by using fractions (fatty acids, glycones, rhamnolipids, polyphenols, etc.) or biomolecules (chlorogenic acids, specific fatty acids) extracted for industrial or biological applications. These valuations can be by direct use of the extract or after formulation / chemistry in the context of sustainable chemistry. Among the applications we develop, we can cite the use of;

- Carbohydrate and lipid fractions for obtaining amphiphilic antibacterial, antitumoral compounds.
- Rhamnolipid fractions with antimicrobial, pesticide / elicitor properties (notion of bio-control).

Patrick Martin*, Ludovic Chaveriat, Nicolas Joly, Vincent Lequart

Universite d'Artois – UniLaSalle, Unite Transformations & Agroressources, ULR7519, Bethune, F-62408

Biography

Patrick Martin, Professor at the University of Artois (Bethune, France) and Director of the Artois site of the Unit Transformations et Agroressources (ULR 7519) is expert in bio-based chemistry (extraction, characterization, formulation/ modification). He is specialized in the conception of bio-based products starting from biomolecules and biopolymers as raw material by chemical pathways. His current research interests are in the field; glycochemistry and lipochemistry (surfactants, liquid crystals, biocontrol, biopesticides, drug targeting), secondary metabolites (anti-oxidants, dyes) and biomaterials (plastic, concrete).

- Chlorogenic acids, quercetine for their antioxidant property in particular.
- Specific fatty acids such as nervonic acid and its involvement in certain Neurodegenerative diseases.
- Biopolymers to biomaterials as bioplastics, biocomposites.

It also addresses the fact that these valuations / uses must be integrated into a bio-based economy, the bio-economy; sustainable production from biomass of products for the food, animal nutrition, industrial and energy markets. With the necessity of creating bridges between the different sectors and a balance between economy, environment and social component.

Audience Take Away Notes

- It could be used by a scientific audience as well as a non-scientific one, because we all have agricultural co-products in front of us and at our disposal that can be valorized in technologies that may be high value-added, but also in our daily lives
- Through a new vision of things and a rational use of biomass, particularly plant biomass
- Yes, certainly, and at every level of education. It will be shown that certain actions were originally pedagogical and have become scientific as a result of developments
- Yes, but this is already known
- We're talking here about eco-design and, more precisely, eco-responsibility with eco-efficiency
- Topics and applications described to meet current needs. Added naturalness.

Personalized and Precision Medicine (PPM) as a unique healthcare model to be set up through biodesign-inspired biotech-driven translational applications and upgraded business marketing to secure the human healthcare, wellness and biosafety

A new and upgraded approach to the diseased states and wellness, and to re-shape tomorrow's healthcare whilst doing it today, resulted in a new global trend in the healthcare services, namely, Personalized and Precision Medicine (PPM). PPM as a Unique Entity demonstrating an integration of Fundamental, Healthcare & Life Sciences, Biodesign-driven BioTech, Translational ART and IT Armamentarium, is based on the new developmental strategy driven by Biomarkers- and Biotargeting-related biomachines. So, it would be extremely useful to integrate data harvesting from different databanks for applications such as pre-early predictive diagnostics, precise prognostication and personalization of further treatment to thus provide more tailored measures for the diseases bodies and persons-at-risk resulting in improved outcomes and more cost effective use of the latest health care resources.

PPM as being the Grand Challenge to forecast, to predict and to prevent is rooted in a big and a new science generated by the achievements of (i) Systems & Synthetic Biology; (ii) Biodesign-driven Translational applications and Biotech-driven Biomanufacturing; (iii) Bioindustry and Biomarketing of the next step generation. The latter, being a Grand Brick laid into the frame of National Bioeconomy, says and confirms that the efficiency and efficacy of the Bioeconomy are determined and dictated by the innovative trends, generated by fresh knowledge and their transfer into the scientific, bioindustrial and social areas to maintain the national stability and extensive development of the country.

The core strategic tool to operate the transdisciplinary approach is rooted in a unique tandem consisting of (i) Integrated platforms of Fundamental Sciences (Basics) and innovative OMICs biotechnologies on one hand, and (ii) the algorithms of Bioinformatics, on the other one.

Healthcare is undergoing a transformation, and it is imperative to leverage new technologies to support the advent of PPM. This is the reason for developing global scientific, clinical, social, and educational projects in the area of PPM and TraMed to elicit the content of the new trend. The latter would provide a unique platform for dialogue and collaboration among thought leaders and stakeholders in government, academia, industry, foundations, and disease and patient advocacy with an interest in improving the system of healthcare delivery on one hand and drug discovery, development, and translation, on the other one, whilst educating the policy community about issues where biomedical science and policy intersect

Sergey Suchkov[1-6]*, William Thilly[9], Robert Langer[9], Daniel Scherman[10], Shawn Murphy[7], David Smith[11], Hiroyuki Abe8, Holland Cheng[12], Trevor Marshall[6], Jeff Skolnick[14], Noel Rose[8,13]

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[2]A.I. Evdokimov MGMSU, Moscow, Russia

[3]EPMA, Brussels, European

[4]PMC, Washington, United states

[5]ISPM, Tokyo, Japan

[6]AHA, Houston, United states

[7]Autoimmunity Research Foundation, Los Angeles, United states

[8]Partners Healthcare and Harvard Medical School, Boston, United states

[9]MIT, Cambridge, MA, United states

[10]Centre de Recherche Pharmaceutique de Paris (CRP2); Faculte de Pharmacie, Universite Paris Descarte, Centre National de la Recherche Scientifique, Unite de Technologies Chimiques et Biologiques pour la Santé (UTCBS) Inserm, Paris, France

[11]Mayo Clinic, Rochester, MN, United states

[12]T College of Biological Sciences,

UC Davis, CA, United states

[13]Center for Autoimmune Disease Research, John Hopkins University, Baltimore, MD, United states

[14]Director of the Center for the Study of Systems Biology, Georgia Institute of Technology and School of Biological Sciences, Atlanta, GA, United states

Biography

Dr. Sergey Suchkov was born in the City of Astrakhan, Russia, in a family of dynasty medical doctors. In 1980, graduated from Astrakhan State Medical University and was awarded with MD. In 1985, Suchkov maintained his PhD as a PhD student of the I.M. Sechenov Moscow Medical Academy and Institute of Medical Enzymology. In 2001, Suchkov maintained his Doctor Degree at the National Institute of Immunology, Russia. From 1989 through 1995, Dr. Suchkov was being a Head of the Lab of Clinical Immunology, Helmholtz Eye Research Institute in Moscow. From 1995 through 2004 - a Chair of the Dept for Clinical Immunology, Moscow Clinical Research Institute (MONIKI). In 1993-1996, Dr. Suchkov was a Secretary-in-Chief of the Editorial Board, Biomedical Science, an international journal published jointly by the USSR Academy of Sciences and the Royal Society of Chemistry, UK.

Application of metal single-site zeolite catalysts in heterogeneous catalysis

The metal ions well dispersed at zeolite framework are considered to be active sites of catalytic processes. Therefore, the incorporation of these metals into zeolites as isolated tetrahedral sites appears to be the important task. We have earlier shown that the incorporation of transition metal ions into vacant T-atom sites of framework zeolite is strongly favored when, in the first step, zeolite is dealuminated by treatment with nitric acid solution and then, in the second step, the incorporation of transition metal ions results in the reaction between the cationic metal species of the precursor solution and the SiO-H groups of vacant T-atom sites created by dealumination of zeolite. During my keynote talk the design of single-site zeolite catalysts with transition metal will be described and characterized by different physical techniques both at the macroscopic (XRD, BET, TPR, TEM) and molecular level (FT-IR, NMR, DR UV-Vis, XPS, EPR, XAFS). The application of metal single-site zeolite catalysts in environmental catalysis will be discussed. This two-step postsynthesis method applied in this work allowed obtaining metal single-site zeolite catalysts active in different catalytic processes such as oxidative dehydrogenation of propane into propene, selective catalytic reduction of NO_x to N_2, production of 1,3-butadiene or hydrogen from renewable sources, including ethanol obtained from biomass. Their catalytic activity strongly depended on the speciation and amount of metal incorporated into zeolite structure as well as their acidity.

Audience Take Away Notes

- The audience will be able to understand as control of preparation of catalyst systems
- They will see that catalytic activity depend on dispersion of metal in the framework of zeolite
- The researchers will be able, after my talk, do their own catalyst preparation using similar method

Stanislaw Dzwigaj

Sorbonne Universite, UMR 7197, Laboratoire de Reactivite de Surface

Biography

Professor Stanislaw Dzwigaj received his Ph.D degree in 1982 in Jerzy Haber Institute of Catalysis and Surface Chemistry, Krakow (Poland). After two years of postdoctoral stay at the Laboratoire de Reactivite de Surface Universite P. et M. Curie (Paris) he obtained in 1990 a position of contracted researcher in the same Laboratory devoted to surface reactivity in relation to catalysis phenomena. Then, in 2008 he obtained permanent position in CNRS as a researcher. On February 19, 2014 for outstanding scientific achievements he received the title of professor. His published work includes more than 170 papers published in reputable international journals.

Energy production by integrated adsorption and catalysis in fuel cells – the case of hydrogen sulphide

The present study proposes integrated approach for sulfide removal based on combination of chemisorption on electro-conductive sorbent and the consecutive regeneration of the sorbent using sulfide driven fuel cell where the electro-conductive sorbent serves as anode with the simultaneous catalytical sulfide oxidation to sulfite and sulfate thus restoring the sorption capacity of the anode. In the meantime, electricity is generated to meet the energy demand of the facility.

The benefit of this approach is double. First, the wastewater containing sulfide is cleaned converting sulfide to sulfate generating energy. Next, the sulfide is concentrated on the electro-conductive sorbent with the consequent catalytic oxidation to sulfate and thus to regenerate the sorbent.

The straight use of sulfide as well as the other reductors in a waste stream in a fuel cell is also available for simultaneous wastewater treatment with energy production.

The experiments were caried out on industrial wastewater, i.e. stillage from ethanol distillation. Oxides of heavy metals were used as sorbent and catalysts. Complete removal of sulfide was attained.

Acknowledgement: This work was supported by the Fund for Scientific Research, Bulgaria, Project KP-06-H67/3.

V Beschkov*, L Liutzkanov, S Stefanov

Institute of Chemical Engineering, Bulgarian Academy of Sciences, Sofia 1113, Bulgaria

Biography

Venko Beschkov, PhD, DSc was born in 1946 in Sofia, Bulgaria. He has got PhD in 1978 and DSc degree in 1996 in the Bulgarian Academy of Sciences. His present interests are chemical and biochemical processes for environment protection and for utilization of renewable energy sources. He published over 200 scientific papers, 2 monographs and 14 chapters in selected issues. He was editor of 2 books on selected topics. Over 1900 citations of his papers have been noted. He has been Head of the Institute of Chemical Engineering at the Bulgarian Academy of Sciences (1993/2014) and Deputy Minister of Environment (1991/92).

Autoanalysis, a powerful software for laboratory automation

AutoAnalysis is a software which affords a high flexibility in automating analytical methods. Thus, with an appropriate choice of instrumental modules and the required Dynamic Link Libraries (DLLs), AutoAnalysis allows the automatic or semi-automatic implementation of a host of flow techniques including FIA, SIA, MCFIA, MPFS, MSFIA, LOV, CE and HPLC.

Although it was primarily conceived for flow techniques, AutoAnalysis also affords the automation of other laboratory processes such as maintaining the pH of a medium by addition of appropriate amounts of an acid or base (pHStat) or controlling bioreactors. In fact, this software provides a wide range of analytical solutions only limited by the user's instrumentation.

One of the greatest advantages of AutoAnalysis is that it allows a variety of problems to be solved using a single software suite, thereby avoiding the need to learn and use a different program for each instrument, providing an open environment. Since AutoAnalysis has been developed for the Windows platform, it can be run simultaneously with other programs such as word processors, spread sheets or internet browsers.

AutoAnalysis accepts conditional variables and commands; in fact, it has its own programming language, which facilitates the development of intelligent routines. Thus, AutoAnalysis is capable of taking a decision by itself based on the analytical results gathered at a given point without intervention of the analyst.

AutoAnalysis is a hardware-independent system for automating various analytical methods. System design is based on the division of the software into four layers, defining a communications interface among them. The definition of these layers allows the isolation of the highest, corresponding to the analytical application, from the lowest, the hardware, composed of the various parts of the block diagram.

Audience Take Away Notes

- Show how to automate their research work
- Yes, AutoAnalysis will show how to automate a lot analytical techniques using only one program
- AutoAnalysis is able to automate a lot of methods combining a lor of kind instruments (fluorimetry, spectrophotometry, voltamperometry, HPLC, CG/MS, ICP, etc)

Victor Cerda

Sciware Systems, S L, Bunyola, Balearic Islands, Spain

Biography

Victor Cerda, graduated and PhD in Chemistry by the University of Barcelona. Full Professor of Analytical Chemistry in 1982 at the University of the Balearic Islands (UIB). Has conducted 41 Ph.D. Thesis, written 14 books, and collaborated with 14 chapters in other scientific books. Has published 620 papers and presented 847 contributions in national and international symposia. His main research lines are related with the development of new automatic methods in Analytical Chemistry and their application to environmental and pharmaceutical samples. Has been organized more than 15 international symposia. Has been Vice-President of the Spanish Society of Analytical Chemistry.

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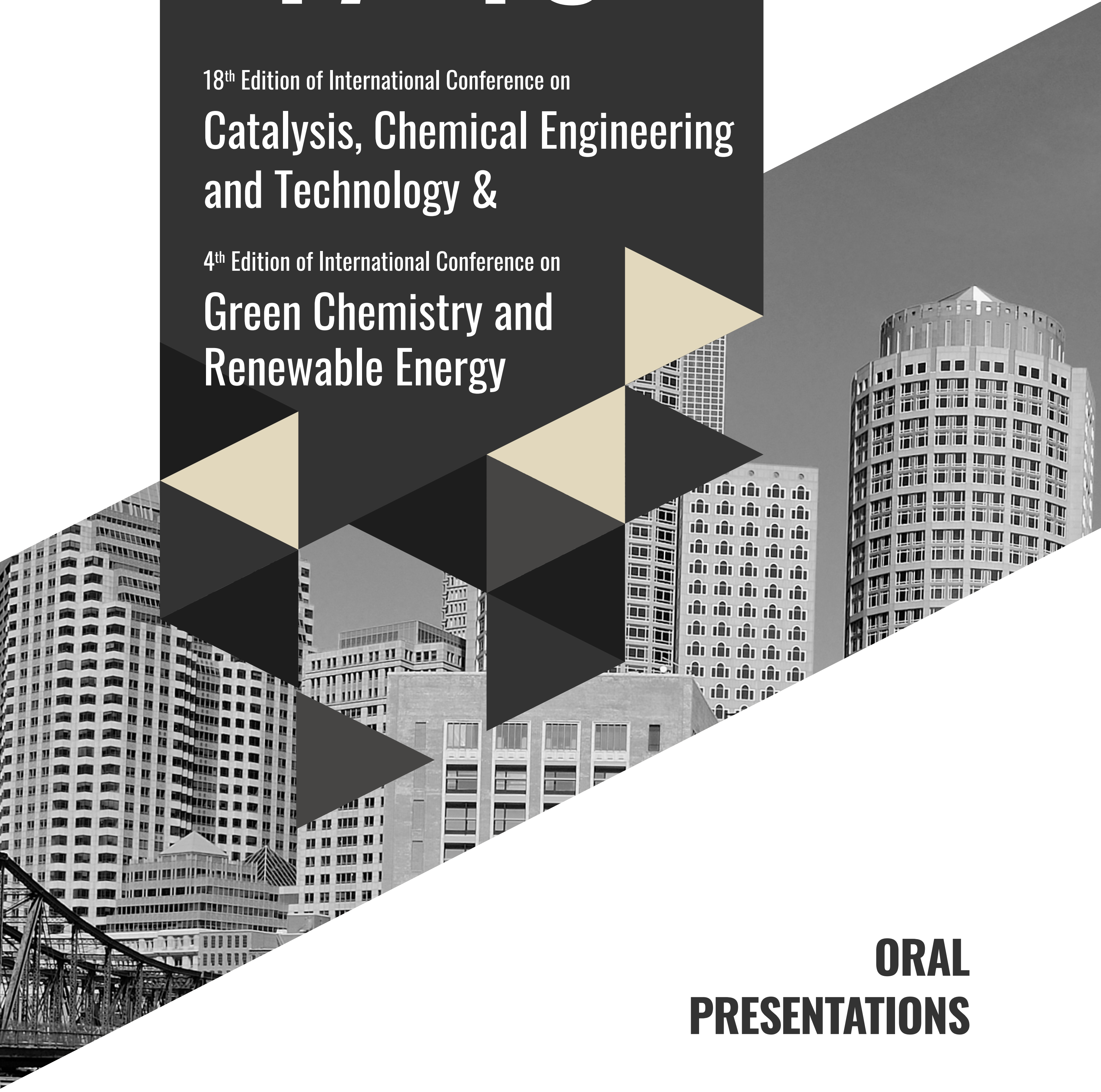
4th Edition of International Conference on

Green Chemistry and Renewable Energy



ORAL PRESENTATIONS

Aditi Singhal

School of Engineering and Applied Science, Ahmedabad University,
Ahmedabad-380009, Gujarat, India

Preparation and oxygen evolution reaction on nanoporous semi-transparent La0.8Sr0.2CoO$_3$ coatings: Stability and mechanism in neutral medium

For the prospective use in oxygen evolution reaction as an electrocatalyst, the semi-transparent thin film of La0.8Sr0.2CoO$_3$ (LSCO), was deposited on FTO (Fluorine- doped Tin Oxide) coated glass substrate, by using a sol-gel method. This involves gelation of LSCO sol followed by spin coating. Detailed characterization explains the homogeneity and nanoporosity of the film (Figure 1). Films are conducting with low sheet resistance and high carrier concentration. Sheets are also semi-transparent and very homogeneous. Electrochemical measurements in 0.1 M phosphate buffer solution (pH 7.4) confirm evolution of oxygen which starts at 1.51 V vs RHE with an overpotential value of 280 mV and Tafel slope value of 104 mv dec-1 in a neutral medium (0.1 M phosphate buffer), which remain stable for a long time. The overvoltage is comparable to the other studies done in the basic medium. LSCO is a well-known material for OER reaction in basic medium, as demonstrated in many literature studies. However, this study demonstrates its electrocatalytic activity in neutral medium and how the surface of material changes after some time. Catalyst is subjected to the stability test for 1 and 2 hours and it is found that for one hour the stability is good and after that surface oxidation process is visible. Post electrochemical characterization with the aid of XRD and XPS indicates that the bulk lattice remains intact but breakdown of the surface lattice structure produces separate oxides. Briefly, reduced cobalt oxide and oxidised Sr species form on the surface after electrocatalysis. The reduction is well correlated with the depletion of lattice oxygen from the La0.8Sr0.2CoO$_3$ compound depicting its role in the OER process. The assumption that cobalt ions play a decisive role in the electrochemical reaction is also established from XPS studies (Figure 2) and cobalt is indeed the active site during the OER process. As mentioned earlier, while several studies exist in literature which talks about the activity of LSCO in basic medium, this study is one of its kind where neutral medium is explored. Neutral medium studies are important and can serve a starting point in developing electrolysers based on sea water.

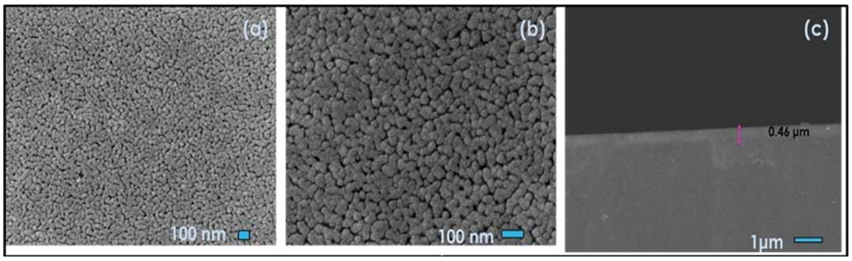


Figure 1: SEM image of LSCO thin film prepared by sol-gel process.

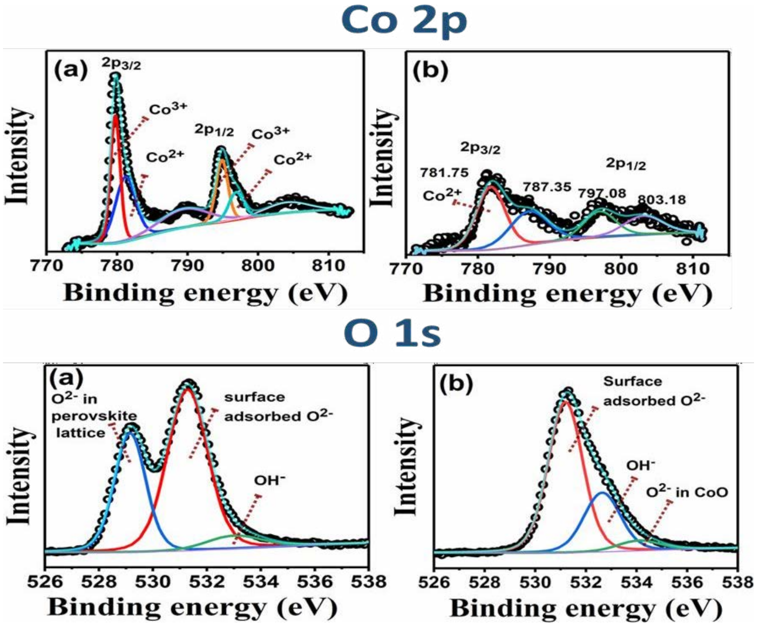


Figure 2: XPS of LSCO thin film prepared. Change in the surface chemistry of cobalt as well as O is apparent. This proves the active site is cobalt and lattice oxygen does participate in OER.

Audience Take Away Notes

- This work belongs to fundamental research on the area of electrochemistry. Thus, the audience belonging to this area will learn how experimental and analysis in the area of electrochemistry
- Probing the active site is difficult understand unless expensive techniques ate available. But here it is shown hoe just one XPS data can be used to probe the same
- This research can also be expanded in the sea water electrolysers technology because Sea water is pH neutral and the studies reported here have also been carried out in neutral medium

Biography

Professor Aditi Singhal is Assistant Professor at School of Engineering and Applied Science, Ahmedabad University. She has Master's and PhD degree in Chemistry from Indian Institute of Technology (IIT) Roorkee. There after she pursued post doctorate from University of California Santa Barbara (UCSB) and Arizona State University (ASU), USA. She also has teaching experience at colleges in USA and India. Her research interest includes synthesis and properties of nanoparticles and core shell systems via different routes, inorganic synthesis and electrochemistry of materials. Further interests include, studying the interaction of the inorganic/organic composites with biomolecules and environmental implication of these nanoparticles for water purification process.

S Alami*, M Missbah El Idrissi

Center of Plant and Microbial Biotechnology, Biodiversity and Environment,
Faculty of Sciences, Mohammed V University in Rabat, Avenue Ibn Battouta, BP
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The inoculation with ensifer meliloti sv. rigiduloides improves the growth of robinia pseudoacacia under lead-stress

With the aim to use black locust for phytostabilization of the Zaida abandoned mine tailings in Eastern Morocco, we isolated and characterized its indigenous microsymbionts. Thus, out of 27 bacteria isolated, four strains were selected for the analyses of symbiotic, molecular, phenotypic, as well as plant growth properties under increasing lead-acetate concentrations.

The Phylogenies of rrs, the MLSA, and symbiotic genes analyses showed the affiliation of the strains with Ensifer meliloti sv. rigiduloides and E. kummerowiae sv. meliloti.

Inoculation experiments under metal stress showed that both strains improved plant growth and chlorophyll content. The plant proline content increased as a response mechanism to increasing concentrations of lead.

Our results show that E. meliloti sv. rigiduloides strain RPZ12 improves plant growth under lead stress conditions more than E. kummerowiae sv. meliloti strain RPZ17. This is the first description of symbiovar meliloti in E. kummerowiae.

Keywords: Robinia Pseudoacacia, Zaida Lead Mine, Ensifer Meliloti, Phytostabilization, Symbiovars Rigiduloides, Proline.

Biography

S. Alami is a doctoral student at the Center for Biotechnology, Biodiversity and Environment, Faculty of Sciences, Mohammed V University, Rabat. He work focuses on studying the genetic and biological activities of microorganisms, such as Rhizobia, endophytic microbes, and PGPR. Currently, he research focuses on the characterization and identification of rhizobia nodulating wild legumes in some abandoned mines.

Alena B Kharissova, Ph.D*, Shadai Lugo Loredo

Facultad de Ciencias Quimicas, Universidad Autonoma de Nuevo Leon, Av. Universidad, Cd. Universitaria, 66455 San Nicolas de los Garza, Nuevo Leon, Mexico

Nature's solutions, engineered: Biomimetic design of antifouling materials for artificial reefs using green chemistry approaches

Coral reef degradation has led to increasing efforts to develop artificial reef structures that are biocompatible surfaces for healthy coral growth. Fouling by marine macroalgae and microorganisms can compete with coral settlement on these artificial structures. This study explores the fabrication of antifouling ceramic materials for artificial reefs using calcium carbonate nanostructures combined with sargassum seaweed fatty acids. Sargassum extract containing saturated fatty acids was incorporated into porous calcium carbonate nanoparticles synthesized by a facile precipitation method. The nanoparticle-enhanced sargassum fatty acids demonstrated inhibition of biofilm formation by macroalgae are implicated in macrofouling processes. Impregnation of the antifouling particle-acid structures into ceramic artificial reef substrates created a multilayered topography that discouraged algal adhesion while remaining harmless to coral larval settlement in laboratory assessments. Field immersion trials of the ceramic tiles showed a 60% reduction in microbiofouling coverage compared to controls after 4 weeks while allowing successful recruitment of coral juveniles. This work demonstrates a new biomaterial-enabled approach to developing microorganism-resistant artificial reef structures by synergizing natural antifouling compounds with biocompatible calcium carbonate nanostructures suited to coral propagation.

Audience Take Away Notes

- How sargassum seaweed fatty acids can act as antifouling agents against reef macrobiofouling when combined with $CaCO_3$ nanoparticles
- That impregnating these antifouling biomaterial structures into ceramic substrates creates surfaces resistant to microbes but compatible with coral larval settlement
- Field testing demonstrated a 60% reduction in macroalgae on the ceramic tiles with the antifouling treatment compared to controls
- This nano-enabled approach could provide a new method for developing microorganism-resistant artificial reef structures

Biography

Alena Kharissova is a Ph.D student at UANL at the Faculty of Sustainable Chemistry. Alena is a PhD student at the Sustainable Chemistry department at the Autonomous University of Nuevo Leon (UANL) in Mexico. Graduated with a degree in Materials Science Engineering and has over 6 years of experience working in industry R&D roles. Her work explores the synergies between natural biomaterials and nanotechnology to address important environmental issues.

Alexander A Kamnev*, Anna V Tugarova

Laboratory of Biochemistry, Institute of Biochemistry and Physiology of Plants and Microorganisms, Saratov Federal Scientific Centre of the Russian Academy of Sciences, Saratov, Russia

Vibrational spectroscopy techniques in analysing biogenic selenium nanostructures

Selenium is a vitally essential element, and the range between its dietary deficiency (under 0.04 mg per day) and toxicity (over 0.4 mg per day) is notably narrow. Diverse anthropogenic agricultural and technological activities are known to cause local selenium pollution of soils and aquifers, where selenium anions (selenite, $Se^{IV}O_3^{2-}$, and selenate, $Se^{VI}O_4^{2-}$) are its most soluble and hence toxic chemical species.

Since late 1980s, it has been well documented that a wide range of microorganisms are capable of reducing selenite and (less frequently) selenate to selenium(0) Nanoparticles (SeNPs). Besides potential bioremediation strategies for sites with excessive concentrations of selenium oxoanions, such processes are applicable as “green chemistry” routes for obtaining SeNPs. Such biogenic SeNPs of microbial origin are always capped with biomacromolecular layers of variable compositions depending on the Se^{IV}/Se^{VI}-reducing microorganism and conditions; these Se(0) nanomaterials can be widely used in various fields of (bio) technology. Thus, their analysis using a range of instrumental techniques is topically significant. Among such techniques, vibrational spectroscopy is of special interest comprising modern Fourier Transform Infrared (FTIR) and Raman spectroscopies. In this talk, various examples will be presented which illustrate the usefulness and convenience of these highly informative techniques, including our own already reported and ongoing studies. While FTIR spectroscopy is highly sensitive to macromolecular composition and structure of the capping bioorganic layers, Raman spectroscopy allows allotropic modifications and crystallinity states of Se(0) in SeNPs to be distinguished, including the detection of possible covalently bound sulfur atoms (revealed by S–Se vibration modes).

This research has been supported by the Russian Science Foundation (Grant no. 23-24-00582).

Audience Take Away Notes

- The application of vibrational spectroscopy techniques is useful in analysing virtually all ‘green chemistry’ products, including both (bio) organic and inorganic substances
- Various experts could learn how to apply the techniques to be discussed in this talk in their own research or practice
- The knowledge on the capabilities of the discussed techniques could be widely used to expand the scope in both research and teaching

Biography

Professor Kamnev studied chemistry at Saratov State University (SSU), Russia, and graduated as a MS in 1980. He investigated physicochemical/electrochemical properties of 3d-metal hydroxides in alkaline media at SSU and received his Cand.Sci./PhD degree in 1992 from SSU. After that, he moved to the title Institute (Russian Academy of Sciences) and has been leading domestic and international projects at the Laboratory of Biochemistry, developing molecular spectroscopic approaches in biochemistry/microbiology. In 2002, he obtained a DSc in physical chemistry from SSU. He has published over 140 articles in SCI(E)/Scopus journals, serves in Editorial/Advisory Boards of four international journals (of quartiles Q1).

Alexey Tsyganenko
Faculty of Physics, St.Petersburg State University, St.Petersburg, 198504, Russia

Advances in FTIR spectroscopy of catalysts

Advances in the application of vibrational spectroscopy to the studies of catalysts and difficulties of the method are discussed. IR spectra provide information on the nature of active sites, their strength and concentration. At low-temperatures it is possible to see the spectra of simple test molecules that do not adsorb at room temperature and characterize surface OH-groups, electron-accepting or electron-donating sites. Variable temperature spectroscopy enables us to study thermodynamics of surface processes and get information about the mechanisms of catalytic reactions. Quantum chemical calculations and electrostatic approach predict the correlation between the frequency shifts on adsorption and absorption coefficients, in agreement with experiment. Some unstable adsorption products arise at the surface as a result of thermal excitation. So, besides usual C-bonded structure CO forms with the cations in zeolites energetically less favorable O-bonded species. Such linkage isomerism was established for some other adsorbed species. FTIR spectra are sensitive to lateral interactions between the adsorbed species, which shift the bands of test molecules or complicate their contours. These data provide additional information on the geometry of surfaces. Co-adsorption of acidic and basic molecules leads to mutual enhancement of adsorption. Acidity of surface sites can be increased by adsorbed acidic molecules, this explains the superacidity of oxides doped with SO_4^{2-}. Quantum mechanical calculations support the dependence of Lewis acidity of cations on the charge and size of surrounding anions and elucidate high acidity of cations in zeolites. By means of isotopic dilution the static interaction can be distinguished from the dynamic one. The latter accounts for the vibrational energy exchange in the adsorbed layer. Splitting of absorption bands in the spectra of isotopically mixed compounds provide information on the structure and symmetry of surface species. Resonance vibrational excitation of certain isotopologues of adsorbed molecules can initiate their desorption or reactions, however isotopic selectivity, as a rule, is very poor because of quick energy exchange in the adsorbed layer.

Audience Take Away Notes

- Other faculty could use this research to expand their research or teaching
- This research could provide a practical solution to a problem of isotope separation
- The results on linkage isomerism could assist in the creation of new media for information storage

Biography

Alexey Tsyganenko is a Professor of physical faculty of St. Petersburg State University, head of a chair. Graduated in 1971, Ph.D. 1975. Since 1983 head of the research group of Infrared Spectroscopy, faculty of Physics of the University. Participated in scientific researches in France, Germany, Spain, Mexico, Finland. The list of publications includes over 140 papers, 3000 citations. The main field of scientific activity is spectroscopy of adsorbed molecules, lateral interactions and reaction mechanisms, linkage isomerism of surface complexes. Developed the methods of low temperature spectroscopy of dispersed ice or adsorbed ozone, photocatalytic processes and those induced by resonance vibrational excitation, quantitative surface site characterization.

Alexis Spalletta*, Nicolas Joly, Patrick Martin

Unite Transformations & Agro-ressources - Univ. Artois, UniLasalle, ULR7519, F-62408 Bethune, France

Toward biocatalyzed carbohydrate-based surfactants synthetic strategy: Optimization of biocatalyzed multi-step one-pot synthesis of a biosourced lipophilic moiety

The actual worldwide need for a more sustainable consumption leads conventional chemistry to undergo profound changes to meet nowadays and future challenges, especially processes decarbonization. Biocatalyzed processes can fit with this purpose of more sustainable industrial processes. Considering surfactant-producing industry, especially "green" surfactants (association of a hydrophilic group and a lipophilic moiety), non-ionic biobased fatty acid carbohydrate esters are used in multiple fields, such as cosmetics, food industry, and pharmacology and biocontrol. These multi-applications have created a worldwide market for such bioproducts and consequently expectations for their greener production. In-between hydrophilic and lipophilic groups, a spacer/linker can be introduced to confer additional properties to the surfactant, such as improved amphiphilic properties or a lower CMC (Critical Micellar Concentration) value. Beyond the surfactant aspects, add a spacer would allow to integrate molecular patterns to classical surfactants and thus create a molecule-application relationship, with for example Pathogen-Associated Molecular Patterns (PAMP). The present work, as a part of biocatalyzed synthesis of carbohydrate-based surfactants, deals with the selective biocatalyzed conception of an aglycone, including biosourced spacer and lipophilic synthons, in two steps one-pot synthesis. The purpose is to condense a fatty alcohol onto dicarboxylic acid using a lipase as catalyst. Then, a diol is added to the reaction medium to react with the products obtained in the first step to obtain a monohydroxylated aglycone. A study of the specific substrates involved in the reaction identified the most efficient intermediates. Kinetic study using gas chromatography further enabled us to optimize reaction time and volume for a more efficient process. For example, a maximum yield is obtained after only short time. Various points have been optimized to maximize yields and enzymatic selectivity: lipase origin, temperature, green solvent alternative, co-solvent lipase molecular bio-imprinting. For example, the use of 2-methyltetrahydrofuran-3-one as solvent increased reaction selectivity. We have therefore mapped various parameters and so we can propose a multi-step one-pot synthesis of spacer-lipophilic biosourced synthon in 4h, without treatment. We are now working on the grafting this entity onto carbohydrate using a β-glucosidase, to implement an enzymatic cascade.

Audience Take Away Notes

- How to manage a multi-step biocatalytic synthesis
- How solvents impact enzyme selectivity
- How protein conformational memory can be an interesting tool

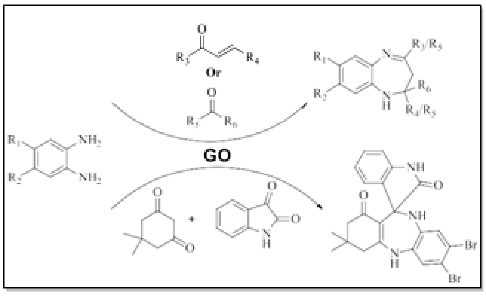
Biography

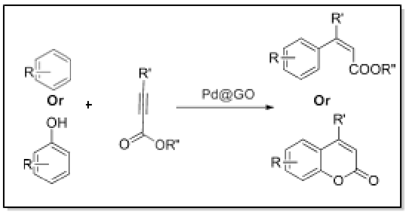
Dr. Alexis Spalletta studied biochemistry and biotechnology at the University of Lille, France, and graduated in 2020 with a Master's degree in plant, enzymatic and microbial biotechnological innovation. Then, He joined the Transformation & Agroressources Unit (UTA) at Artois University (Bethune, France) where he obtained his PhD in 2023 under the supervision of Pr Patrick Martin and Pr Nicolas Joly, working on enzymatic catalysis. He is currently a contract Associated Professor (ATER) in the Béthune IUT Chemistry Department and continues to develop his work on biocatalysis in the UTA unit.

Amarta Kumar Pal
Department of Chemistry, North Eastern Hill University, Shillong-793022,
Meghalaya, India

Graphite oxide is an efficient green catalyst and support material in organic synthesis

Catalyst is an important ingredient in organic synthesis. Many catalysts are known which show very good selectivity and reactivity but they are not green and sustainable. Therefore, scientists around the globe are trying to develop not only efficient but also green and sustainable catalysts. On the other hand, to avoid the agglomeration issues of nanoparticles, support materials also played a very crucial role. In both cases, carbon materials are far ahead of other type of materials. Among the various allotropes of carbon, Graphite Oxide (GO) occupies a supreme position because it has a large surface area with various functional groups. We exploit these properties of GO for the synthesis of various biologically, pharmaceutically, and industrially important organic molecules. Benzodiazepine and its derivatives are one of the most privileged structures in the pharmaceutical industry. It possesses a broad spectrum of activities. Mainly they are used to treat anxiety disorder. GO was utilized to synthesize 1,5- benzodiazepines and spirodibenzo[1,4] diazepines under green and sustainable conditions1,2. Palladiums are mainly used to construct carbon-carbon and carbon-heteroatom bonds. Palladium salts are costly and moreover, reusability is one of the biggest challenges. So, palladium nanoparticles was grafted on GO surface (Pd@GO) and utilized to make Carbon- Carbon bond followed by coumarin synthesis using C-H activation of aryans and alkynes3.





Audience Take Away Notes

- Application of environment-friendly, sustainable materials in organic synthesis
- Other researchers can also utilize graphene oxide in their research
- This catalyst can be used at the Industrial level

Biography

Dr. Amarta Kumar Pal acquired his master's degree in chemistry from the University of Calcutta, in 2001. Then, he joined in Prof. K. C. Majumder's group to pursue his Ph.D. degree. He received his Ph.D. in 2007 and went to Taiwan for his post-doctoral study. He spent around one year at Academia Sinica, Taiwan in Prof. C. H. Lin's laboratory. In 2009, he joined as an Assistant Professor at the Department of Chemistry, in North-Eastern Hill University. He has been promoted to Associate Professor in 2021. He produced seven Ph.D. students and published more than fifty publications in international peer-reviewed journals. His research interests are the development of green and sustainable methods for organic synthesis and, the synthesis of biologically important heterocyclic molecules.

AnneMarie Clements*, Donald M

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Green chemistry to overcome green roof reluctance in urban Sydney

Australia is the land of fires, floods and droughts. With the expansion of our cities, canopy tree cover has decreased and heat island effects intensified. Application of green roofs has not been widely embraced.

To understand why there is resistance to installing green roofs in Australian cities, we carried out a green roof trial on a light-weight metal roof in the North Sydney residential area. This Council Authority in their planning legislation encourages residents “to accommodate green roofs immediately after construction”. Their Resource Manual details the merits of green roofs including thermal insulation, increasing the life span of the roofs, reducing heat-island effects, and reducing stormwater runoff.

In Australia, the barriers to widespread acceptance by residents and commercial developers of functional Green Roofs appear to be related to cost and lack of proven reliability, as well as confusion between functional Green Roofs and landscaped Roof Gardens. Landscape architects specify at least 300 mm of soil, watering systems and use of non local native plant species such as Sedum spp. Sedum spp. are the commonly planted species used on functional green roofs in Europe and America. They are succulents in the family Crassulaceae, and generally planted as a Sedum-mix blanket containing eight to twelve different types of Sedum.

From a restoration ecology point of view, growing plants on harsh roof environments is similar in many ways to growing dune species on silica sands, where mycorrhizal fungal symbioses are critical for plant nutrient and water uptake. The efficiency of any green roof for climate mitigation is likely to depend on establishing these plant / soil fungal associations.

The North Sydney roof trial followed the FLL-Guidelines for the Planning, Execution and Upkeep of Green Roof Sites. Instead of using Sedum spp., local native groundcover species were used. The factorial trial consisted of 40 cells (5 replicates, 2 soil types and 4 species mixes). The trial commenced on 8 November 2023 and the green roof was exposed to summer storms. After 3 months, despite the wind, summer heat and short bursts of intense rain, the plants in the 40 cells are thriving and soil micorrhizal fungi developing.

The green chemistry of the soil micorrhizal fungi associated with local native species may be the breakthrough required for long-term reliability of Green Roofs in the harsh exposed environment.

Audience Take Away Notes

- Roofs are challenging, exposed harsh environments, similar to that of exposed wind-swept coastal dunes
- Utilising natural green chemistry of naturally occurring soil micorrhizal fungi is critical for the success of low maintenance Green Roofs
- Local native plants are natural hosts of soil micorrhizal fungi
- The efficiency of any green roof for climate mitigation is likely to depend on establishment of plant / soil fungal associations

Biography

Dr. AnneMarie Clements, a restoration ecologist with MSc. (Macquarie Univ.) and a Ph.D. (Univ. of Sydney) in ecology, and more than 30 years experience. Her major research interests include the re-establishment of native ecosystems, impacts of urban development on vegetation and soil, pattern analysis, effects of inundation and salinity on the plant communities, metal concentrations on plant growth and bioaccumulation. She has utilised her research in designing and implementing numerous rehabilitation / conservation programs as part of sustainable developments.

Maria Cristina Arena[1]*, Roberto Guida[2], Beatrice Mandelli[2], Antonella Profumo[1], Daniele Dondi[1], Gianluca Rigoletti[2], Mattia Verzeroli[3], Stefania Alexandra Juks[4]

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[3]Universite Claude Bernard Lyon 1, Lyon, France
[4]Universite Paris-Saclay, Paris, France

Recuperation systems for fluorinated gas at the CERN LHC Experiments

In the context of particle physics, different families of gaseous detectors are operated with gas mixtures containing fluorinated gases for different purposes at the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN). The main gases used in these detectors are tetrafluoromethane (CF_4), tetrafluoroethane ($C_2H_2F_4$), sulphur hexafluoride (SF_6), perfluorobutane (C_4F_{10}). Given their high Global Warming Potential (GWP) and the increasingly stringent European regulations regarding the use and trade of these gases, different approaches have been adopted for reducing the Green House Gas (GHG) emissions. One of the strategies, currently operating at the LHC Experiments, is the use of gas recuperation systems.

At the CERN LHC experiments four operational GHG recovery systems are operational: two for the CF_4, one for the R134a ($C_2H_2F_4$), and one for the C_4F_{10}. They are industrial-scale systems, each of which relies on different principles of gas separation and purification. Indeed, in most cases, fluorinated gases are used within gas mixtures where other components have lower Global Warming Potential (GWP). Considering the unique gas mixtures used in particle detectors, these recovery systems have been specifically developed as no industrial apparatus currently exists to address these particular requirements.

The separation of fluorinated gases is carried out mainly through membranes, absorbers, or distillation. In the case of CF_4, it is separated from a CF_4/Argon/CO_2 mixture (in the proportions of 10/40/50). The R134a is recuperated from a gas mixture of $C_2H_2F_4/iC_4H_{10}/SF_6$ (in the proportions of 95.2/4.5/0.3) where freon forms an azeotropic mixture with the isobutane. The C_4F_{10} is separated from CO_2, O_2 and N_2. It is worth to notice that these gas mixture undergo high electric field and radiation dose in the LHC experiments and therefore dedicated studies on the breakdown products have also been performed.

The recovery system efficiencies are approximately 70% for the CF_4, 80% for the R134a, and 90% for the C_4F_{10}. The goal is to reuse the purified gases within gas mixtures sent to detectors in variable fresh/recovered fractions, depending on the purity of the obtained gas (usually between 90% and 98%).

The various stages of the recovery processes are monitored through gas chromatographic analyses, GC/MS (Gas Chromatography/Mass Spectrometry), and Infrared (IR) analyses.

The use of these recovery systems in recent years has led to significant savings both in economic and emissions terms at CERN. In 2023, 950 kg of recovered CF_4 were utilized out of a total of 2800 kg, and 1200 kg of R134a were used out of a total 20000 kg. It's worth noting that the R134a system is still under test and it was operational only for some weeks starting from September 2023 onward.

The development and construction of two new recovery systems for SF_6 and C_4F_{10} are still ongoing, and they are expected to be operational by the end of 2024.

Audience Take Away Notes

- Given the widespread use of fluorinated gases and their high Global Warming Potential (GWP), the topics discussed in the talk can be valuable for anyone working with these substances, helping them to learn about gas separation processes and to develop similar systems. Although there are some eco-friendly alternative gases available in the market, they may not always be directly substitutable for particle detectors. Recovery, therefore, serves as an excellent solution to reduce costs and emissions. The scientific literature still lacks comprehensive information on these topics, making the discussed information potentially valuable for those intending to develop similar systems, both on an industrial and laboratory scale

Biography

Maria Cristina Arena studied Chemistry at the University of Messina, Italy, where she graduated with a bachelor's degree in 2019. Then she moved to University of Pavia, Italy, and graduated with master's degree in 2021. In 2021 she joined the Gas Team at CERN where she worked on the optimization of CF4 recovery system for the CMS Cathode Strip Chamber gaseous detectors. In 2022, she started her Ph.D. project "R&D for gas recovery systems and study of eco-friendly gas mixtures for new gas detectors for the Experiments at the CERN Large Hadron Collider" at the same university and in collaboration with CERN.

Benjeddi Abir[1,2]*, Bakhy Khadija[2], Abdelmoumen Hanaa[1]
[1]Center for Biotechnology, Biodiversity and Environment, Faculty of Sciences, Mohammed V University, Rabat, Morocco
[2]National Institute of Agronomic Research, Rabat, Morocco

Chemical diversity of the genus mentha: Promoting green chemistry with nature's diversity

The integration of medicinal and aromatic plants with green chemistry is a significant and promising area, particularly in utilizing renewable resources. These natural plants offer a sustainable alternative to synthetic substances in pharmaceuticals and cosmetics, aligning with green chemistry's goals of reducing environmental impact and fostering sustainable practices.

The Mentha genus stands out as a particularly relevant example, renowned for its richness in polyphenols and terpenic compounds. The polyphenols found in Mentha are known for their antioxidant properties, while the terpenes contribute to the plants' distinctive aromas and therapeutic virtues.

The chemical diversity within the Mentha species is not only intriguing from a botanical perspective but also has practical implications. Each species within this genus possesses a unique chemical profile, leading to a wide range of applications, especially in the field of essential oils and extracts. These essential oils and extracts are highly prized in various industries, from pharmaceuticals to cosmetics and even in culinary arts, for their therapeutic properties and flavor profiles. This versatility highlights the significant role of the Mentha genus in both traditional and modern applications, which is in line with the principles of sustainable resource utilization as championed by green chemistry.

The present research focuses on evaluating the chemical diversity of essential oils and quantifying total polyphenols, flavonoids, and tannins of extracts, from different species within the genus Mentha, in order to investigate their antioxidant activities.

By harnessing the potential of naturally regenerating and reproducing plants, we minimise our dependence on non- renewable resources and promote a more harmonious approach to the environment.

Furthermore, the use of these plants is part of an environmentally friendly production and extraction framework that fortifies the connection between medicinal botany and the principles of green chemistry. In summary, aromatic medicinal plants are a valuable resource for human health and can be a crucial tool in the hunt for more sustainable, greener chemistry.

Audience Take Away Notes

- Attendees will gain insights into the complex polyphenolic and terpenoid compositions of various Mentha species
- The presentation will explore how these compounds are utilized in pharmaceuticals, cosmetics, and even culinary arts, providing practical insights for professionals in these fields
- The talk will highlight how the use of these natural resources aligns with the principles of green chemistry, emphasizing sustainable and eco-friendly practices
- The presentation could inspire new research directions, particularly in exploring the untapped potential of the Mentha genus

- Attendees will have the chance to network and discuss potential collaborations for future research or product development

Biography

Abir Benjeddi, is a doctoral student at the Faculty of Sciences, Rabat and the National Institute of Agricultural Research, holds a Baccalaureat in Life and Earth Sciences, a DEUST in Biology, Chemistry, and Geology, and degrees in Biomedical Technologies and Applied Microbiology from the Faculty of Science and Technology of Mohammedia. Passionate about Medicinal and Aromatic Plants since her undergraduate studies, her research, culminating in her doctoral thesis, builds upon this long-standing interest. Abir actively participates in national and international congresses, showcasing her evolving expertise in botanical, molecular and biomedical sciences.

Cemil Koyunoglu[1]*, Ece Polat[2]

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[2]Department of Environmental Engineering, Sinop University, Sinop, Turkiye

Boron-doped catalysts and the production of energy from microalgae

The combustion of petroleum-derived fuels contributes to the accumulation of carbon dioxide. The sustainability of the environment and the economy depends on the use of renewable fuels. Biofuels derived from microalgae appear to have the potential to meet the global transportation fuel demand. Microalgae use solar energy more efficiently than crops. A microalgae's oil productivity is much higher than most oil crops. Researchers are increasingly interested in microalgae for their potential applications in producing bioactive ingredients, producing hydrogen and energy sources, and capturing and reducing carbon dioxide. Several advantages can be achieved, including environmental sustainability, reduction of carbon footprint, and production of products for many different industries. A catalyst can optimize energy and material use, increase product efficiency, and reduce the environmental impact of these processes by improving the performance of microalgae. Thus, the combined use of microalgae and catalysts offers significant potential in several environmental applications. Occasionally, boron can be used as a catalyst additive to enhance the activity or selectivity of metal catalysts. This paper presents an analysis of the energy production from microalgae biomass using boron-doped catalysts, as well as a possible direction for future research.

Audience Take Away Notes

- Microalgae's role in environmental applications and their contribution to carbon sequestration
- An overview of the most common methods for producing energy from microalgae
- Efficacy of catalysts in the production of energy
- The contribution of boron-doped catalysts to the production of energy

Biography

Dr. Ogr. Uyesi Cemil Koyunoğlu is an experienced academic and scientist working at Yalova University. He is known for his contributions to the academic field through his extensive educational and research experience. Cemil Koyunoğlu began his educational journey before University, and his interest in science led him to Yalova University. He completed his undergraduate studies in Chemical Engineering at İnönü University, followed by master's and doctoral studies (including a year as a visiting researcher in the United States) at İnönü University and Istanbul Technical University, respectively. He graduated with honors from the Laboratory and Veterinary Health Associate Degree Program at Istanbul University. His doctoral thesis focused on examining the environmental impact of pulverized coal and mixtures injection in the iron and steel industry, garnering attention in the academic world. Dr. Koyunoğlu currently serves as a faculty member at Yalova University, teaching in the field of Energy Systems Engineering. He actively continues his research, particularly in areas like energy systems modeling, energy-industry 4.0, theoretical physics in design processes, and statistical thermodynamics. His international work in these fields has established him as a well-recognized name in the scientific community.

Choong Kil Seo

Department of Automotive & Mechanical Engineering, Howon Unversity, Gunsan City, Jeollabuk-do, Republic of Korea

Harmful gases reduction characteristics according to the additive catalysts and support types of H_2-SCR

Internal combustion engines still account for a large proportion of automobiles. The internal combustion engine still accounts for a significant portion of automobiles and is a major contributor to air pollution and global warming. As a result, air quality regulations are becoming stricter. Regulations on automobiles, construction machinery, ships, and household boilers have been tightened, and air quality is being managed by expanding the air management area nationwide in a manner suitable for local conditions. With the advent of the hydrogen economy in the future, technologies that generate and utilize hydrogen, the cleanest energy source, are in the spotlight with meaningful research ongoing. To date, selective catalytic reduction(SCR) catalysts have been commercialized as a powerful NOx reduction after-treatment technology. In addition, H_2-engines have been developed and commercialized, and the concern of NOx and H_2 emissions has also been raised. In the research trend of the H_2-SCR catalyst, research on reducing NOx using H_2 as a reducing agent has been conducted. Previous studies have been conducted on the main catalyst (Pt, Pd, Ag), additive catalysts(Na, La, Ce, Ni, W, Cr, Mn, Mo, etc), support (Al_2O3, TiO_2, Zeolite, etc), reaction mechanism, etc., mainly to improve the performance of the H_2-SCR catalyst. Among various studies using noble metal-based catalysts, platinum has been demonstrated as a suitably active metal showing superior activity for H_2-SCR at low temperatures. The purpose of this study is to simultaneously reduce NOx and CO harmful gases according to the promoters and support types of the H_2-SCR. The 0.5Pt-2CeO_2-5Ru/TiO_2 catalyst loaded with 7wt% Ru showed a lower NOx conversion rate compared to than the 0.5Pt-2CeO_2/TiO_2(STD), but the window shifted to the right, and it showed NOx reduction performance of up to 30% at 175°C. When Zr was loaded, de-NOx performance was not improved at the temperature of 200°C starting from a low catalyst temperature of 75°C. With In the influence of the support types, the 0.5Pt-2CeO_2/TiO_2 H_2-SCR catalyst showed the highest NOx conversion rate below 125°C, and the low-temperature activity of NOx was higher than that of the three zeolite-loaded H_2-SCR catalysts. Low temperature activity was improved because the TiO2 has excellent reducing and oxidizing ability. Among the three zeolites, the CO reduction performance of the 0.5Pt-2CeO_2/Zeolite(1) catalyst with high Al content was the lowest.

Audience Take Away Notes

- In this study, the follwing results were obtained through the harmful gaese reduction characteristisc accoding to the additive catalysts(Ru, Zr) and the support types(TiO_2, Zeolites) of H_2-SCR
- The 0.5Pt-2CeO_2-5Ru/TiO_2 catalyst loaded with 7wt% Ru showed a lower NOx conversion rate compared to than the 0.5Pt-2CeO_2/TiO_2(STD) catalyst, but the window shifted the right, and it showed. NOx reduction performance of up to 30% at 175℃. The window moved to the right because a lot of cataly activation energy was required
- When the additive catalyst Zr was added to the H_2-SCR catalyst, it did not affect the catalytic activity, but it did affect the durability or good acid point control
- The 0.5Pt-2CeO_2/TiO_2 H_2-SCR catalyst showed the highest NOx conversion rate below 125℃, and

the low-temperature activity of H_2-SCR catalyts. The support TiO_2 has excellent oxidizing power for chemical substance decomposition such as spillover

- In the zeolite(Si/Al)-based H_2-SCR, the perfomance of the catalyt tended to reduce as the content of Al, Which is less active than Si, increased

Biography

Choong Kil Seo is a professor at the Department of Automotive & Mechanical Engineering at Howon University at Gunsan city, Jeollabuk-do, Republic of South Korea. The major is combustion and post-exhaust treatment engineering, renewable energy. In particular, He had devoted to catalytic research and development, which is an exhaust gas abatement device for vehicles and machinery, and have contributed to practical use of de-NOx catalysts(Lean NOx Trap, Selective Catalytic Reduction, and Natural Gas Oxidation Catalyst). He received his Ph. D. degree in the Department of Mechanical Engineering from Chonnam National University at Gwangju city in February 2012. He has been working on the environmentally friendly diesel hybrid research center of Korea Automotive Technology Institute (KATECH) under the Ministry of Tread, Industry and Energy, and mainly developed the catalysts for vehicles and sensors.

Chung Yu Guan

Department of Environmental Engineering, National Ilan University, Yilan 260, Taiwan

Plant microbial fuel cells and biorefinery technology for climate change, global warming, energy shortages, and environmental problems

Due to environmental problems, energy shortages, climate change and global warming, it is urgent to use green technologies to treat pollution and convert green energy and valuable chemicals. The Plant Microbial Fuel Cell (PMFC) is considered a sustainable technology that can absorb CO_2, treat pollution, and produce energy. Several studies have demonstrated the use of the PMFC system for the remediation of contaminated soils and groundwater. The removal efficiency of Cu and Cr in soils could reach 58.85% and 60.00%, and Zn of groundwater could also be reduced. Biomass materials are a widespread and renewable resource. In biorefinery area, collecting and converting biomass materials into valuable chemicals and energy. Biorefinery technology can reduce human use of fossil fuels. The microwave heating method has higher heating efficiency and shorter reaction time for biomass conversion. The higher reacting temperature and higher catalyst concentrations improve levulinic acid generation. Furthermore, the plant biomass waste used for plant remediation of groundwater and soil can also be collected and pre-treated. Afterward, the plant biomass samples were converted by microwave heating to produce platform compounds. The temperature, catalyst concentration, and green solvent can affect the yield of platform compounds and energy. Therefore, plant microbial fuel cells and biorefinery technology have the potential to be applied to environmental protection and sustainable development.

Audience Take Away Notes

- This work will bring green technology, especially plant microbial fuel cells, and biorefinery technology, which can treat environmental problems and energy shortages
- Plant microbial fuel cells and biorefinery technology have multiple functions. Researchers and teachers can develop and teach these methods
- Plant microbial fuel cells and biorefinery technology are practical methods

Biography

Chung Yu Guan is currently Associate Professor in the Department of Environmental Engineering at National Ilan University. He was a Visiting Scholar at the Hong Kong Polytechnic University, Visiting Scholar at Kyushu Institute of Technology in Japan. Chung-Yu Guan holds PhD from National Taiwan University, Taiwan. He has published over 30 SCI journal papers and serves as Gust Editor of some Journal paper.

Clement Chastrette[1,2]*, Laure Candy[1,2], William Tapia[1,2], Christine Raynaud[1,2]

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The Atlantic case in Sea2Land project: Optimization of the fractionation by twin-screw extrusion of fish by-products for the production of biobased fertilisers and fish oil

The Sea2Land project is a 4-year collaborative Innovation Action (IA) funded by the EU in the frame of the Horizon 2020 programme. Based on the circular economy model, Sea2Land promotes the production of fertilisers in the EU from its own raw materials. This solution is expected to reduce the soil nutrient imbalance in Europe. The basis of the project is the regional production of Bio-Based Fertilizers (BBF) from fishery and aquaculture by-products by developing dedicated demonstration pilots that can be replicated across Europe, boosting local growth. 26 partners from 11 countries are participating in the project. 9 technologies are developed on the basis of 7 demonstration pilots implemented in 6 representative areas of the European fishing and aquaculture sectors.

For the Atlantic area case study, the project aims at producing BBF's from fish by-products1 using Thermo Mechano Chemical (TMC) fractionation by twin-screw extrusion as innovative process. TMC process is a continuous process, working at low liquid/solid ratios and able to provide a solid and a liquid fraction 2. The use of TMC process for BBF's production is an innovative approach that makes it possible to recover not only products with an agronomic value but also other components such as lipids to reach a ZERO-waste process. The process was developed on the fractionation of heads and frames of Steelhead trout's (Oncorhynchus mykiss), provided by a fish farm (Pisciculture Ispeguy, French Basque country). The N, P, K, and lipids contents in raw materials were respectively of 6.8%/DM, 1.4%/DM, 0.54%/DM and 42.5%/DM for heads and 6.9%/DM, 1.9%/DM, 0.62%/DM, 46.5%/DM for frames. The Atlantic pilot integrates the TMC extruder as principal technological unit but also includes pretreatment units and downstream processes. The TMC fractionation process was optimized at lab scale studying the twin screw extruder configuration and the influence of temperature, screw profile, screw speed or enzymes introduction on the yield in BBF's and the yield in lipids recovery and on BBF's composition (total N and residual lipids). The process developed at lab scale at a feed rate of 5-10 kg/h was scaled to pilot scale at a feed rate of 20 kg/h and at an industrial pilot scale at a feed rate of 100-200 kg/h. Two fertilizing products were obtained for the Atlantic Area: i) an organic solid BBF (9% N/DM), ii) a liquid organic fertilizer (11% N/DM). Both were directly tested in pot trials without formulation and the solid BBF was retained for field trials. Moreover, the TMC process generates as highly valuable co-product an oily phase. This oil, rich in omega 3 (5.1% in EPA+DHA) but also in astaxanthin (11 mg/kg), a red carotenoid, could be used in food and feed sectors 3.

Audience Take Away Notes

- H_2020 Sea2Land project presentation
- Overview of the mapping of European fishery and aquaculture wastes
- Twin-screw extrusion as a solid/liquid fractionation technology
- Extraction by twin-screw extrusion as a continuous solid/liquid fractionation technology to provide biobased fertilisers and fish oil from fish by-products

Biography

Clement Chastrette is a Process Development Engineer and Innovation Officer. He holds a double diploma of chemical engineering from the INP-Toulouse ENSIACET (France) and the UFRN in Natal (Brazil). He has a 3 year experience in the regulation for cosmetic and perfume industry and REACh and a 4 year experience in technological transfer for vegetal and animal bioresources fractionation, extraction and purification of high-value molecules. He is mainly involved in European R&D projects and industrial projects with SME. His main topics of research are batch or continuous extraction processes such as extraction using twin-screw extrusion and purification of high valued extracts.

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Sustainable biodiesel production and high-value alginate extraction from invasivesargassum seaweeds: Unlocking economic opportunities from waste

The great influx of pelagic brown algae Sargassum along coastlines has created widespread environmental and economic challenges since 2011 on the coasts of the Caribbean, Gulf of Mexico, Brazilian east Coasts and West Africa in events known as golden tides. However, this abundant macroalgae holds the potential to alleviate these issues by providing valuable economic opportunities. This study focuses on the utilization of Sargassum biomass collected from Quintana Roo, Mexico, to produce biodiesel and a high-value alginate stream.

To unlock the potential of the biomass, a two-step process was employed. First, the biomass underwent pretreatment using Alginate Extraction Autohydrolysis (AEA), followed by enzymatic saccharification through fungal Solid-State Fermentation. This process successfully released 7 g/L of total sugars. The resulting sugar mixture was then subjected to fermentation using engineered Yarrowia lipolytica, resulting in total lipid titer of 0.35 g/L at the lab tube scale.

Moreover, this study demonstrates the extraction of a purified alginate stream from the Sargassum material, yielding 0.3875 g/g DW. This high-value alginate stream represents a significant achievement and further enhances the economic potential of Sargassum utilization.

The findings presented in this study are highly promising, highlighting the feasibility of establishing a biodiesel production biorefinery for efficient utilization of Sargassum seaweeds during periods of high invasion. These results serve as a solid foundation for further optimization and scaling up of the process, opening doors to sustainable solutions and economic relief in affected regions.

Audience Take Away Notes

- The conference will provide attendees with insights into the critical role of effective waste management in the pursuit of sustainability goals
- The conference will offer attendees valuable insights into the process of converting waste to energy through the production of biofuels using the invasive seaweed Sargassum
- Attendees will gain insights into cutting-edge technologies and methodologies that enable the efficient extraction of alginate from Sargassum and posterior enzymatic saccharification of the algae to obtain fermentable sugars
- The presentation highlights the feasibility of establishing a biodiesel production biorefinery for efficient utilization of Sargassum seaweeds

- The presentation will also underline the importance of fostering collaboration among academia, industry, and policymakers to advance sustainable waste management strategies

Biography

Danay Carrillo is a Chemical Engineer with a degree from the Instituto Superior Politecnico Jose Antonio Echeverria (ISPJAE) in Cuba (2006). She holds a Master's degree in Process Analysis and Control (2011) from ISPJAE, Cuba, and a Ph.D. in Food Science and Technology (2016) from Universidad Autónoma de Coahuila. Dr. Carrillo is a research professor at Tecnologico de Monterrey and a member of the Molecular and Systems Bioengineering Research Group. Her research focuses on utilizing agro-industrial waste for biofuel production and cultivating microalgae in wastewater for value-added products. With 26 publications, 10+ journal reviewer roles, and technical lead experience on 11 projects, Dr. Carrillo has 17 years of teaching experience and holds the category of Assistant Researcher.

Danuta Olszewska

AGH University of Krakow, Faculty of Energy and Fuels/Al. A. Mickiewicz 30, 30 059 Krakow, Poland

Catalytic materials for flue gas cleaning based on used drinking water filters

The aim of the presentation is to assess the suitability of used filters from drinking water treatment for the preparation of composite catalyst precursors. These materials can be used as catalysts to remove gaseous pollutants from waste gases. Precursor making, physicochemical analysis and catalytic tests can help assess whether these materials can contribute positively to environmental protection and waste management. In this case, the filters used for tap water - instead of being thrown into the garbage - can be reused. These activities will reduce the amount of garbage in landfills and provide one of the materials to make air purifiers. Comparative tests of physicochemical properties of a new filter, a worn filter and a worn filter subjected to further adsorption under various conditions were carried out.

As part of physicochemical tests, the following were performed: Sieve analysis, determination of pH of water extract, determination of ash content, determination of methylene number, determination of iodine adsorption number and chlorine leaching.

After comparing the results of all samples, it can be concluded that further adsorption of compounds on used filters is possible. This is confirmed by similar results of the adsorption number of iodine consumption filter and samples of the A and B series. An additional advantage is the fact that the pH of the water extraction of the used and new filter differ slightly and is close to the neutral pH, which means that the chemical nature of the filter does not change after its wear.

The ash content test showed that the used filter contains a very large amount of inorganic compounds, mainly derived from the adsorption of compounds responsible for boiler scale on ion exchange resin. Due to the fact that these compounds, as well as the entire ion exchange resin, do not participate in the process of creating catalysts, they are superfluous. It is possible to separate activated carbon (it is the main catalyst precursor) from the resin, which was demonstrated by sieve analysis. The above conclusions may confirm the thesis that used water filters are suitable for processing and making catalyst precursors. In the further stage of the research, carbonization and activation of precursors with steam and carbon dioxide were carried out. Then, in order to determine the properties of catalysts, their specific surfaces and porosity were determined. Catalytic tests were carried out. The resulting materials after modification can be used as waste gas purification catalysts.

Audience Take Away Notes

- Reuse of water filters can improve environmental protection
- These are studies that can be extended to other types of filters and used for teaching work in the field of catalysis, environmental protection or energy
- Research shows practical solutions to optimize the process of producing catalysts from used filters

Biography

Dr. Danuta Olszewska studied Chemistry at the Jagiellonian University, Poland and graduated as MS in 1996. She then joined the research group of Prof. Teresa Grzybek at the Faculty of Energy and Fuels, Academy of Krakow (AGH University, Poland). She received her PhD degree in 2002 at the same institution. In 2012, she did her habilitation in the field of catalysis. She obtained the position of an Associate Professor at the AGH University. She also conducts scientific work in the field of energy storage.

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Feasibility analysis and design optimization of MCFC gas recirculation for enhanced carbon capture

“Hard to abate” sectors present significant challenges in reducing CO_2 emissions due to their dependence from fossil fuels and limited low-carbon alternatives. One of the most important sectors is the maritime sector, which accounts for approximately 2-3% of global CO_2 emissions. Removing CO_2 in this sector is crucial to achieving the 40% and 70% reduction targets set by the International Maritime Organization (IMO) for 2030 and 2040.

Molten Carbonate Fuel Cells (MCFCs) represent a promising technology for Carbon Capture and Storage (CCS) on board ships, offering an innovative solution to reduce CO_2 emissions from the maritime sector. One of the main advantages is that this type of technology is a modular device and can work high performance even when treating exhaust gases with low CO_2 contents, 4-5% by volume. It also allows the retrofit on exiting vessels.

Taking advantage of this peculiarity, the exhausted gases of the ship's engines can be fed to the cathode side and the CO_2 present in the exhausted gases is thus transferred to the anode side. Here it can be easily separated through condensation and a simplified liquefaction from the other components (mainly steam and unreacted hydrogen).

Furthermore, the energy simultaneously produced by the MCFC stack can be used to reduce the load of ship's engines and consequently decreasing the emissions. However, process optimization is key to maximizing CO_2 capture efficiency and making it economically sustainable.

For this reason, in this study a new system scheme is proposed and simulated to maximize the global capture of CO_2 through the optimization of the recirculation of the process streams.

Audience Take Away Notes

- How MCFCs can capture CO_2
- Potential solution for CO_2 emissions in maritime sector
- Plant optimization for carbon capture

Biography

Dr. Bove studied Chemical Engineering at the University of Genoa (UNIGE), Italy and graduated as MS in 20123. He then joined the research group of Prof. Arato and Prof. Bosio at the University of Genoa, Italy. He received his PhD degree in 2017 at the Free University of Bozen-Bolzano. After three years research fellowship on electrochemical cells, he obtained the position of Fixed-term Researcher at the UNIGE provided by National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 505 27 506 Investment 1.3—Call for tender No. 1561 of 11.10.2022 of Ministero dell'Universita e della Ricerca (MUR), within which project this work was carried out.

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Halogen-enhanced metal-organic frameworks: Selective CO_2 capture and sustainable chemical fixation

Three novel halogen-appended cadmium(II) metal-organic frameworks (MOFs) denoted as $[Cd_2(L1)_2(4,4'\text{-Bipy})_2]_n.4n(DMF)$ (1), $[Cd_2(L2)_2(4,4'\text{-Bipy})_2]_n.3n(DMF)$ (2), and $[Cd(L3)(4,4'\text{-Bipy})]_n.2n(DMF)$ (3), were synthesized through solvothermal reactions The new MOFs are constructed using new multifunctional halogen-based dicarboxylic acid pro-ligands, namely 5-{(4-bromobenzyl)amino}isophthalic acid (H_2L1), 5-{(4-chlorobenzyl)amino}isophthalic acid (H_2L2), and 5-{(4-fluorobenzyl)amino}isophthalic acid (H_2L3), alongside $Cd(NO_3)_2{\cdot}4H_2O$. Crystal structure analyses reveal that these MOFs share a similar three-dimensional architecture, with 1 and 2 exhibiting enhanced thermal and chemical stability compared to 3.

The MOFs, featuring diverse functional groups such as halogen, carboxylate, and amine, present themselves as promising candidates for applications in gas storage and separation. Gas adsorption analyses highlight their remarkable capability to selectively adsorb CO_2 over N_2 and CH_4 at different temperatures (273 and 298 K) and pressures (120-275 kPa). Specifically, MOF 2 displays the highest CO_2 adsorption capacity of approximately 2.58 mmol/g at 273K, accompanied by a BET surface area of 281 m2/g. Computational studies using configurational bias Monte Carlo simulations corroborate these findings, emphasizing the stronger interaction between our MOFs and CO_2 compared to N_2 and CH_4.

Beyond gas adsorption, these MOFs exhibit another facet of their versatility by serving as efficient Lewis acid-based heterogeneous catalysts for solvent-free CO_2 fixation reactions with epoxides. In the presence of Tetrabutyl Ammonium Bromide (TBAB), the MOFs facilitate the conversion of CO_2 into industrially valuable cyclic carbonates. Notably, the MOFs exhibit high conversion rates (96-99%) of epichlorohydrin to the corresponding cyclic carbonate after 12 hours of reaction time at 65 °C under 1 bar of CO_2 pressure. Size-selectivity of the MOFs towards smaller and larger substrates is demonstrated, and catalytic recycling experiments reveal that these MOFs can be reused for at least three cycles without a considerable loss of activity.

This work unveils halogen-enhanced Cd(II)-MOFs as multifaceted materials, showcasing exceptional selectivity in CO_2 capture and sustainable catalytic performance in chemical fixation reactions. The findings hold significant promise for addressing environmental challenges by offering efficient and reusable materials for selective carbon dioxide capture and conversion into industrially relevant cyclic carbonates.

Audience Takeaway Notes

- **Global Climate Change and Greenhouse Gas Emissions**: Understand the current environmental challenges posed by global climate change, emphasizing the role of greenhouse gases, particularly carbon dioxide (CO_2), and the need for effective mitigation strategies
- **Significance of CO_2 Capture Technologies:** Explore the importance of developing advanced CO_2 capture technologies in the context of rising atmospheric CO_2 concentrations, driven by industrial activities and fossil fuel combustion, and the limitations of existing methods. synthesized MOFs
- **Versatility of Metal-Organic Frameworks (MOFs):** Gain insights into the diverse applications of MOFs, including their large surface area, permanent porosity, high thermal and chemical stability, and tunable functionality, positioning them as promising materials in various scientific and industrial fields
- **Challenges in Catalyzing CO_2 Fixation:** Recognize the challenges associated with catalyzing the chemical fixation of CO_2, especially in the context of developing suitable catalysts that exhibit high efficiency under mild conditions, addressing issues related to energy consumption and reaction pressure

Biography

Elisabete C.B.A. Alegria received her PhD in Chemistry in 2006 (IST, University of Lisbon, Portugal). Researcher at Centro de Química Estrutural (Coordination Chemistry and Catalysis) and Professor in Instituto Superior de Engenharia de Lisboa (ISEL, Portugal). She has authored 90 papers in international peer review journals, 4 patents and 8 book chapters. Editorial board member, Guest Editor and Reviewer in several scientific journals. Her main research interests' range over Coordination and Sustainable Chemistry, Homogeneous and Supported Catalysis, Stimuli-Responsive Catalytic Systems, Green Synthesis of Metallic Nanoparticles for Catalytic and Biomedical Applications. Mechanochemistry (synthesis and catalysis) and Molecular Electrochemistry.

Elsa Justino, Ph.D*, Helena Belchior Rocha

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Converging paths: Green chemistry and human rights advocacy

This presentation explores the interconnected discourses of green chemistry and human rights advocacy, highlighting their shared objectives and synergistic potential. Green chemistry, as a discipline, emphasizes the design of chemical products and processes that reduce or eliminate hazardous substances, minimize waste, and conserve resources, thereby promoting environmental sustainability. Conversely, human rights advocacy focuses on protecting and promoting the inherent dignity and rights of all individuals, encompassing principles of equity, justice, and access to essential resources.

The relation between green chemistry and human rights advocacy arises from their mutual pursuit of a healthier, safer, and more equitable world. Green chemistry principles inherently align with human rights imperatives by safeguarding environmental quality, enhancing public health, and fostering social justice. For instance, the development and adoption of green chemistry practices contribute to mitigating pollution-related health risks, particularly in marginalized communities disproportionately burdened by environmental hazards.

Also, green chemistry initiatives can serve as catalysts for advancing human rights objectives, particularly in areas such as access to clean water, air, and food, which are fundamental to realizing the right to a healthy environment and the right to life. By promoting the development and dissemination of eco-friendly technologies and sustainable production methods, green chemistry initiatives can contribute to addressing environmental injustices and promoting equitable access to resources essential for human well-being.

Therefore, human rights frameworks offer valuable insights and normative guidance for shaping the ethical dimensions of green chemistry practices. Embracing human rights principles within green chemistry endeavours ensures that environmental sustainability efforts are equitable, inclusive, and respectful of human dignity. Additionally, human rights discourse provides a compelling moral imperative for prioritizing sustainability and environmental stewardship in chemical innovation and industry practices, which means that the intersection of green chemistry and human rights advocacy offers a fertile ground for interdisciplinary collaboration and collective action towards a more sustainable and rights-respecting future, achieving environmental justice, social equity, and human well-being on a global scale.

Audience Take Away Notes

- The audience will gain a comprehensive understanding of the interconnectedness between green chemistry and human rights advocacy, enabling them to identify opportunities for synergistic collaboration and interdisciplinary approaches in their respective fields
- This knowledge will empower professionals to integrate ethical considerations and human rights principles into their work, promoting sustainable practices, equitable outcomes, and social justice in their roles
- Yes, this research provides a valuable foundation for other faculty members to expand their research or teaching in fields such as environmental science, chemistry, human rights law, and social justice

studies. It offers a nuanced perspective on the intersection of environmental sustainability and human rights, fostering interdisciplinary dialogue and cross-disciplinary research endeavors

- By considering the principles and insights presented in this research, designers and practitioners can develop more ethical and sustainable solutions that prioritize human well-being, environmental stewardship, and social equity
- It offers practical guidelines and frameworks for integrating human rights considerations into design processes, facilitating the creation of solutions that address pressing societal challenges while respecting the dignity and rights of all individuals

Biography

Elsa Justino, holds a Ph.D in Social Work, with a Master's degree and a degree in the same area. She's an assistant professor at the Department of Political Science and Public Policies at the University Institute of Lisbon (ISCTE-IUL) and an integrated research member at the Centre for Research and Studies in Sociology (CIES/Iscte - IUL). From 2019 to 2022, she was on the Board of the Hospital Center in the Portuguese region of Tras-os-Montes e Alto Douro (CHTMAD). From 2016 to 2022, she was an Invited Professor at the University of Tras-os-Montes e Alto Douro (UTAD). Among other leading positions, she was a University Administrator at the UTAD and Manager of the University Social Services (2008-2019), Head of Office of the Secretary of State for Employment and Vocational Training (2006-2008), Deputy Director of the Directorate General for Higher Education from 2002 to 2006 (Ministry of Science Technology and Higher Education) and Vice-President of the Student Support Fund (Ministry of Education) from 1998 to 2002.

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Effectiveness of biopolymer adsorbent treatment method for small-medium winery industry in South Africa

The South African winery industry generates large amounts of contaminated wastewater with significantly high organic and inorganic substance concentrations. Winery wastewater treatment research has shown that there are several potential researchers that have limited awareness of biopolymer adsorbents and their relevance. This study aims to understand potential purchasers' specific expectations as they progress along the awareness scale. Also, to promote our new treatment method, biopolymer adsorbent, qualitative and quantitative research was conducted regularly. The promotion treatment research was two-phased. First, a qualitative phase entailed document searchers. The second phase entailed a semi-structured interview, focused on open- ended questionnaires on the knowledge and significance of biopolymer adsorbent technology/any winery treatment technology. Data was compiled from 6 respondents (1 winery and 5 technology treatment experts from the Department of Agriculture). Thematic analysis was used to analyze the data. Three themes emerged in marketing our new technology product solution, biopolymer adsorbent.

The proposed treatment method for adopting biopolymer adsorbent technology is further supported by insights from users and experts in the treatment field. Feedback from potential purchasers and technology experts highlighted the superior features of biopolymer adsorbents, including their renewable nature, high adsorption capacity, and environmental friendliness. Despite initial scepticism and concerns, stakeholders expressed interest and openness to the potential benefits of biopolymer adsorbent technology, underscoring the importance of continued education and awareness initiatives to promote its adoption.

The novel biopolymer adsorbent method offers a sustainable and environmentally friendly alternative to conventional wastewater treatment methods, addressing the crucial challenges faced by the South African wine industry. Unlike physicochemical treatment methods, which often involve complex chemical processes and high energy consumption, biopolymer adsorbents derived from renewable sources such as chitosan and cellulose present an inherently biodegradable solution, reducing reliance on non-renewable resources. Adopting the Biopolymer Adsorbent technology method represents a promising approach to addressing wastewater treatment challenges in the South African wine industry, offering a viable, environmentally sustainable, and economically feasible solution. By building on its unique advantages, addressing existing barriers, and fostering stakeholder engagement, biopolymer adsorbents have the potential to revolutionize wastewater treatment practices, promote sustainability, and support the long-term growth and prosperity of the industry.

Keywords: Small-Medium Winery, Wastewater Treatment Technology, Biopolymer Adsorbent, Mix Method.

Biography

Dr. Ernestine Atangana obtained his BSc and Honors (Chemistry) from the University of the Free State, Bloemfontein, and PhD (Environmental Science) from the Central University of Technology, Free State. She has presented and participated in international and local conferences within Africa and South Africa. She has previously worked at the Central University of Technology Free State. Her PhD research was based on water remediation using natural agricultural waste. She is a researcher at the Center for Environmental Management, University of the Free State. She has worked on several national projects based on waste management. Her area of interest is ecotoxicology, Waste Management. She has been a reviewer of more than many internationally accredited journals. She has published more than 20 articles in accredited journals related to science and the Environment.

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Walnut shell, an essential agricultural-horticultural byproduct, serves as an effective bio-absorbent for heavy metals in water

Walnut shells, an essential agricultural-horticultural byproduct, effectively absorb heavy metals from water, which is crucial for public health due to the toxicity of these metals. Given their unique properties, walnut shells offer an environmentally friendly solution for metal removal. Industrial and agricultural activities have widely dispersed heavy metals, contaminating the environment and the human food chain. Bio-absorbents provide a cost-effective method for extracting these metals. This study explored the potential of walnut shells to adsorb heavy metals from polluted water. Walnut shells were collected in autumn 2023 from fars province in Iran, and the concentrations of various heavy metals were analyzed using ICP-MASS. The shells were examined for their adsorption capacity in a batch system, considering factors such as contact time, absorbent quantity, and particle size. The study found that increasing the dose of walnut shells and extending contact time significantly enhanced heavy metal adsorption. Walnut shells demonstrated a high capacity for accumulating heavy metals, effectively reducing water contamination.

Audience Take Away Notes

- **Walnut Shells are Effective Bio Absorbents for Heavy Metals:** The audience will learn about walnut shells' unique properties, which make them suitable for removing heavy metals from water
- **Environmental and Health Benefits:** The presentation will highlight the importance of removing heavy metals from water to protect public health and the environment
- **Practical application of walnut shells:** Insights into how walnut shells can be collected, and used for water purification.
- **Economic and Ecological Advantages:** The cost-effectiveness and environmental friendliness of using walnut shells compared to other methods of heavy metal removal
- **Detailed Experimental Results:** The study's findings, including the impact of different variables like contact time, absorbent quantity, and particle size on adsorption efficiency, are included
- **Implementation in Water Treatment:** Professionals in environmental science and water treatment can apply the findings to develop or improve methods for purifying water using walnut shells
- **Research and Development:** Academics and researchers can build on this study to further explore the use of agricultural byproducts in pollution control
- **Enhanced Water Treatment Practices:** Environmental engineers and scientists can incorporate walnut shells into water treatment systems to improve the removal of heavy metals.
- **Cost Reduction:** By using a readily available agricultural byproduct, organizations can reduce the costs associated with heavy metal removal
- **Sustainable Practices:** The use of walnut shells aligns with sustainable practices, helping professionals meet environmental regulations and standards

- Yes, this research provides a solid foundation for further studies on bio-absorbents and can be incorporated into teaching materials to educate students about innovative and sustainable environmental solutions
- Yes, this research offers a practical solution for designing efficient, low-cost water purification systems that utilize natural materials, simplifying the design process and enhancing system sustainability
- Yes, the detailed analysis of factors like contact time and absorbent quantity provides valuable data that can improve the accuracy and efficiency of water treatment system designs
- Some of the other benefits
    - **Environmental Impact:** Reduces reliance on chemical treatments, lowering environmental pollution
    - **Resource Utilization:** Promotes the use of agricultural waste, adding value to otherwise discarded materials
    - **Public Health:** Contributes to safer drinking water, reducing health risks associated with heavy metal contamination
    - **Community Engagement:** Encourages local communities to participate in sustainable practices by utilizing locally sourced walnut shells

Biography

Dr. Fatemeh studied Agricultural Engineering - Food Science and Industry at Islamic Azad University Pharmaceutical Branch at the Islamic Azad University, Iran, and graduated with an MS in 2014. She then joined the research group in the Islamic Azad University Pharmaceutical Branch. She received her PhD degree in 2021 in Food industrial engineering and science - Food Chemistry" at Islamic Azad University Sciences and Research. She has done research on agricultural products, edible oils, and extracts. She obtained the position of Lecturer at the Islamic Azad University, Sciences and Research. She has joined more than 50 national and international conferences. She has published more than 10 research articles in SCI(E) journals.

Hisham S Bamufleh

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Investigation of physical properties and carbon dioxide solubility in tetramethylammonium bromide and tetraethylammonium bromide ionic liquids solutions using multi-non-linear regression analysis

Carbon dioxide is a major greenhouse gas that is responsible for global warming and renders harmful effects on the atmosphere. The unconstrained release of CO_2 into the atmosphere should be prevented and various techniques have been developed in this regard to capture CO_2 using different solvents and other compounds. Ionic liquids are a suitable candidate to capture CO_2 due to their better solubility behaviour. In this work, two ionic liquids namely Tetramethylammonium Bromide (TMAB) and Tetraethylammonium Bromide (TEAB) are employed experimentally to capture CO_2 and investigate their solubility behaviour. The study is performed at the temperature values of 303 K, 313 K, and 323 K and the pressure values of 5, 10, 15, and 20 bar equivalent to 0.5, 1.0, 1.5, and 2.0 MPa respectively. The concentrations of both ionic liquid solutions are 2.5 wt%, 5.0 wt%, and 10.0 wt%. The solubility results are considered in terms of mol fraction which is the ratio of moles of CO_2 captured per moles of ionic liquid. The density and viscosity values are also determined for both compounds at respective conditions. COSMO-RS is used to generate the sigma profile, sigma surface, and Henry's constant of the ions involved in the study. CO_2 is found to be soluble in both ionic liquids, but TEAB showed better solubility. Outliers' analysis is performed using the boxplot method to determine the suitability of ranges of the selected input parameters. The preceding literature does not predict the activity coefficient in relatively lower to higher temperature and pressure ranges for CO_2 solubility in ionic liquids. Initially, the activity coefficient values from COSMO-RS were obtained and compared with the correlation results. The COSMO-RS and the correlation predicted results were subsequently validated with the experimental data. The Average Absolute Error (AAE%) of the predicted correlation values is 19.53% while the Root Mean Square Error (RMSE) value is 0.465. The correlation can be used in the future to predict the CO_2 activity coefficient values in ionic liquids to facilitate qualitative analyses of their CO_2 capture efficiency.

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Mo complexes derived from simple acyl-hydrazones as green catalysts in oxidation reactionsn

Synthesis is a key step in creating materials, leading to the formation of single crystals, polycrystalline powders, or thin films. Various methods are used to synthesize transition metal coordination compounds. The traditional method involves dissolving metal precursors and Schiff base ligands in solvents like methanol or ethanol, often applying heat. This process can result in the desired product precipitating or remaining in solution, later isolated by evaporation. An alternative, solvothermal synthesis, takes place in an autoclave under high pressure and temperature, favouring the production of high-quality single crystals by cooling the mixture gradually. Compared to these liquid-based methods, solid-state synthesis offers a greener alternative by reducing or eliminating solvent use, relying on mechanical techniques like grinding or ball-milling.

After preparing materials, identifying applications is crucial. The catalytic potential of aroyl-hydrazonato molybdenum complexes was previously explored in cyclooctene epoxidation with tert-butyl hydroperoxide, as a green oxidizing agent and without the addition of organic solvents to the reaction media. The research presented herein introduces the novel use of Mo compounds, with MoO_2^{2+} cores and acyl-hydrazone ligands, as catalysts, following the green-chemistry principles, highlighting the innovative examination of ligand role in such reactions. Despite the scarcity of studies on transition metal complexes with acyl-hydrazones, due to potential steric hindrance, examination of CCDC database points out the complexity of these compounds. The study also ventured into linalool epoxidation, leveraging a common and renewable resource whose derivatives are valuable in flavours, fragrances, and perfumes, expanding the catalytic research scope.

Audience Take Away Notes

- The presented research considers molecular catalysts applied for alcohol oxidations following the principles of green chemistry
- The presented research will enrich the academic audience and will create possible discussions as a step towards collaboration
- The research presented follows the principles of green chemistry and provides catalytic systems with good activity and selectivity parameters

Biography

J. Pisk got a Ph.D. in Chemistry in 2012. In 2010 she spent one year at LCC Toulouse and IUT P. Sabatier Toulouse III, France, where she learned the basics of catalysis. She was Marie Curie Cofund's fellow and did postdoctoral research at the LCC, Toulouse (Project “Diligent search for chemical bio-sources: Solvent-free homogeneous and heterogeneous oxidation processes catalyzed by polyoxometalates”). She was an Assistant Professor at the Faculty of Science, Zagreb, in 2018, and from 2023 she is an Associate Professor. Her major interest is the coordination chemistry of molybdenum and vanadium and the investigation of catalytic properties of the obtained materials.

Jana Pisk[1], Ph.D*, Edi Topic[1], Dominique Agustin[2,3], Mirta Rubcic[1], Visnja Vrdoljak[1]

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Catalytic potential of vanadium coordination compounds in oxidation reactions

In the context of global climate change, the diminishing availability of fossil fuels, and prevailing geopolitical tensions, Europe is actively seeking energy-efficient and resource-conservative strategies. This approach is being implemented across various sectors, including academia, with a particular focus on reducing reliance on organic solvents predominantly sourced from non-renewable fossil fuels. The imperative now is to develop methods for the synthesis of both inorganic and organic compounds that eschew the use of solvents entirely.

Molybdenum-based catalysts have gained recognition for their efficacy and selectivity in various oxidation reactions, including epoxidations. Building on this foundation, the research has expanded to explore vanadium coordination compounds as potential catalysts for oxidizing alcohols. Terpenic alcohols, for instance, have garnered interest as precursors for the manufacture of fine chemicals, fragrances, perfumes, and agrochemicals. Recent investigations have delved into the catalytic capabilities of both molybdenum and vanadium compounds in the oxidation of linalool, utilizing environmentally benign oxidants like tert-butyl hydroperoxide and minimizing catalyst use. These practices align with the principles of green chemistry, which advocates for the minimization of hazardous substance use and aims to reduce waste and energy consumption in chemical manufacturing processes.

This body of research underscores a commitment to advancing sustainable and innovative solutions within the field of chemistry. It emphasizes the critical role of green chemistry in adopting environmentally friendly practices and leveraging renewable resources to satisfy the demands of diverse industries.

Audience Take Away Notes

- The presented research considers molecular catalysts applied for alcohol oxidations following the principles of green chemistry
- The presented research will enrich the academic audience and will create possible discussions as a step towards collaboration
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Biography

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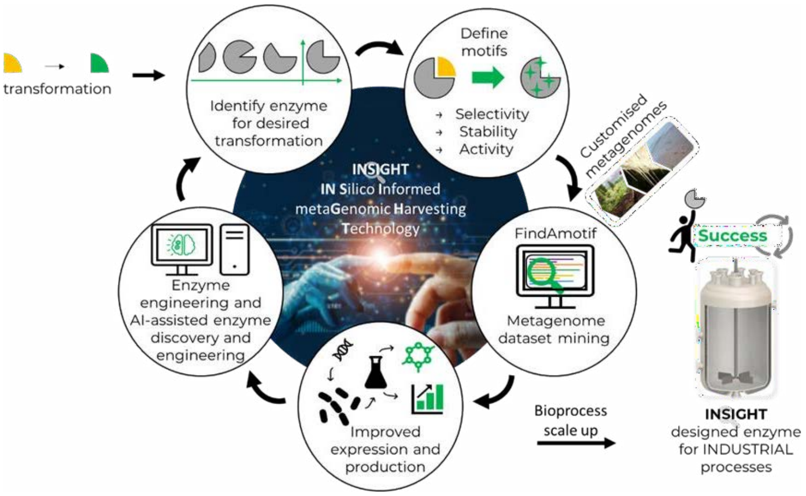
Jane Mueller

Almac Sciences, Craigavon, County Armagh, United Kingdom

In silico informed metagenomic harvesting technology-(INSIGHT) - how a smart platform can accelerate the timelines of genes-to-GMP

Biocatalysis is a key enabling technology towards more sustainable and efficient GMP manufacture of active pharmaceutical ingredients. The processes involved in traditional enzyme selection and screening can be resource heavy and limited to publicly available sequenced genomes. Almac's newly developed INSIGHT platform streamlines enzyme discovery, engineering and development by combining metagenomic and bioinformatic enzyme discovery, high throughput screening, in silico enzyme engineering and machine learning. INSIGHT enables Almac to accelerate the development of enzymes to the specific conditions of industrial processes (high substrate loadings and high catalytic efficiency) for the efficient synthesis of chemical intermediates and Active Pharmaceutical Ingredients (APIs). To accelerate development from "genes-to-GMP" Almac integrates enzyme gene library synthesis into INSIGHT's multi-level enzyme engineering platform which will shorten timelines and make enzyme engineering more affordable.



This presentation will showcase a number of selected examples of the benefits of INSIGHT. It will highlight the stages of INSIGHT from the discovery of novel bulky-bulky Carbonyl Reductases (CREDs) from Almac's very own metagenomes with superior properties and take the audience through the accelerated engineering of cosubstrate stability in Transaminases that enabled reaction completion. It will also show an example of expression enhancement for a monooxygenase that ensured economic viability of the investigated biotransformation.

Biography

Dr. Jane Mueller is Technical Leader within Almac's Biocatalysis group. After obtaining a degree in Chemistry Jane obtained her PhD in Biocatalysis in 2011 from Technical University Berlin. She is one of many international staff, enriching Almac's scientific community. Jane's career has focussed on enzyme engineering, production and screening. She has carried out projects, which went from initial screening hit to mg, g and kg scale. She joined Almac's Biocatalysis group in 2012 with expertise in Organic Chemistry as well as Analytics and Biotechnology.

Janus Louw*, Somayeh Farzad, Johann Gorgens
Department of Chemical Engineering, Stellenbosch University, Stellenbosch, South Africa

Techno-economic and life-cycle assessment of biobased plastic production

The production of biobased plastics has gained considerable interest in recent years as society moves toward a more biobased economy. The economic viability of bioplastics production is dependent on the implementation of effective bio- and chemical catalytic processing. Polyethylene (PE) and Polyethylene Terephthalate (PET) are two of the most widely used fossil-based plastics. The production of bio-PE has been commercialized, through the catalytic dehydration of biobased ethanol to ethylene. PET is produced through the polycondensation of Terephthalic Acid (TPA) and Monoethylene Glycol (MEG). Bio-based MEG has been commercialized using bioethanol as feedstock, but commercial production of bio-p-xylene (precursor to TPA) has not yet been realized. A proposed pathway towards p-xylene is through 5-Hydroxymethyl Furfural (HMF) as intermediate. HMF is produced through the acid-catalyzed dehydration of sugars, and can be catalytically converted to p-xylene in two steps. Alternatively, HMF can be oxidized to 2,5-Furandicarboxylic Acid (FDCA), a chemical analogue to TPA, which can be polymerized with MEG to produce Polyethylene Furanoate (PEF) to replace PET.

This study aimed to identify the most viable biorefinery scenario for production of bioplastic from molasses. Process simulations were developed in AspenPlus® for bioplastics and their monomers/intermediates, and Techno-Economic Analyses (TEAs) and Life-Cycle Assessments (LCAs) were performed based on simulated mass and energy balances. PEF was the most profitable bioplastic, requiring a Green Premium (GP) price that is 44.4 % higher than the current market selling price of fossil-PET, mainly due to the efficient production of FDCA, which had the second highest production rate (59.0 ktpa) and the lowest energy demand (heat: 20.7 MW, power: 3.74 MW) of all scenarios. Advantages of the FDCA process includes the use of a single solvent system for all reactions, ease of solvent and product recovery, and the use of unrecovered FDCA as the dehydration catalyst. The Platinum Catalyst (Pt/C) used for HMF oxidation was responsible for 43.1% and 25.7% of the equipment operating cost, respectively. FDCA (GP:17.3%) was more profitable than PEF, due to the high cost of MEG (GP: 79.1%) production, which involves four conversion steps. Compared to FDCA, MEG had a lower yield (47.7 ktpa), higher energy demand (heat: 34.1 MW; power: 7.1 MW) and higher capital investment ($145.2 MM vs $78.5 MM). Ethylene had the second lowest energy demand (heat: 26.6 MW; power: 3.64 MW), and benefited from a relatively inexpensive catalyst, compared to other monomers and intermediates. Ethylene had the lowest capital investment ($59.7 MM) and operating cost ($33.3 MM), but was not economically viable (GP:84.7%), due to a low mass yield (27.3 ktpa) associated with dehydration products. PE (GP of 56.1 %) was preferable to ethylene, due to its' higher market price and difficulties related to the transportation and storage of ethylene. PET required a GP of 128.1 %, due to the complex pathway of MEG, and especially p-xylene production from sugars, which involved many catalytic reactions and large volumes of organic solvents, resulting in extremely high energy demands and capital and operating costs. More work could be done to improve the catalytic activity and reaction selectivities, but other emerging technologies, which produce p-xylene and MEG from sugars in one or two steps, will likely be the key to cost-competitive bio-PET in the future. Life-cycle assessments were performed for each bioplastic, which determined that PE was the most environmentally sustainable, due to the minimal inventory requirement, compared to PET and PEF, which required large volumes of solvents, precious metals, and other raw materials.

Audience Take Away Notes

- Viable routes towards the production of bioplastics will be identified, with specific focus on chemical-catalytic processing
- The results of the study will show which biobased plastics and monomers/intermediates are the most profitable as annexed to a sugar mill and highlight any shortcomings/ bottlenecks towards their future commercialization
- The research will highlight areas of biobased, catalytic process technologies that require improvement/ further research
- The research is an early phase design/pre-feasibility study of bioplastic production, which can provide readers with direction towards the development of their own biorefinery designs

Biography

Janus Louw studied Chemical Engineering at Stellenbosch University and received his bachelor's degree in 2017. In 2019, She joined the sugarcane biorefinery research chair at Stellenbosch University as a Masters' student under Prof. Gorgens. Since then, She has successfully upgraded his dissertation to a PhD in 2021, which She will complete in 2023. Janus will continue working in the sugarcane biorefinery research chair as a postdoctoral fellow under Prof Gorgens after obtaining his doctorate.

Manasseh Sikazwe, Jeanne Louw*, Johann Gorgens
Department of Chemical Engineering, Stellenbosch University, Stellenbosch,
South Africa

Economic and environmental benefits of bioprocess improvements for the production of 2,3-butanediol and adipic acid in a sugarcane biorefinery

The production of bio-based chemicals in a biorefinery is a critical component for a sustainable bioeconomy, with reduced dependency on fossil fuel resources. Although, bio-based chemicals such as 2,3-Butanediol (2,3-BDO) and adipic acid are avid produced through microbial conversion of sugars, typically offer substantial environmental benefits compared to fossil-derived products, their application is limited by production costs, warranting further improvements to microbes and bioprocesses. The financial and environmental benefits that could be obtained from improvements to microbial strain and bioprocess development, within the theoretical limits of these sugar conversions, were assessed through a 32 Full-Factorial Design (FFD), considering the impacts of bioprocess yield and productivity on the product Minimum Selling Price (MSP) and life cycle Greenhouse Gas (GHG) emissions. The production scenarios for these bioproducts assumed production from A-molasses in a biorefinery annexed to an existing sugarcane mill, and were simulated in Aspen Plus®, providing mass and energy balances for subsequent financial and environmental assessments. Stochastic financial methods were incorporated to consider the effect of market price variations on the viability of the considered production processes. The work was able to demonstrate whether further improvements to microbial strains (through synthetic biology) and bioprocesses could achieve the desired financial viabilities and environmental benefits that these products are intended to deliver. These outcomes are critical to setting priorities for further technology development and policymaking, as some of the production processes were not able to deliver the intended goals, within the theoretical limits of microbial conversion processes.

Audience Take Away Notes

- Understanding the effect of product yield, product titre and volumetric productivity in the microbial conversion of sugars in a biorefinery on the economic performance (MPSP, OPEX and CAPEX) and Greenhouse Gas (GHG) emissions
- Use of full factorial design in optimization studies of process economics and environmental performance assessment and forecasting
- Identifying parameters around a bioprocess which are priorities for R&D for a more viable process

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Simultaneous removal of VOC and NOx from air in photo-catalytic process using a pilot-scale photo-reactor

The purification of air from nitrogen oxides (NO and NO_2 as NOx) and volatile organic compounds, VOCs, is a crucial environmental task due to the negative influence of these compounds on human health. The air purification can be realized in the photo-catalytic process. This contribution presents the experience of photo-catalytic air purification from VOC (i.e. acetone, toluene, propane and butane) and NOx using a continuous flow pilot-scale photo-reactor. The annular type reactor (diameter of 100 mm and 80 mm, length of 1120 mm, flow rate of 50-5000 L/h of air) was combined with a pilot-scale room with dimensions of 4 meters in length, 2 meters in width, and 2.5 meters in height. The experimental investigation results are discussed in terms of process parameters (i.e. compound type, concentration and light irradiation) and removal efficiency. The optimal NOx removal efficiency reached 100%, and the optimal acetone removal was approximately 85%. The optimal toluene removal rate approached nearly 100%, while propane, due to its stable structure, exhibited a removal of only 5-10%.

This research was investigated under the Polish-Taiwanese/Taiwanese-Polish Joint Research Project entitled “Photo-catalytic and temperature-assisted air purification from VOC and NOx using a pilot-scale photo-reactor” (Photo-PURE); grant number PL-TW/VIII/2/2021 and grant number MOST 110-2923-E-002-010-MY3. The authors gratefully acknowledge the Ministry of Science and Technology (Taiwan) and the National Centre for Research and Development (Poland).

Audience Take Away Notes

- This presentation concerns a pilot-scale photo-catalytic air purification. Thus, this research has a practical approach and can be beneficial in the design of photo-catalytic purification systems

Biography

Janusz Lasek studied Metallurgy at the Silesian University of Technology (SUT), Poland, graduated as MS in 2004 and received his PhD degree in 2009 at the same institution. After one year postdoctoral fellowship at National Taiwan University, Taiwan, he obtained the position of Adjunct at the Institute for Chemical Processing of Coal. He received his Habilitation (DSc.) degree in 2020 at the SUT, and obtained the position of an Associate Professor at the Institute of Energy and Fuel Processing Technology. He has published more than 40 research articles in SCI(E) journals. Field: photocatalytic NOx removal, thermal processing of solid fuels.

Chandra Mohan[1], Jenifer Robinson[2]*

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Sustainable chemistry in education

Sustainable Chemistry in Education includes project-based, production-based, and application-based approaches towards students to inculcate well-organized, actual, and environmental-friendlier non-toxic chemical synthesis, processes, and products. These three approaches help students to understand the prevention of pollution, elimination of risky wastes, and support human well-being, society, and the environment in a better way. This article will describe the real definition of sustainable chemistry, how is it related to green chemistry, its advantages, and disadvantages, the depletion of natural resources, its main sources, causes, and prevention methods through applied chemistry, the replacement of synthetic chemicals with natural resources, innovation tools and activities in green and sustainable chemistry, how to increase the rate of management and rate of remediation faster than the rate of waste generation and damages at the basic level, the inclusion of sustainable chemistry education at the curriculum and global levels and satisfying the requirements of current and future generations striking a balance in this challenging world. Sustainable chemistry will be one of the applied sciences in future educational studies that can address practical problems and challenges which will aid learners comprehend the impacts and benefits of sustainability with the growing ecological threats and thereby, achieving a green economy. The paper presentation will also cover the success stories and case studies of sustainable chemical sciences in terms of raw materials, technical aspects, water consumption, energy consumption, packaging and distribution, waste disposal, strategies of 3Rs, safety management through education, research, and professional resources. Sustainable Chemistry in education will seal the gaps to promote sustainability from schools to universities globally and through content and examples. Developing fundamental learning objectives, pedagogies, and assessments, disseminating best practices, integrating other basic subjects such as economics, law, etc., scaling up the education levels of teachers and lecturers, enhancing and establishing new and innovative strategies, understanding and implementing local government law and policies, will foster the best learning outcomes among the learners in all spheres.

Audience Take Away Notes

- My audiences are learners, teachers, lecturers, environmentalists, chemical industrial entrepreneurs, chemical engineers, and any other related fields. They will be able to use their knowledge and understanding gained through the presentation, in the development of new innovative chemical products and processes, a deep understanding of waste management, and the elimination of toxic substances and save the environment. The audiences can apply their understanding in various research fields related to chemical technology, biotechnology, and nanotechnology. This presentation will expand the research and teaching aptitude of the audiences. The success stories and case studies of the presentation will help learners to improve their design thinking, development methods, and innovative approaches towards the sustainability of the planet Earth

Biography

Mrs. Jenifer Robinson, M.Sc. (Chemistry), M.Sc. (Applied Psychology), M.Phil.(Chemistry), (Ph.D.) - Research Scholar in Chemistry, is the Head of the Department of Science and French in Indian School Al Wadi Al Kabir, Sultanate of Oman. She has 27 years of experience in the Teaching profession and in Research. She is currently pursuing her Ph.D. in Chemistry, SBAS, KR Mangalam, Gurugram, Haryana, India. She has successfully completed many Chemistry related seminars, workshops, and projects and has presented research papers, authored book chapters, and Chemistry smart drawings of chemical structures. She has been awarded the prestigious CBSE Best Teacher Award in 2022.

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The effect of additives (Sea Salt & Na_2CO_3) on hydrothermal liquefaction of biomass for biocrude production and intelligent prediction

Hydrothermal Liquefaction (HTL) utilizes subcritical/supercritical water as a reaction medium to convert biomass into biocrude, presenting a promising avenue for mitigating greenhouse gas emissions. However, prevailing research predominantly employs freshwater as the reaction medium, posing a significant challenge in terms of resource availability. We investigated the potential of seawater as an alternative medium for HTL, with a particular focus on elucidating the mechanistic role of sea salt in the HTL process of biomass. The primary component of sea salt, Sodium Chloride (NaCl), is examined in detail to evaluate the influence of sea salt in relation to NaCl. While sodium carbonate (Na_2CO_3) is commonly used as a catalyst in real biomass hydrothermal liquefaction, its impact on individual biomass components is not well-explored. Therefore, study delves into the role of Na_2CO_3 in HTL of biomass model components under varying conditions. Four types of biomass components—carbohydrate, lignin, protein, and lipid—are subjected to HTL under different concentrations of additives and temperature conditions. Subsequently, machine learning algorithms are employed to create a highly accurate predictive tool.

The findings reveal that in the HTL of lignin and protein, sea salt demonstrates a promotional effect, augmenting biocrude formation. Compared with NaCl, it is observed that these minor constituents in sea salt have minimal effects on lignin HTL but contribute to increased biocrude yields in carbohydrate HTL compared to NaCl. Compared with freshwater Na_2CO_3 at 5wt.% enhances carbohydrate degradation into biocrude and Aqueous-Gaseous products (AG), aligning with previous findings on carbohydrate-rich feedstocks. Although Na_2CO_3 has a marginal effect on lignin HTL, it negatively influences lipid HTL. At 5wt.% and 13.5wt.% Na_2CO_3 concentrations, the biocrude yield decreases from 95.6% to less than 10%, simultaneously increasing the AG yield to approximately 90%. This is attributed to the interaction of lipid decomposition intermediates (fatty acids) with sodium cations, resulting in water-soluble soap. For protein HTL, a low Na_2CO_3 concentration (5wt.%) has no significant impact on product formation, but excessive Na_2CO_3 (27wt.%) converts a substantial portion of biocrude into AG. We employed machine learning algorithms, leading to a highly accurate predictive tool with an R_2 value exceeding 0.94, surpassing conventional mathematical methods. This software tool facilitates rapid estimation of additive-involved HTL biocrude yield and offers recommendations for additive type, loading, and optimal HTL conditions based on the feedstock.

In summary, this research provides fundamental insights into the role of additives in the HTL product formation pathway, presenting an intelligent and precise prediction model for HTL biocrude yield. These advancements contribute to the development of more efficient and sustainable bioenergy production processes.

Audience Take Away Notes

- HTL converts biomass to biocrude for emissions reduction
- Seawater, NaCl's role in biomass conversion explored
- Na_2CO_3 impact on individual biomass studied
- NaCl enhances biocrude in lignin and protein HTL
- Machine learning algorithms predict additive-involved HTL biocrude yield

Biography

Dr. Yang joined the research group of Prof. Quan (Sophia) He studied Agriculture at Dalhousie University, Canada, and graduated as MS in 2016. He received his PhD degree in chemical engineering, in 2019, at the same institution. After one year of instructor fellowship at Dalhousie University, Canada he obtained the position of Associate Professor at the Minjiang University, China, adjunct at Dalhousie University, Canada. He leads the Sustainable Utilization of Marine Green Resources Lab and has published over 30 research articles in SCI(E) journals. His research interests lie in Green and sustainable biorefinery, biofuels productions, hydrothermal liquefaction, biochemicals/materials.

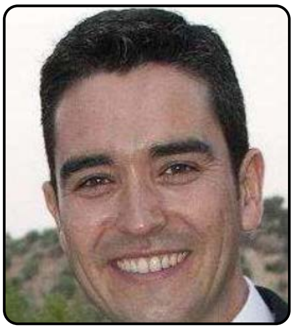
Jinsong Wu
Guilin University of Electronic Technology, China

Environmental sustainability and intelligence as well as general green technologies

Although the term of green has been often used to refer to energy consumption reduction or energy efficiency by many people and literatures, green actually should refer to environmental sustainability in more general senses. Environmental sustainability issues have been important topics for recent years, which has impacted and will further impact individuals, enterprises, governments, and societies. Environmental sustainability is not simply regarding reducing the amount of waste or using less energy, but relevant to developing processes leading to completely sustainable human society in the future. The long term consequences of the relevant serious issues have not yet been fully forecasted, but it has been generally accepted in many communities that immediate responses are necessary. From 30 November to 12 December 2015, the 21th United Nations Climate Change Conferences of the Parties (COP 21) was held in Paris, France, as the a historical breakthrough and milestone towards securing the future Earth, a global agreement on the reduction of climate change, the text of which represented a consensus of the representatives of more than 193 countries attending it, which was a profound milestone for global environmental sustainability. Nowadays there is another significant tendency on data driven intelligence. This talk would discuss the history, technical issues, challenges, and new trends of data driven environmental sustainability and Intelligence. Further this talk will extend the view to general green technologies.

Biography

Jinsong Wu won 2020 IEEE Green Communications and Computing Technical Committee Distinguished Technical Achievement Recognition Award, for his outstanding technical leadership and achievement in green wireless communications and networking. He is as Vice-Chair Technical Activities (2017-present), IEEE Environmental Engineering Initiative. He was Founding Chair (2011-2017) of IEEE Technical Committee on Green Communications and Computing (TCGCC). He is also Founding Vice-Chair (2015-present) of IEEE Technical Committee on Big Data (TCBD). He received 2017, 2019, and 2021 IEEE System Journal Best Paper Awards. He was the leading Editor and co-author of book "Green Communications: Theoretical Fundamentals, Algorithms, and Applications".



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Towards improving urban waste management: Characterization and evaluation of odorous impact

One of the challenges that modern societies are facing nowadays is the development of strategies and tools for efficient urban waste management. In fact, the improvement of the valorization of urban waste is essential to promote circular economy and the implementation of the smart cities concept. In that context, an ambitious research study has been carried out in collaboration with the Municipal Sanitation Company of Cordoba (Spain) (SADECO, S.A.) and within the frame of the national R+D+i project PID2020-117438RB- I00 (MICINN). The investigation focuses on establishing the bases for efficient management strategies of urban solid waste, with the aim of valorizing and promoting the recirculation of the main nutrients, in parallel to reducing the odorous impact.

The composition of 228 samples of urban solid waste withdrawn from containers for organic matter and packaging/inert materials (inorganic) in the city of Córdoba (South Spain; > 325,000 inhabitants) was analyzed. The evaluation was carried out through waste typology classification, physical-chemical characterization and dynamic olfactometry. Samples were collected throughout a 2-year period (at different seasons) and in the different districts of the city.

The main results obtained show that the selective separation of urban solid waste by the inhabitants is not optimal, since 54% and 28% of the substrates are incorrectly deposited in the containers for inorganic and organic matter, respectively. Furthermore, no significant statistical differences have been detected among districts, neither in the typology of waste nor in their physical-chemical characterization (except for pH and total Kjeldahl nitrogen in samples withdrawn from inorganic containers). On the other hand, the evaluation of the emission of odors from waste through dynamic olfactometry shows a more marked impact derived from the organic fraction. The odorous impact has been related with higher concentrations of volatile solids, nitrogen and total soluble organic carbon in waste.

These preliminary results highlight the need to promote citizen awareness on the importance of segregating waste in origin and its proper disposal to improve recycling and valorization of the different fractions of urban solid waste. Additionally, in order to mitigate the social impact derived from waste odorous emissions, an intelligent sensorized prototype is also being developed for early detection and management of odors along the chain links of waste collection (by minimizing the residence time in urban containers) and treatment.

Audience Take Away Notes

- The study will allow the audience to become aware of the importance of correct segregation and management of urban solid waste as one of the main residual substrates generated worldwide, as well as the need to develop efficient tools for quantifying and minimizing the odorous impact
- Job niches related to waste management are increasingly abundant and knowledge on the composition of different residual fractions and the odorous impact is essential for their correct management in different contexts, both at urban and industrial levels

- Definitely. It is an environmental, social and economic problem directly related to the achievement of sustainable development goals. Consequently, a wide range of ambitious research lines can be carried out on the topic
- Absolutely, due to urban and industrial waste managers frequently demand the research and development of solutions for the evaluation and minimization of odors derived from waste management
- Yes, understanding the characterization of waste, including its composition and the odoriferous emissions it generates, is essential for developing effective strategies to reduce the environmental impact of waste management
- Specially remarkable is the improvement of the quality of life of citizens and the promotion of sustainability within the frame of circular economy

Biography

Dr. Siles studied Environmental Sciences at the University of Cordoba (UCO), Spain and graduated as MS in 2005. He then joined the research group RNM-271 at the Department of Chemical Engineering (UCO). He received his PhD degree in 2010 at the same institution and was awarded the Extraordinary Doctoral Award. After 1.5 year of research stays at Oxford (UK), Southampton (UK) and Rey Juan Carlos (Spain) Universities, he obtained the position of a Substitute Professor at UCO and promoted to its current position as Senior Lecturer of Chemical Engineering. He has published more than 80 research articles in SCI(E) journals.

Kaoutar Kaddouri*, Mustapha Missbah El Idrissi

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Different solubilizing phosphate bradyrhizobium SPP. from symbiovar genistearum nodulate the endemic retama dasycarpa in the Maamora forest, Morocco

The Maamora is the largest cork oak forest in the Southern Mediterranean area and serves important social, economic, and environmental purposes. However, it faces significant edaphoclimatic and anthropic pressures, leading to erosion, desertification, and regression. To counteract forest degradation, several types of plants are being replanted or newly introduced to overcome the lack of tree and vegetation cover. Some shrubby legumes represent an appropriate alternative to reduce forest degradation, and an ecologically sustainable strategy that respects the environment, protects against desertification, and improves soil quality and fertility. Retama species are generally used to fight desertification thanks to their aptitude to elicit symbiotic nitrogen-fixing associations with soil bacteria called rhizobia. Our work focuses on the ability of R. dasycarpa to form nitrogen-fixing symbioses with compatible rhizobia in the soils of Maamora forest, and the assessment of their biodiversity.

Out of 73 isolates from root nodules of R. dasycarpa, 20 strains were selected for molecular and phenotypic analyses based on their REP-PCR fingerprinting. The analysis of the 16S rRNA and nodC gene sequences revealed that all isolated strains are members of the genus Bradyrhizobium symbiovars genistearum. Multilocus Sequence Analysis (MLSA) of five housekeeping genes (glnII, gyrB, recA, atpD and dnaK) showed that the strains are closely related to B. lupini, B. canariense, B. cytisi, and B. rifense. The strains metabolize a wide variety of carbohydrates and amino acids as sole sources of carbon and nitrogen. Additionally, they exhibited the plant growth-promoting activities of phosphate solubilization and auxin production.

This work shows that although endemic to the High Atlas Mountains, R. dasycapa could be nodulated by different species of Bradyrhizobium in the Region of Rabat.

Keywords: Retama Dasycarpa, Nodulation, Genistearum, Bradyrhizobium, Plant-Growth Promoting Activities, Maamora Forest.

Lorena Salazar Gamez[1]*, Mario Luna delRisco[2], Diana Sofia Rosales Delgado[3], Rober Yekson Melo Pazos[4], Sebastian Alexander Realpe Coral[4], Gloria Cardenas Calvachi[4]

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Natural Organic Matter (NOM), turbidity removal and biodegradability behavior by coagulant solution based on M. Oleifera in water treatment

Organic Matter (NOM) is a diverse group of soluble and insoluble constituents in water that influences the sensory and aesthetic quality of drinking water. The presence of NOM is associated with alterations in taste, odor, trans-parency, among others, and it presents a considerable challenge in water treatment processes due to its contribution to the origin of potentially harmful disinfection by-products.

There are different processes to reduce NOM in water treatment, some chemical and others biological, this article explores a new natural alternative for physico-chemical treatment, which are natural coagulants, especially the seeds of M.Oleifera, (M. Olefera) in the improvement of NOM, particularly focusing on its comparative performance against the standard Aluminum Sulphate (AS) in turbidity reduction, pathogen mitigation, and influence on the biodegradability of effluents. M. Oleifera is known for its turbidity removal efficacy, but its capabili-ties for NOM reduction, pathogen elimination, and enhancement of biodegradability are still under rigorous scrutiny.

Employing a comprehensive suite of physicochemical and microbiological tests, this investigation treated high-NOM river water samples using M. Oleifera and AS in a controlled jar test environment to evaluate their treatment efficacies. The results were meaningful, with M. Oleifera achieving an 81% turbidity reduction, slightly lower than AS's 97.9% efficiency. However, M. Oleifera's performance in reducing COD was modest at 1.6%, with AS showing no effect. BOD reduc-tions were 5% for M. Oleifera and a more significant 27% for AS. Pathogenic coliforms were reduced by 31% with M. Oleifera and by 35% with AS.

Interestingly, the study highlighted those effluents treated with M. Oleifera had a biodegradability index of 0.011, surpassing AS's 0.007, indicating a 63% im-provement in the potential for biological degradation. This underscores M. Oleif-era's predisposition to facilitate organic matter decomposition in effluents.

The research study confirms the ability of both coagulants in turbidity removal; however, it reveals their limitations in organic matter degradation, with AS being notably less effective. Therefore, neither coagulant is advisable for COD removal. Nevertheless, the study presents a notable retention of microorganisms by both coagulants, marking an important consideration for water treatment strategies.

Keywords: Natural Organic Matter (NOM), Biodegradability, Moringa Oleif-Era (M. Oleifera), Aluminum Sulphate (AS), Turbidity Reduction, Pathogen Reduc-Tion, Chemical Oxygen Demand (COD) Removal.

Audience Take Away Notes

- The audience will to know about the capacity of natural species like M. Oleifera, for water treatment, especially in reduce the natural organic matter (NOM), turbidity removal and biodegradability behavior by coagulant solution based on M.Oleifera. Them will to know about about the health risks and environmental impact of chemical coagulants like aluminum sulphate have prompted the search for sustainable alternatives. Natural coagulants, derived from plants and seeds, present a promising solution. Their cost-effectiveness, environmental friendliness, and operational efficiency make them suitable for water treatment in resource-limited settings in the vital task of reducing water turbidity. This process is crucial for ensuring the provision of clean, safe drinking water, a key factor in protecting public health and preserving ecological system integrity. This plant is widely know specially in tropical countries, present a viable and sustainable method for water treatment, particularly in rural communities

- This paper will show the possibility to probe to designers in others alternatives more organics, naturals, and explore in nature-based solutions for water treatment

Biography

An analytical Civil engineering, Ph.D Environmental Engineering, passion for project management, and strong background in water treatment, plumbing design, territorial ordering, climate change, disaster risk reduction, and research in civil and environmental topics" Experienced research engineer with an extensive background in engineering principles, project leadership, and effective application of research in public and technological companies. More than 8 years in project management positions and as specialist consultant for government, for nonprofit sector and for private sector in regions with socio environmental conflicts, in ordering and water projects. More of 10 years as associate professor – researcher, develop research in environmental projects. University professor with over 10 years of full-time teaching experience at various universities, both at the undergraduate and postgraduate levels (master's and specializations). Author of international and national articles, indexed in the ISI Web of Knowledge, and presenter at numerous national and international conferences.

Luis Eduardo Ramirez Cardenas[1], Ph.D*, Rachid Ouaret[2], Lea Schwersenz[3], Vincent Gerbaud[2], Markus Kohlstadt[3], Sophie Thiebaud Roux[1], Ivonne Rodriguez Donis[1]

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Screening of solvents for perovskite solar cells using reverse engineering approach

Perovskite Solar Cells (PSC) are a promising technology in the field of photovoltaics due to their high performance and simple fabrication methodology. Important achievements in device stability and power conversion efficiency have been obtained by inorganic-organic perovskites through the fine tuning of cation size and stoichiometry proportions. However, the dependency on highly toxic solvents that affects both human health and the environment needed to solubilize perovskite precursors still limits the upscaling of PSCs to larger solar modules. The search of alternative solvents relies primarily on trial-and-error approaches due to the lack of knowledge of both the precursor solubility mechanisms and the perovskite crystallization during film formation. In this work we propose a reverse engineering methodology based on COSMO-RS to find solvent substitutes for the triple cation lead Cs0.05FA0.85MA0.10PbI2.90Br0.10. Due to the complexity of the system in solution because of the formation of complexes between precursors and the solvents, predictive thermodynamic methods cannot be applied to calculate the solubility values. Therefore, the search has to be performed by comparing several molecular descriptors related to the solubility power of the solvent. The σ-potential obtained with COSMO-RS serves as a descriptor of the medium's response to a molecule. To compare the σ-potential curves for many molecules, Functional Principal Component Analysis (FPCA) is applied, reducing a curve to two dimensions. FPCA allows to compare our set of ~5000 molecules through their distance to the target solvent. Our screening using this methodology led to molecules which have been all reported in the literature, as well as new molecules never used for our system. Experimental results of solubility measurements are explained using other molecular descriptors, enabling a deeper understanding of the interactions between solvents and perovskite precursors during the solubility phase of PSC production.

Audience Take Away Notes

- Discover the practical problems surrounding the transition to the new solar cell materials
- Learn about the Reverse Engineering methodology and COSMO-RS through a research application
- New approach for the search of general solvents capable of solubilizing perovskite precursor solar cells

Biography

Luis Eduardo Ramirez Cardenas is a Ph.D student at the Laboratoire de Chimie-Agroindustriel (LCA) in the Institut National Polytechnique de Toulouse (INP-Toulouse) in France. He holds a physics engineer diploma from the UASLP (Mexico) and a master diploma in materials engineering from the University of Strasbourg (France). His current work focuses on the bio-conception of solvents for perovskites and organic semiconductors applied to solar cell technologies.

Maria Candeia Kuliakita Sakukuma[1,2]*, Mauricio Moraes Victor[1,3]

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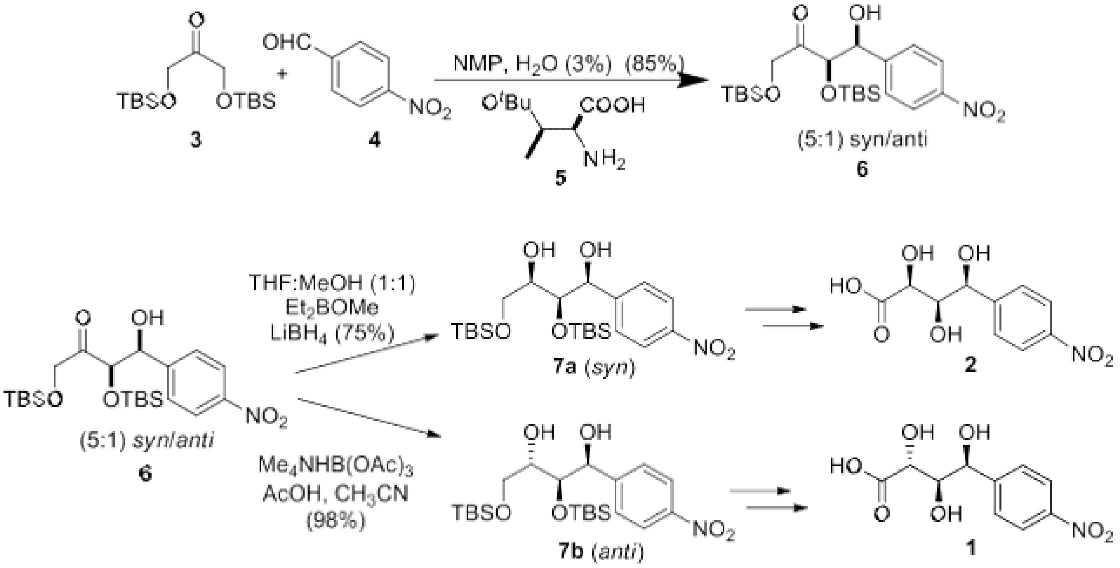
Use of organocatalysis for the synthesis of phenyl-hydroxylated-butyric acids

Organocatalytic reactions are becoming powerful tools in the construction of complex molecular skeletons. In 2021, Benjamim List and David MacMillan were awarded the Nobel Prize in Chemistry for the development of asymmetric organocatalysis. In this work we used the organocatalysis reaction as key step to get the 4-(p-nitro)-phenyl- hydroxylated-butyric acids. The acids 1 (2,3-anti-3,4-syn) and 2 (2,3-syn-3,4-syn) were synthesized from TBS- Dihydroxyacetone (TBS-DHA) 3 and p-nitrobenzaldehyde 4 using an organocatalyzed aldol reaction as the key step. The stereoselectivity of the syn-aldol coupling was suggested as resulting from a transition state including a low energy anti-Z enamine, derived from the condensation of TBS-DHA and O-tBu-L-threonine. Selective anti- and syn- carbonyl reduction of the carbonyl adducts led to 2,3-anti-3,4-syn and 2,3-syn-3,4-syn hydroxy compounds, respectively, which underwent the same sequence of transformations (ketal synthesis, primary TBS-deprotection, oxidation and deprotection) to afford 4-(p-nitro)-phenyl-hydroxylated-butyric acids 1 and 2 in seven steps and 22% and 24% overall yield, respectively.



Scheme 1: Use of organocatalysis for the synthesis of phenyl-hydroxylated-butyric acids.

Keywords: Total Synthesis, Organocatalysis, Aldol Reaction, Asymmetric Reaction.

Audience Take Away Notes

- The public will be able to learn the experimental part, which is one of the main challenges of this work
- With this investigation in a similar way we will be able to prepare new chemical compounds
- The methodology used allows its extension to the teaching component
- Organocatalysis has numerous advantages

Biography

Dr. Maria Candeia Kuliakita Sakukuma studied Chemistry at the Higher Institute of Education Sciences, Department of Exact Sciences, 230, Isced-Huila, Lubango, Angola and graduated. She then joined the research group of Prof. Mauricio Victor at Chemistry Institute, Federal University of Bahia, UFBA, in 2014, when received her MS and PhD degree in 2017 at the same institution. After one year postdoctoral fellowship supervised by Dr. Steve Davies working about in Synthetic Methodolgy with Lithium Amide Conjugate Addition and Total Synthesis at the University of Oxford, UK she obtained the position of an Auxiliar Professor where work actually.

Maria L Mota

CONAHCYT-Institute of Engineering and Technology, Autonomous University of Ciudad Juarez, Av. del Charro 610, Ciudad Juarez, CHIH 32310, Mexico

Non-enzymatic biosensor based on wasted photosensitive drugs

Due to the high purity of expired drugs, the present active sites on the structure of those can be used for specific health related applications in a sustainable way. The proposed presentation will show a novel study based on different expired drugs as non-enzymatic bioreceptor of glucose. Drugs were stabilized by sol-gel method as hydrogel bioreceptor and then, hydrogel was deposit on the semiconductor membrane as a transducer. After the structure fabrication, optical and electrical interactions due to dipole-dipole attractions between the structure and the analyte was measured. Sensitivity of the samples was able to generate interaction signal response. It was possible to observe a good affinity with receptor drug to offer cheap, sustainable, very promising and environmentally friendly technologies in support of health. The general objective is to obtain preliminary data to develop a non-enzymatic optical biosensor, to contribute to health while reusing expired drugs, and promotes an ecological pharmaceutical recycling and to offer a second time life.

Biography

Dra. Mota is currently a Professor in the Electrical and Computing Department at the institute of Engineering and Technology of the Autonomous University of Juarez City (UACJ) by commissioned of CONACYT for Investigators of Mexico program. Her research fields include the synthesis and study of chemical, mesomorphic, microstructural and opto-electrical properties of organic an inorganic materials development by soft chemistry to be applied in electronics devices as optical sensors, organic solar cells and OLEDS. Dra. is member of the National Research System in Mexico (SNI, due to its Spanish translation) and Member of the polymeric society of Mexico.

Lianhui Ding, Batool Altaher, Mohammad Bahhar*, Faisal Mulla, Guanghui Zhu, Robert Hodgkins

Catalyst Center of Excellence, Research and Development Center,
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Effect of mesoporosity and acidity on crude oil direct hydrocracking

In this study, various hydrocracking catalysts were synthesized using modified zeolite Y with different levels of mesoporosity and acidity to investigate their effects on crude oil hydroconversion. The zeolites and catalysts were characterized with N2-adsorption, XRD, and NH_3-TPD techniques. Their hydrocracking performance was evaluated using crude oil under commercial operating conditions in a pilot plant unit. The results indicate that catalysts featuring high acidity, strong acid sites, and increased mesoporisity enhance crude conversion and middle distillate yields. This improvement is primarily due to better accessibility to active sites and more efficient transport of bulky molecules in mesopores compared to micropores. Additionally, an optimized distribution of zeolitic acidity also contributes to the performance enhancement.

Audience Take Away Notes

- The main findings can help to develop heavy oil hydrocracking catalysts which is core technologies in petroleum refining and chemicals production
- The research can be taken as a good example that how mass transfer and acidity can affect the real chemical reactions, and how to balance the two factors

Biography

Dr. Mohammed Bahar joined Saudi Aramco, Research & Development Center in 2010. He received his PhD in Chemical Engineering from the University of Manchester, UK in 2018. He has been part of several applications and projects focused on hydrocarbon conversion, upgrading and refining. He has several years of experience in the field of zeolite synthesis, catalyst development, Characterization and testing. Dr. Mohammed focuses on hydroprocessing, hydrocracking and petrochemical catalyst and process development. His main interest is to synthesize, modify and tailor zeolite frameworks to improve yields and selectivity of refinery valuable products as well as sustainability applications.

Ofir Degani[1,2]*, Asaf Gordani[1,2]

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6-Pentyl-α-Pyrone, a strong antifungal compound, against the maize late wilt pathogen, magnaporthiopsis maydis

6-Pentyl-α-Pyrone (6-PP) is a powerful Magnaporthiopsis maydis antifungal compound, recently discovered when the potent growth medium of Trichoderma asperellum was analyzed. Its high potential in plate assay was approved here and inspected for plant treatment prevention. Late wilt disease, caused by the fungus M. maydis, threatens commercial maize production in high-risk areas. Thus, searching for control options against the pathogen is one of the top priorities in Israel, Egypt, and other countries. Disease-resistant maize genotypes can reduce the damage. Yet, aggressive variants of the fungus can overcome host resistance. The current study aimed to inspect T. asperellum and its secreted metabolite, pure 6-PP, against the pathogen in plants over a full growth period. First, adding T. asperellum directly to seeds with sowing provides significant protection to sprouts (up to 42 days) in a growth room, with more than two-fold growth promotion and reduced pathogen root infection (detected by real-time PCR). The same procedure applied in a commercial field was less beneficial in rescuing the plants' growth and yield. Still, it reduced the cobs' symptoms by 11%, resulting in nine-fold lower levels of the pathogen's DNA in the stem tissue. Second, the T. asperellum purified 6-PP compound (30 µg/seed) was used in seed coating and tested against the T. asperellum secretory metabolites' crude (diluted to 50%). At the season's end, these treatments improved plant biomass by 90–120% and cob weight by 60%. Moreover, the treatments significantly ($p < 0.05$) reduced the symptoms (up to 20%) and pathogen infection (94–98%). The current study's results reveal the potential of 6-PP as a new fungicide against M. maydis. Such a treatment may protect maize plants from other soil diseases.

Audience Take Away Notes

- Late Wilt Disease (LWD) is a devastating threat in high-risk areas
- Trichoderma asperellum and its secreted 6-Pentyl-α-Pyrone (6-PP) restrict the pathogen in vitro
- While the enrichment of seeds with T. asperellum rescued sprouts from the disease but was less efficient in the field, T. asperellum secreted metabolites or 6-PP seed coating significantly protected mature plants and reduced infection
- The 6-PP's high potential against the LWD pathogen can be significant in integrated control

Biography

Dr. Ofir Degani completed his Ph.D. (2005) at the Technion-Israel Institute of Technology (Haifa, Israel), specializing in genetic engineering approaches in phytopathology. He carried out his post-doctoral studies at the Migal-Galilee Research Institute (Israel). Dr. Degani is the research group head of this institute's Phytopathology and Crop Protection Laboratory and a senior staff member at Tel-Hai College (Israel). His research is based on molecular, biochemical, and microbial approaches for understanding and preventing plant fungal diseases. He has published over 50 research articles and chapters in reputable journals/books.

Orchidea Maria Lecian

Sapienza University of Rome, Italy

Markov lumping hydrocracking and markov catalytic hydrocracking revisited

The finite Markov chain originating the Markov-State Model of the conformational dynamics of the K-Ras4B proteins in the catalytic reaction is spelled. The corresponding Markov-Sates-Models are studied according to the experiment described. Markov State Models and Molecular Dynamics Simulations Reveal the Conformational Transition of the Intrinsically Disordered. Hypervariable Region of K Ras4B to the Ordered Conformation, The study is based on the large-scale conformational changes of the Hypervariable Region from its intrisicaly-disordered state to the ordered state. Crucially, the conformal substates along the transition paths are reviewed in the path description; interactions between the HVR and the catalytic domain are recapitulated to be possible. Two possibilities are studied from the Markov landsscape accessible to the systems as one five-states Markov-State Model and one four-states Markov-State Model. A new two-states Markov-State Model is constructed, according to the qualities of the K-Ras4B dynamics processes; the new analysis of the transition to the final state is newly analytically studied. The Galerkin description's final-state transition's related eigenvalue's time evolution is newly spelled out from the new 2-states Markov State Model. As a result, the new tools needed in the analytical computation of the relative error are ready. The relative error is newly analytically calculated. The experimental data and the characterisation of the lag time in shaping the discretization error are used to write new analytical formulations of the time evolution of the eigenvalue corresponding to the final-state transition. The new analysis is proposed, on the discretization error's features, according to which the discretization error is expected to increase monotonically with increasing lag time. The comparison with the experimental data is exposed.

Audience Take Away Notes

- New analysis of the K-Ras4B dynamics according to the qualities of the new Markov-State Model, to the new analytical calculation of the relative error, and to the new implementation of the definition of the discretisation error due to the lag time
- A new Markov-State Model is analytically spelled, according to which the K Ras4B
- The new Markov-state Models is simpler to handle; the new protocols of the analytical calculation of the relative error and those for the that of the discretisation
- New role of the conformational dynamics in pharmaceutical uses envisaged accoriding to the new Markov-States Model
- New paradigms for the understanding of the conformational dynamics of the K-Ras4B proteins, of their interaction with the catalytical environment and the new application applications are provided with

Biography

Prof. Orchidea Maria Lecian graduated in Theoretical Physics at Sapienza University of Rome and ICRA- International Center for Relativistic Astrophysics in 2005 ad completed her International Relativistic Astrophysics Phd at Sapienza University and ICRA. She was post-doctoral Fellow at IHES (Bures-sur-Yvette, France), AEI-MPI (Potsdam-Golm, Germany) and Sapienza University of Rome. She has taken part in intensive research prorammes at AEI-MPI (Potsdam-Golm, Germany) and The Fields Institute for Research in Mathematical Sciences (Toronto, Canada). She has been researcher for SAIA- NS'P (The National Scholarship Programme of the Slovak Republic- National S'tipendium Program) as Research grantee and appointed Erasmus Lecturer at Comenius University in Bratislava, Faculty of Mathematics, Physics and Informatics, Department of Theoretical Physics and Physics Education- KTFDF. She has been Assistant Professor at Sapienza University of Rome and is Professor at Sapienza University of Rome. She is was Visiting Professor at Kursk State University, Chair of Algebra, Geometry and Didactics of Mathematics Theory within the Programme Education in Russia for Foreign Nationals of the Ministry of Science and Higher Education of the Russian Federation in 2022-2023. She has contributed in national conferences and international conferences. She is member of several Research Consortia. She is author of research papers, conference papers, review papers, invited papers and two books. She is reviewer and editorial-board member of several international Journals.

Oscar MartInez Rico*, Angeles Dominguez, Begona Gonzalez
Universidad de Vigo, Department of Chemical Engineering, Vigo, 36310, Spain

Circular solutions for textile sustainability: Water and resource conservation

The convergence of climate change and global population growth poses an escalating threat to the availability of critical resources, notably water and garments. Traditionally, the textile industry has adhered to a linear production model, extracting raw materials, transforming them, and introducing the refined products into the market. However, this approach yields substantial waste, often inefficiently recycled and consequently deposited into landfills, resulting in profound environmental ramifications. Consequently, a concerted effort has emerged to propel the textile sector towards a circular, zero-waste economy.

This presentation focuses on two pivotal domains within this transformative journey. Firstly, it addresses the treatment of wastewaters through the synthesis and exploration of novel solvents. These solvents, particularly Deep Eutectic Solvents (DESs), exhibit remarkable efficacy in purifying textile wastewaters, particularly in the removal of dyes. Significantly, their production from sustainable sources underscores their commitment to minimizing environmental impact.

Secondly, the discussion delves into the critical topic of fiber recycling, with a specific emphasis on cotton. Developed nations such as the USA and the UK collectively generate substantial volumes of cotton waste, underscoring the urgency for advanced recycling methodologies. Despite their relatively higher recycling rates, averaging around 20%, the demand persists for sustainable techniques that efficiently extract dyes from cotton. This presentation underscores the pressing need for innovative solutions and sustainable methods in addressing the ecological footprint of the textile industry.

Biography

Oscar Martinez Rico is a researcher and a Ph.D candidate in the Advanced Separation Processes research group, part of the Chemical Engineering Department at the University of Vigo, leading pioneering work in the field of environmental chemical engineering, particularly related to the textile sector. Holding a bachelor’s degree in Chemistry and a master's degree in Theoretical Chemistry from the University of Oviedo, his presentation at the congress will address circular solutions for sustainability in the textile industry. His contributions to ongoing research projects include the development of new solvents for extracting dyes from textile wastewaters via liquid-liquid extraction or adsorption and the decolorization of cotton fabric.

Osman Adiguzel

Department of Physics, Firat University, Elazig, Turkey

Thermomechanical processes and lattice reactions in shape memory alloys

Shape memory alloys take place in a class of advanced structural materials by exhibiting dual memory characteristics, shape memory effect and superelasticity with the recoverability of two shapes at different conditions, in the β-phase region with chemical composition. Shape memory effect is initiated with thermomechanical processes on cooling and deformation and performed thermally on heating and cooling, with which shape of the material cycles between original and deformed shapes in reversible way, and this behavior can be called thermoelasticity. This phenomenon is governed by the thermomechanical transformations, thermal and stress induced martensitic transformations. Thermal induced martensitic transformation occurs on cooling with cooperative movement of atoms in <110 > -type directions on {110} - type plane of austenite matrix, along with lattice twinning and ordered parent phase structures turn into the twinned martensite structures, and twinned structures turn into detwinned martensite structures by means of stress induced martensitic transformations with deformation.

Superelasticity is performed in only mechanical manner with stressing and releasing the material in elasticity limit at a constant temperature in the parent austenite phase region, and shape recovery occurs immediately upon releasing, by exhibiting elastic material behavior. Superelasticity is also result of stress induced martensitic transformation, and the ordered parent phase structures turn into the detwinned martensite structures with stressing. It is important that lattice twinning and detwinning reactions play important role in martensitic transformations.

Copper based alloys exhibit this property in metastable β-phase region, which has bcc-based structures. Lattice twinning is not uniform in these alloys, and the ordered parent phase structures undergo the non-conventional layered structures with martensitic transformation. These layered structures can be described by different unit cells as 3R, 9R or 18R depending on the stacking sequences on the close-packed planes of the ordered lattice.

In the present contribution, x-ray diffraction and electron diffraction studies were carried out on copper based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections. Critical transformation temperatures of these alloys are over the room temperature, and the specimens were aged at room temperature, and a series of X-ray diffractograms were taken during aging. These diffractograms show that locations and intensities of diffraction peaks change with the aging time at room temperature, and this result refers to the redistribution of atoms in diffusive manner.

Keywords: Shape Memory Effect, Martensitic Transformation, Thermoelasticity, Superelasticity, Twinning, Detwinning.

Audience Take Away Notes

- Shape memory alloys are multifunctional materials and used in many fields from biomedical to the building industry. In principle, I introduce the basic terms and definitions related to shape memory effect, and introduce the experimental studies performed on the alloy specimens

Biography

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post- doctoral research scientist in 1986-1987, and studies were focused on shape memory effect in shape memory alloys. His academic life started following graduation by attending an assistant to Dicle University in January 1975. He became professor in 1996 at Firat University in Turkey, and retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He supervised 5 PhD- theses and 3 M. Sc- theses and published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international level with contribution. He served the program chair or conference chair/co-chair in some of these activities. Also, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Additionally, he joined over 120 online conferences in the same way in pandemic period of 2020-2022. Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.

Osman Adiguzel
Department of Physics, Firat University, Elazig, Turkey

Shape reversibility and diffusionless transformations in shape memory alloys

Shape memory alloys take place in a class of advanced smart materials by giving stimulus response to changes in the external conditions. These alloys are adaptive structural materials and exhibit a peculiar property called shape memory effect, with the recoverability of two shapes at different conditions. This phenomenon is initiated with thermomechanical treatments on cooling and deformation and performed thermally on heating and cooling, with which shape of the material cycles between original and deformed shapes in reversible way. Therefore, this behavior can be called thermal memory or thermoelasticity. Deformation in low temperature condition is plastic deformation, with which strain energy is stored in the materials and releases on heating by recovering the original shape. This phenomenon is governed by the diffusionless phase transformations in crystallographic level, thermal and stress induced martensitic transformations. Thermal induced martensitic transformations occur on cooling with cooperative movement of atoms in <110 > -type directions on a {110} - type plane of austenite matrix, by means of lattice invariant shears, along with lattice twinning and ordered parent phase structures turn into the twinned martensite structures. The twinned structures turn into detwinned martensite structures by means of stress induced martensitic transformations with deformation. Atomic movements are confined to the nearest atom distances, and these transformations have diffusionless character.

These alloys exhibit another property, called superelasticity, which is performed with mechanically stressing and releasing in elasticity limit at a constant temperature in the parent phase region, and material recovers the original shape upon releasing, by exhibiting elastic material behavior. Superelasticity is performed in non-linear way, stressing, and releasing paths are different, and cycling loop refers to the energy dissipation. Superelasticity is also result of stress induced martensitic transformation, and the ordered parent phase structures turn into the detwinned martensite structures with stressing.

Copper based alloys exhibit this property in metastable β-phase region with chemical composition, which has bcc-based structures at high temperature parent phase field. Lattice invariant shear and twinning is not uniform in these alloys, and cause to the formation of layered structures, like 3R, 9R or 18R depending on the stacking sequences on the close-packed planes of the ordered lattice.

In the present contribution, x-ray and electron diffraction studies were carried out on copper based CuAlMn and CuZnAl alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections. Critical transformation temperatures of these alloys are over room temperature. The specimens were aged at room temperature and taken a series of x-ray diagram during aging. X-ray diffractograms taken in a long-time interval show that diffraction angles and intensities of diffraction peaks change with the aging duration at room temperature. This result refers to the rearrangement of atoms in diffusive manner.

Keywords: Shape Memory Effect, Martensitic Transformation, Thermoelasticity, Superelasticity, Lattice Twinning, Detwinning.

Audience Take Away Notes

- Shape memory alloys are functional materials and used in many fields from biomedical application to the building industry. This is a multidisciplinary conference, and I will introduce the basic terms and definition at the beginning of my talk and continue with experimental results. This is important, because, every scientist is not familiar with every subject of the science, and basic knowledge in elementary level, in order the audience will learn the basis of the presented lectures

Biography

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied on shape memory alloys. He worked as research assistant, 1975-80, at Dicle University and shifted to Firat University, Elazig, Turkey in 1980. He became professor in 1996, and he has been retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international and national level as participant, invited speaker or keynote speaker with contributions of oral or poster. He served the program chair or conference chair/co-chair in some of these activities. In particular, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Also, he joined over 120 virtual conferences in the same way in pandemic period of 2020-2022. He supervised 5 PhD- theses and 3 M. Sc- theses. Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.

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Thermodynamic analysis of COx-free Hydrogen generation by Ammonia cracking

Hydrogen stands out as a promising fuel for the future, holding significant potential in cutting down carbon dioxide emissions. However, challenges related to its storage, transportation, and safety hinder its widespread adoption. To address this, ammonia has emerged as a potential carbon-free carrier for hydrogen due to its several advantages such as high volumetric energy density and simple storage. Yet, due to some limitations related to ammonia's net combustion like its low flame speed, the suggestion is to store hydrogen in the form of ammonia and convert it back into hydrogen or hydrogen-rich gas just before utilization, aiming to overcome these limitations. In this paper, the thermodynamic analysis of hydrogen-rich gas production by ammonia decomposition is performed using Aspen Plus V.12 considering the idealized Gibbs reactor. Such a reactor determines the decomposition products by employing the Gibbs free energy minimization method. The system's thermodynamic analysis gives the opportunity to assess how various operational factors, particularly temperature and pressure, impact the system's performance measures. This analysis provides insights into the system's maximum energy efficiency and conversion rates. These limit levels can be a guideline for the optimum design of the elements of the ammonia decomposition system and for evaluating the experimental results. Different criteria have been evaluated, especially Ammonia conversion rate, Hydrogen-rich gas energy ratio, and Enthalpy change. The results show that at a specific temperature, the conversion rate of ammonia decreases as the pressure rises so that the conversion rate of more than 50% occurred at temperatures of about 427 and 513 K for pressures of 1 and 10 bar respectively. Since the reaction is endothermic, the increase in temperature provides the necessary energy to overcome the activation energy barrier required for the reaction to occur. Therefore, at higher temperatures, decomposition of ammonia is favored, leading to an increase in the value of equilibrium constant. Regarding the enthalpy of reaction, as temperature rises, the reaction's enthalpy also rises at a specified pressure, while the pressure increasing leads to a decrease in the reaction enthalpy. Moreover, adiabatic flame temperature is investigated for different blending of ammonia and hydrogen based on equivalence ratios from 0.4 to 1.6 so that the results reveal that increasing the molar percentage of hydrogen from 0 to 100% in the fuel mixture leads to the increase of maximum adiabatic flame temperature from 2079 K to 2438 K.

Audience Take Away Notes

- Understanding of the potential of using ammonia as a carbon-free carrier for hydrogen
- Ultimate level of different performance criteria of ammonia decomposition such as conversion rate
- The effect of temperature and pressure on energy-related measures of the ammonia decomposition such as enthalpy and gibbs-free energy
- The positive effect of hydrogen addition to ammonia on adiabatic flame temperature and lower heating value
- Due to the important role of ammonia as a carbon-free hydrogen carrier, different industries will

be the audience of this study, especially maritime, power plants, furnaces and internal combustion engines. The information and results presented in this study will be a proper source to determine the effect of various operational factors, such as temperature and pressure, on the system's performance. Moreover, future experimental studies in the field of ammonia decomposition, for example by using catalytic reactors, will be able to use the data from our study to validate and compare their results

- For professionals in fields related to alternative fuels, energy, and chemical reactions, this presentation offers several practical advantages such as providing a basis for developing more efficient systems for hydrogen production and utilization in different industries. Moreover, they can assess the performance of their systems more accurate. Also, the results related to ammonia-hydrogen combustion will be useful for researchers and professionals considering the safety and optimizing combustion efficiency in hydrogen-rich fuel applications
- The faculty members involved in fields like mechanical engineering, chemistry, chemical engineering, energy systems, or environmental sciences can use this research as a foundation to explore further facets of ammonia decomposition, investigate different catalysts or reactor designs, or study the broader implications of hydrogen-rich fuels in different energy systems. Moreover, this research provides a rich resource for some important engineering courses such as thermodynamics, reaction kinetics, energy conversion, and alternative fuel technologies
- Considering the effect of pressure on different aspects of the ammonia decomposition as well as the importance of pressure in storing and transporting fuels, designers can use this research to develop systems that efficiently store and release hydrogen when needed, due to the benefits of ammonia storage compared to hydrogen. Moreover, Designers can create more efficient reactors or systems that convert ammonia into hydrogen-rich fuel, maximizing energy output while minimizing energy losses
- This paper contributes to both improving the accuracy of design and offering new insights crucial for addressing design problems related to utilizing ammonia for hydrogen production. This analysis allows for a more accurate understanding of how various operational factors affect the system's performance. Consequently, such knowledge can guide more precise designs for such systems. Moreover, the established limit levels and criteria evaluated in the paper can serve as essential guidelines for evaluating problems related to design and experimental analyses

Biography

Payam Shafie has Establishing a Rich Theoretical Base and strong hands-on capability, He received both Bachelor's and Master's degrees in Mechanical Engineering from prestigious Iranian universities including Azad University and Tarbiat Modares University. He has started his PhD studies in Mechanical Engineering at Laval University, Canada since Fall 2020. As a research assistant, he is working in the field of using Ammonia and Hydrogen for Dual-fuel engines under the supervision of Prof. Alain DeChamplain and Prof. Julien Lepine in collaboration with Chantier Davie Canada Inc, which is Canada's largest shipbuilder.

Pushkar Shejwalkar, Ph.D
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Input management for sustainable chemistry

Sustainable chemistry, also known as green chemistry, is a fundamental approach to chemical management that aims to minimise adverse effects on the environment and human health whilst maximising resource efficiency. It involves the design, manufacture, and use of efficient, effective, safe, and more environmentally benign chemical products and processes. This integration can be accomplished by implementing sustainable processes and technologies at an industrial scale by adopting green and sustainable chemical practices in the manufacturing of chemicals, materials, and products. With the United Nations Environment Programme (UNEP) and the Organisation for Economic Co-operation and Development (OECD) highlighting the significance of sustainable chemistry in risk management and the life-cycle assessment of chemicals, materials, and products, the concepts of green and sustainable chemistry have gathered a great deal of attention globally. In the context of chemical management, the application of sustainable chemistry principles can lead to the development of safe and sustainable alternatives for chemicals of concern, the sustainable sourcing of resources and feedstocks, and the advancement of sustainability in production processes and products.

In the implementation of sustainable programs, the end-of-pipe scrutiny, and treatment thereof is invariably considered as the significant step. However, we believe that sustainable chemistry starts with “Input Management” and it is therefore a crucial stage for chemical industries. We believe that clean input delivers clean output.

For the Input management, we have created MRSL (Manufacturing Restricted Substances List), which is a list of chemicals, known to be hazardous for various reasons (including but not limited to be classified as CMR/PBT/vPvB). By restricting the chemicals in the input stream, the contamination in the output (whether be it a product, wastewater, air emitted, or the sludge developed) can be controlled. These outputs are directly related to the consumers or to the environment, thereby reducing the adverse impact.

Our Vision is to create a world where better chemistry leads to the protection of life, land, air, and water.

Audience Take Away Notes

- A new concept of Input management will drive the researcher to think about their research from a different perspective, by employing a cleaner input chemical rather than end-of-pipe treatments
- The supply chain management is paramount in any of the chemical industries. By understanding the requirements and basic concepts, the audience not only will benefit in their current job, but it will help them understand the upcoming requirements of the industries as well
- Of course, the topics that will be discussed in the presentation will help not only expand but also make them understand the future requirements and expectations of the industries
- More than efficient, I think the information provided will help make their job more relevant to the industries
- The topics that will be discussed, will help make research more relevant to the industry standards and needs

Biography

Dr. Pushkar Shejwalkar completed his Master's from Ramnarain Ruia Senior College, Mumbai University, India in 2005 with a Gold Medal in Organic Chemistry. After briefly working in industrial set-up, he joined the University of Missouri Saint Louis, USA, and completed his Ph.D. with Summa Cum Laude in 2013. He then moved to Hokkaido University, Sapporo, Japan for his post-doctoral research, for which he received a JSPS fellowship. He returned to India and continued his research and work in the field of regulatory in the textile and footwear field and joined ZDHC Foundation in 2023. He has published over 10 research articles in international journals and publications.

Ram Sambhar Shukla
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Cyclohexane oxidation catalysed by ruthenium complex at atmospheric pressure of molecular oxygen

The oxidation products of cyclohexane, via, cyclohexanol and cyclohexanone, are important intermediates in the manufacture of commercially needed polymers, nylon-6 and nylon-66. The main products formed during cyclohexane oxidation are cyclohexanol, cyclohexanone and adipic acid. The existing commercial process for cyclohexane oxidation is carried out around 150 °C and 1–2 MPa pressure affording ~4% conversion and 70–85% selectivity to cyclohexanone and cyclohexanol over metal cobalt salt or metal-boric acid. Researches are focused for developing the catalyst systems for the selective oxidation of cyclohexane to cyclohexanol and/or cyclohexanone, potentially avoiding the formation of other undesired products. The functionalization of C-H bond in the selective oxidation of the lowest alkane, methane to methanol is although tough, yet it is catalyzed at the active site of a metalloenzyme known as methane mono oxygenase in presence of molecular oxygen. Here one atom of the dioxygen molecule is assimilated into the methane oxidation product methanol and the other forms water. In methane mono oxygenase, iron based complex catalyses the selective oxidation of methane to methanol. In line of these aspects, in our wide research programme to develop catalyst systems for the selective C-H bond functionalization of saturated hydrocarbons, Ru analogue of methane mono oxygenase based catalysts are developed and investigated in detail for the selective oxidation of cyclohexane to cyclohexanol and / or cyclohexanone. A Ru-EDTA–ascorbate complex catalysed oxdation of cyclohexane by molecular oxygen appreciably yielded cyclohexanol = 5.45%, cis- 1,3-cyclohexanediol = 2.56% and cyclohexanone = 0.18% at laboratory scale. The reactions are investigated in detail in order to have deep understanding of the involved oxidations: (i) Ru-EDTA catalysed oxidation of ascorbic acid, (ii) Ru-EDTA catalysed oxidation of cyclohexane, (iii) Ru-EDTA-ascorbate catalysed oxidation of cyclohexane and (iv) Ru-EDTA- ascorbate catalysed oxidation of cyclohexanol. The rate of oxidation of cyclohexane with the Ru(III)-EDTA–ascorbate system was faster than that of the Ru(III)-EDTA system in the absence of ascorbic acid. The present talk will involve the presentation of these oxidation reactions focussing on their catalytic, kinetic, thermodynamic and mechanistic aspects in detail.

Keywords: Catalysis, Oxidation, Cyclohexane, Ruthenium, Molecular Oxygen, Kinetics.

Biography

Dr. Ram Sambhar Shukla received B.Sc. (1975), M.Sc. (1977), Ph.D. (1981) degrees and PDF of CSIR (1981-83) from University of Allahabad, India and joined Inorganic Materials and Catalysis Division of CSIR- Central Salt and Marine Chemicals Research Institute, Bhavnagar, India as research scientist since 1983. His specializations include catalyst materials, green organic transformations of O_2, CO_2, CO, H_2 and CH_4, high temperature-pressure material and catalysis. He is Life Member of National Academy of Sciences-India, Allahabad and Catalysis Society of India, Madras. He was Member of Indian Reference Materials, Delhi and was Chairman (Alternate), Inorganic Materials Sectional Committee of Bureau of Indian Standard, Delhi. As Bilateral Exchange of Scientists awardees visited France (CNRS,1993) and Korea (KOSEF, 2002) for collaborative research on C-H and CO_2 respectively. Awarded brain pool scientist (2011) and researched in Korea on utilization of CO_2 as soft oxidant. Performed as faculty Professor for Ph.D. course, of Academy of Scientific and Innovative Research (AcSIR), and of Bhavnagar University. He is reviewer for reputed journals for materials and catalysis and Ph.D. examiner for Indian universities. He credited: 100 papers, 5 patents, 2 reviews, 4 book/chapters, 52 invited lectures: 21 international and 71 national conferences, 17 students guidance and 20 research projects.

Ramona Massoud[1]*, Fatemehsadat Mirmohammad Makki[2], Armita Massoud[3], NargesSadat MirMohammadMakki[4]

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Heavy metals bioremoval by lactobacillus acidophilus in milk as a green technology

Applying profitable microorganisms (yeast, algae and bacteria) is a green novel biotechnological method for removing harmful heavy metals from the environment. Accumulation of heavy metals in human body will cause some serious disorders and cancers. Some of the microorganisms are also able to decontaminate heavy metals from food and water. Probiotics are the potent microorganisms with many positive health effects on our bodies after consumption. Among various probiotics, Lactobacillus acidophilus is one of the most useful microorganisms in food industry especially milk and dairy products. Our research team has investigated the heavy metals bioremoval in milk by using Lactobacillus acidophilus. In this regard, L. acidophilus and initial heavy Metals Lead and Cadmium (Pb and Cd) were added to milk and the biosorption process was monitored during four days after addition. Some variables, including exposure time, L. acidophilus concentration, and initial metals concentration were evaluated in the biosorption process. The highest Lead and Cadmium bioremoval yield of 80% and 75% were observed, respectively, at 1 × 1012 CFU of L. acidophilus in milk at the 4th day and the initial ion (Pb and Cd) concentration of 100 µg/L. L. acidophilus concentration, initial metal concentration, and exposure time were statistically significantly associated with heavy metals removal (p values ≤0.05). These findings provided further evidence for L. acidophilus as a natural powerful biosorbent for heavy metals removal from milk and a potentially safe and green tool for providing safe and healthy food supply.

Audience Take Away Notes

- Bioremoval process as a novel green technology for decontamination of food stuffs
- Lactobacillus acidophilus is a valuable bacteria applying for heavy metals biosorption from milk
- In the optimum circumstance Pb and Cd biosorption efficiency is 80% and 70% respectively
- Biomass dosage, initial Hg concentration and contact time are the three significant variables in this biosorption process

Biography

Dr. Ramona Massoud studied for a PhD in Food Science & Technology at the Science and Research Branch, Islamic Azad University, Tehran, Iran, and received her degree in 2020. She joined the Department of Food Technology, Iran National Standards Organization (INSO). Also, she has been teaching at the same university since 2020 and obtained the position of an Associate Professor. Dr. Massoud has published more than 70 research articles in SCI (E) journals about food security and safety. She has also participated as a speaker in 12 International Conferences in Food, Agriculture, and the Environment.

Ritu Bala[1]*, Ridhima Aggarwal[1], Tarlok Singh Lobana[1], Vinit Prakash[2]

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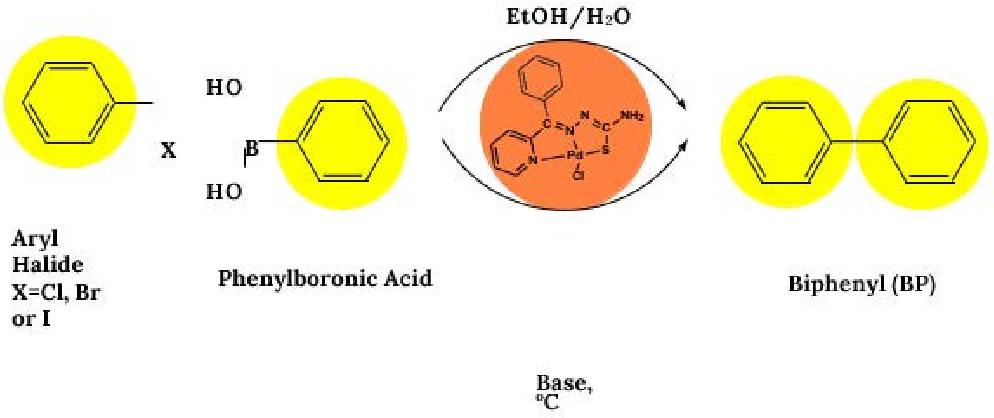
A one pot approach to catalyze Suzuki-Miyaura coupling reaction using (2- benzoylpyridinethiosemicarbazone) palladium(II)

Recently, our group has reported a square planar coordination compound of palladium(II) with 2-benzoylpyridine thiosemicarbazone, having chemical composition, [Pd((C_6H_5) (py-N1)C_2=N_2-N_3H-C1(=S)- N_4H_2)Cl] {Pd(II) catalyst}. The catalytic properties of it were investigated using the Suzuki-Miyaura coupling reaction as a model. Interestingly, the Pd(II) catalyst has effectively catalyzed the cross coupling reaction between aryl halides (ArCl, ArBr or ArI) and phenyl boronic acid in EtOH/H_2O mixture in basic medium at relatively low temperature (50 °C). Multiple additions of reactants in the phased manner to the same reaction vessel effectively catalyzed the reaction of ArBr with $PhB(OH)_2$. Aryl iodide behaved similarly; aryl chloride needed more hard conditions. This catalytic activity was performed under normal atmospheric conditions in the absence of any free ligand or any promoting additive.



Audience Take Away Notes

- Exploration of a novel single pot catalyst for Suzuki-Miyaura coupling reactions
- Easy synthesis of catalyst
- Suzuki-Miyaura coupling reactions take place at 50 °C temperature under normal atmospheric conditions in the absence of any free ligand or any promoting additive

Biography

Dr. Ritu Bala studied Chemistry at Punjab University Chandigarh, India and post graduated as MSc Chemistry (Honrs. School) in year 2021. She then joined the research group of Prof. Raj Pal Sharma at the Department of Chemistry, Punjab University, Chandigarh, India in Inorganic Chemistry. She received her PhD degree in 2007 at the same institution. Immediately after her PhD she joined BILT, India as Research scientist. And in year 2010 she joined as Assistant Professor at Department of Chemistry, Guru Nanak Dev University Amritsar. She is working on Coordination Chemistry and supervised 3 PhD scholars. At present she is working as Associate Professor in the same university and guiding three PhD research students. She has published more than 80 research articles in SCI(E) journals.

Safdar Hossain SK

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Carbon support materials for the electrocatalyst for the formic acid electrooxidation

In this work, Pd-based catalysts supported on various carbon-based support materials for the oxidation of formic acid will be discussed. The role of a chemical structure and bonding of carbon materials such as carbon nanotubes, graphene, mesoporous carbon, and nitrogen-doped reduced graphene oxide in the electrooxidation process will be discussed. The aim is to design and develop a highly efficient and durable electrocatalyst for formic acid oxidation. We have prepared and tested PdCo-based electrocatalysts on several carbon-based materials. The performance of Pd based catalysts on carbon nanotubes, graphene, mesoporous carbon, and nitrogen-doped reduced graphene oxide will compared and analyzed. Nitrogen-doped graphene oxide was prepared using hydrothermal chemical reduction with urea as a source of nitrogen. The PdCo nanoparticles are deposited on the nitrogen-doped graphene oxide support using the impregnation-reduction method using sodium borohydride as a reducing agent and citric acid as a stabilizing agent. The structural features such as phases, composition, oxidation states, and particle sizes were determined by the XRD, TEM, SEM-EDX, and XPS. The PdCo nanoparticles of particle size 3.5 nm were deposited on the nitrogen-doped graphene. The electrochemical performance of the catalysts was determined by CO stripping, cyclic voltammetry, and chronoamperometry. The Pd_1Co_1/N-rGO showed excellent mass activity of 4833.12 mA-1mg Pd in the 0.5M sulfuric acid and 0.5 M formic acid aqueous solution, twice the activity shown. Pd_1Co_1/CNT. Pd_1Co_1/N-rGO showed excellent long-term stability by showing a steady state current density of 700 mA-1mg Pd after 5000 s. Bimetallic PdCo and the nitrogen-doped graphene are responsible for the enhanced performance of the PdCo/N-rGO catalyst.

Audience Take Away Notes

- The role of carbon-based support materials on the performance of formic acid oxidation catalysts
- Understand the role of Pd in formic acid oxidation
- Structure-activity relation of electrocatalysts
- Future direction of research on the formic acid oxidation catalysts development

Biography

Dr. Safdar Hossain SK studied Chemical Engineering at the Indian Institute of Technology, Kharagpur, India, and graduated with an M. Tech in 2005. He then obtained his Ph.D. in Catalysis from King Fahd University of Petroleum & Minerals, Saudi Arabia, in 2012. He is currently an Associate professor of Chemical Engineering at King Faisal University in Saudi Arabia. He is a senior member of the American Institute of Chemical Engineers. He has over 50 research articles and is an inventor of more than 20 US patents. His research interests lie in the development of electrocatalysts for electrochemical processes, including fuel cells and carbon dioxide reductions.

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From waste to wealth: A circular bioeconomy approach for the brewing industry through brewery spent grains valorization

Mexico, a global leader in beer production and export, faces the challenge of managing the abundant waste generated by the brewing industry, particularly Brewery Spent Grains (BSG). This waste, constituting 85% of the total waste produced, has been underutilized due to its high moisture content and difficulties in transportation and storage. However, BSG possesses significant potential as a source of high-value molecules, including proteins, ethanol, organic acids, carbohydrates and fiber.

This project presents a comprehensive approach for the valorization of BSG through a circular bioeconomy model for beer industry. The viability of biotransforming BSG into valuable compounds was successfully demonstrated. The pretreatment of BSG employed green solvents to avoid fermentation inhibitors. Ligninolytic enzymes produced by Mexican native fungi were utilized for effective production of fermentable sugars, which were then converted into ethanol using a yeast strain adapted for pentose and hexose fermentation. The ethanol yield reached x* liters per gram of biomass, highlighting BSG as a competitive feedstock for bioethanol production with reduced environmental impact to be applied mainly in transportation industry.

Furthermore, the liquid fraction obtained from the fermentation process was analysed, revealing the presence of post-fermentation organic compounds such as acetic, succinic, citric, and propionic acid. These compounds exhibited plant growth promotion effects, contributing to enhanced root system elongation and soil improvement for plant productivity. The solid fraction was subjected to heat treatment to inactivate the probiotic yeast used in the fermentation and recover molecules with postbiotic potential, including Short- Chain Fatty Acids (SCFAs) and other bioactive compounds (ongoing experiments), different formulations will be proposed for its use, including for human or animal consumption.

Collaborative efforts between national and international universities (Tecnologico de Monterrey, CIATEJ, and the University of Berkeley) and industry brewery partner Cerveceria Cielito Lindo which facilitated the demonstration of technical feasibility of the technology offers a landscape for future transfer and licensing for other breweries. This paves the way for the commercialization and widespread implementation of these developed processes, enabling brewing industries to achieve zero-emissions goals while increasing profitability. In conclusion, this study showcases the successful conversion of BSG waste into valuable resources through a circular bioeconomy approach. The findings contribute to waste reduction, enhanced sustainability, and the production of high value compounds.

Audience Take Away Notes

- Attendees will gain an understanding of the importance of effective waste management for achieving sustainability goals
- Attendees will gain insights into cutting-edge technologies and methodologies that enable the efficient and sustainable conversion of lignocellulosic waste, that can be transformed into valuable molecules

through bioprocess intensification

- The presentation will emphasize the need to explore new biofuel feedstock options for long-term feasibility, considering that fuel combustion is a significant contributor to global CO_2 emissions
- The presentation will also underline the importance of collaborative efforts between academia, industry, and policymakers in driving forward sustainable waste management strategies
- I will also highlight the potential for technology transfer and commercialization of these processes, to make the technology available for society

Biography

Sara Saldarriaga is an industrial and environmental microbiologist from the University of Antioquia, Colombia, and holds a Master of Science degree with a specialization in Biotechnology from the Tecnologico de Monterrey, Mexico (2020). Her area of expertise lies in Sustainability and Circular Economy. Currently, Sara is pursuing a Ph.D. in biotechnology with a focus on bioenergy. Her research centers around developing a circular economy model to harness waste from the brewing industry, involving the industrial scale-up of Second-Generation Ethanol production and other valuable molecules via SSF bioprocess using native fungi-derived enzymes and thermotolerant (engineered) yeast. Sara has published 9 scientific papers in her early scientific career.

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Antibody-proteases as translational tools of the next-step generation to be applied for biotech, bioindustry and personalized and precision medical practice

Antibodies (Abs) against myelin basic protein/MBP endowing with proteolytic activity (Ab-proteases with functionality) are of great value to monitor demyelination to illustrate the evolution of Multiple Sclerosis (MS).

Along with canonical Abs, some of the families proven to occur are Abs possessing with catalytic activity (abzymes), and thus to belong to Abs with functionality! Abs against myelin basic protein/MBP endowing with proteolytic activity (Ab-proteases with functionality) are of great value to monitor demyelination to illustrate the evolution of MS.

Catalytic Abs are Immunoglobulins (Igs) endowed with enzymatic properties. The activity of Ab-proteases in combination with the sequence-specificity would confirm a high subclinical and predictive (translational) value of the tools as applicable for personalized monitoring protocols. Sequence-specific Ab-proteases have proved to be greatly informative and thus valuable biomarkers to monitor MS at both subclinical and clinical stages! And the translational potential of this knowledge is in the rational design of new diagnostic tools and new therapeutics based on principles of artificial biocatalysts. Meanwhile, the drastic improvements in design-inspired and biotech-driven engineering technologies, combined with the innovations in trans-disciplinary sciences, suggesting that catalytic Abs have opened the way to new translational applications for these combinatorial tools.

Ab proteases can be programmed and re-programmed to suit the needs of the body metabolism or could be designed for the development of principally new catalysts with no natural counterparts. Therefore, the proposed predictive value of MBP-targeted Ab-proteases for the development of MS is being challenged and could be utilized in developing diagnostic tools of the next step generation. Meanwhile, proteolytic Abs made it feasible to develop new catalysts, which had previously been the subject of translational research and such Abs can thus continue to play a role and even fully prevent the emergence of autoimmune disorders, especially in the field of infection and immunity, where the process of its occurrence and development often takes a long time.

The exquisite specificity, natural biological functions, and favorable development properties of proteolytic Abs make them highly effective agents as drugs. Enzymes (as part of catalytic Abs) are able to catalytically turnover multiple substrates, making them a natural sub-stoichiometric solution for targets of high abundance or in poorly accessible sites of action. However, enzymes have their own limitations as drugs, including, in particular, the polypharmacology and broad specificity often seen with native enzymes. In this context, we might suggest and thus introduce Ab-guided proteolytic enzymes to enable selective sub-stoichiometric turnover of therapeutic (possibly, preventive, prophylactic and rehabilitative in the future to come) targets. The catalytic Abs paired with Ab-mediated substrate targeting can enhance enzyme activity and specificity, with proof of concept for the challenging target proteins. The experts in the field would have to become open to advanceand develop a design-driven innovative biotherapeutic platform to get the favorable properties of Abs and proteolytic enzymes integrated to effectively prompt the future of the therapeutic efficacy of the designed medicine.

New possibilities arise for their therapeutic applications. Ab-Directed Abzyme Prodrug Therapy (ADAPT) might largely replace Ab-Directed Enzyme Prodrug Therapy (ADEPT) for selective and/or targeted delivering some agents the affected tissues.

Of tremendous value in this sense are Ab-proteases directly affecting the physiologic remodeling of tissues with multilevel architectonics (for instance, myelin)., whilst securing the requests and standards of regeneration and remyelination. They can enzymatically cleave specific surface proteins on viruses or tumor cells, thereby disrupting the invaders.

Rationales are being accumulated and integrated for the requirements of catalytic Abs with regard to drug dependence in humans and their eventual realization as clinical therapeutics. The latter means that further studies on Ab-mediated MBP degradation and other targeted Ab-mediated proteolysis may provide biomarkers of newer generations and thus a supplementary tool for assessing the disease progression and predicting disability of the patients and persons-at-risks

Biography

Dr. Sergey Suchkov graduated from Astrakhan State Medical University and awarded with MD, then in 1985 maintained his Ph.D at the I.M. Sechenov Moscow Medical Academy and in 2001, maintained his Doctorship Degree at the Nat Inst of Immunology, Russia. From 1987 through 1989, he was a senior Researcher, Koltzov Inst of Developmental Biology. From 1989 through 1995, he was a Head of the Lab of Clinical Immunology, Helmholtz Eye Research Institute in Moscow. From 1995 through 2004, a Chair of the Dept for Clinical Immunology, Moscow Clinical Research Institute (MONIKI. Dr. Suchkov has been trained at: NIH; Wills Eye Hospital, PA, USA; Univ of Florida in Gainesville; UCSF, S-F, CA, USA; Johns Hopkins University, Baltimore, MD, USA. He was an Exe Secretary-in-Chief of the Editorial Board, Biomedical Science, an international journal published jointly by the USSR Academy of Sciences and the Royal Society of Chemistry, UK. At present, Dr. Sergey Suchkov is a Chair, Dept for Personalized Medicine & Precision Nutriciology, MGUPP, and Professor, Dept for Clinical Immunology, A.I. Evdokimov Moscow State Medical & Dental University, Moscow, Russia. He is a member of the: New York Academy of Sciences, USA; American Chemical Society (ACS), USA; American Heart Association (AHA), USA; EPMA (European Association for Predictive, Preventive and Personalized Medicine), Brussels, EU; ARVO (American Association for Research in Vision and Ophthalmology); ISER (International Society for Eye Research); PMC (Personalized Medicine Coalition), Washington, USA.

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Driven visible-light of strategically photocatalytic degradation of methylene blue in water over Au-Ce@Amb catalyst and g-C3N4 co-catalyst

For the activation of Au-Ce@Amb catalyst under visible light, the synergetic addition of g-C_3N_4 as co-catalyst was investigated in the driven visible-light photocatalytic degradation of Methylene Blue contaminant (dye model). Amberlite-732 (noted Amb) is cationic polymeric-resin which was exchanged with Au^{3+}-Ce^{3+} mixture cations ($Au^{3+}/3H^+$= 0.1 and $Ce^{3+}/3H^+$(resin)=0.9 molar ratios) This synthesized solid was calcined at 800°C under air to obtain Au-Ce@Amb catalyst. The Polymer Carbon Nitride Co-Catalyst (PCN) was synthesized by clacination of melamine biocomposite at 550°C temperature. Physico-chemical characterizations of materials include: X-rays diffraction, UV-vis spectroscopy, Raman spectroscopy, scanning electron microscopy coupled to energy-dispersive X- rays spectroscopy and X-rays photoemission spectroscopy. XRD characterization of PCN indicated the presence of (100) and (002) crystallographic lines characteristic of g-C_3N_4 pure phase; while, XRD pattern of Au-Ce@Amb catalyst showed presence of mixture of CeO_2 and Au0 phases. The photo-degradation of Methylene Blue achieved ~97% under visible irradiation after 240 min of reaction with Au-Ce@Amb and PCN together; against ~65% for PCN alone and ~6% for Au-Ce@Am alone. It seems that the presence of co-catalyst beside catalyst has affected considerably the photocatalytic activity. In this research, a purposed mechanism will be related to contact effect of gold-plasmons and PCN particles.

Audience Take Away Notes

- The public will be able to get informed about the synthesized Polymer Carbon Nitride (PCN) as it is a new class of materials attracted in many applications such as the splitting of water into hydrogen, the degradation of dyes by photocatalysis. This interest is due to the structure of polymeric graphitic carbon nitride which exhibits indirect semiconductor properties
- This research could use to expand the other researches on plasmons particles
- Currently, some researchers used the g-C_3N_4 material as a photosensitive co-catalyst obtain ultrasensitive effects or to improve a degradation of complex organic molecules

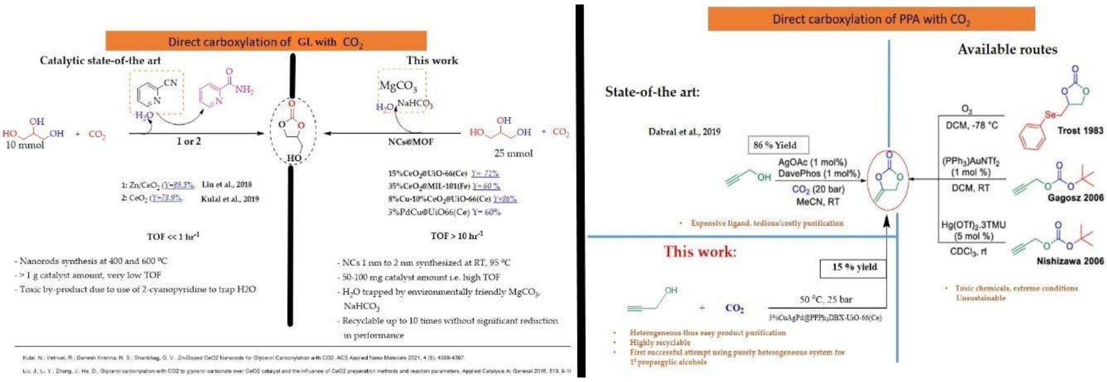
Biography

Pr. Siham Barama is director of laboratory of Materials Sciences and Chemical Processes of USTHB-Algiers University. She obtained her Doctorate in 2011, then her University Accreditation in 2017 at USTHB- Algiers. She supervised (2017-2022) two Doctorate theses defended on theme of photocatalytic depollution of contaminated water. Pr. S. Barama has published many scientific articles on varied themes but all converging on materials such as: exchanged clays, spinels, exchanged polymeric resins and conductive metal oxides. Currently, research works of Pr. Siham Barama is centered on reaction applications such as: Oxidation and dehydrogenation hydrocarbon like methane, ethane, propane and n-butane. Currently, her research focuses on the use of new technologies for development of biofuels from renewable raw materials.

Simon Lukato
University of Warsaw, Poland

Green and scalable approaches for synthesis and encapsulation of clean nanoclusters inside cerium mofs for catalysis: Sustainable synthesis of exovinylene carbonates and glycerol carbonate from glycerol and primary propargylic alcohols and CO_2

Exovinylene Carbonates (ECs) and Glycerol Carbonate (GLC) are important cyclic carbonates with applications such as in pharmaceuticals, Li-ion batteries and biological systems. They are also building blocks or intermediates in synthesis of polycarbonates and polyhydroxyurethanes. Direct carboxylative cyclization of cheap Primary Propargylic Alcohols (PPAs) and crude Bio-Glycerol (GL) by heterogeneous catalysis is the most sustainable approach to access these chemicals and to offset CO_2 and waste bio-GL. Efforts from various research groups in the recent past to engineer catalytic systems to access GLC emphasized purified GL and transesterification using costly organic carbonates, ignoring the need to develop routes using crude GL which is in excess and impeding the development of the biodiesel industry. For ECs, studies have narrowed on homogeneous catalysts to convert tertiary and secondary PAs due to their ease of cyclization. The cheap PPAs, because they are difficult to cyclize, have been ignored yet they are available on a large scale from the reaction of alkynes with aldehydes. Additionally toxic byproducts, unacceptably very low atom-economy and tedious purification steps are involved. These issues have hindered large-scale production of ECs and maintained relative high prices for GLC. Cu, Ag and Pd have been reported in various carboxylative cyclization reactions and have ability to adsorb GL, while CeO_2 activates small molecules including CO_2. Therefore, we synthesized Nanoclusters (NCs) of Cu, Ag and Pd using alcohols and water only with PVP, a weakly binding, environmentally benign protecting agent. The CeO_2-NCs where synthesized by decomposition of the cerium salt in pyridine at RT. The NCs were encapsulated in stable Ce Organic Frameworks (CeMOFs) using simple and green approaches and the NC-MOF composites employed in coupling of crude and pure GL with CO_2 to afford the GLC. Cyclization of PPA was enabled using polymer anchored NC-MOF composite. To the best of our knowledge, we report the first successful and purely heterogeneous catalyst system for direct carboxylative cyclization of PPAs and the highest GLC yield (>21%) for direct carboxylation of crude GL using sustainable protocols. The protocols (with great attention paid to sustainability and recyclability) use cheap, green and/or commercially available chemicals and thus have great potential for industrial application.



- Nanorods synthesis at 400 and 600 °C
- > 1 g catalyst amount, very low TOF
- Toxic by-product due to use of 2-cyanopyridine to trap H2O

- NCs 1 nm to 2 nm synthesized at RT, 95 °C
- 50-100 mg catalyst amount i.e. high TOF
- H_2O trapped by environmentally friendly $MgCO_3$, $NaHCO_3$
- Recyclable up to 10 times without significant reduction in performance

Kulal, N.; Vetrivel, R.; Ganesh Krishna, N. S.; Shanbhag, G. V., Zn-Doped CeO2 Nanorods for Glycerol Carbonylation with CO2. ACS Applied Nano Materials 2021, 4 (5), 4388-4397

Liu, J.; Li, Y.; Zhang, J.; He, D., Glycerol carbonylation with CO2 to glycerol carbonate over CeO2 catalyst and the influence of CeO2 preparation methods and reaction parameters. Applied Catalysis A: General 2016, 513, 9-11

- Expensive ligand, tedious/costly purification

- Toxic chemicals, extreme conditions
Unsustainable

- Heterogeneous thus easy product purification
- Highly recyclable
- First successful attempt using purely heterogeneous system for 1° propargylic alcohols

Biography

Simon Lukato was born in Masaka in Uganda and grew up in a small village in Luwero, Uganda. He received a BSc (Chemistry/Physics) at Makerere University in Uganda. In 2020, he defended his MSc thesis entitled “Supported Silver and Copper Catalysts for Selective Oxidation of Alcohols using Molecular Oxygen as Oxidant” under the supervision of Dr. Emmanuel Tebandeke (Makerere University - Uganda), Prof. Ola F. Wendt (Lund University - Sweden) and Dr. Gabriel N. Kasozi (Makerere University – Uganda). In October, 2021, he joined the Faculty of Chemistry at University of Warsaw – Poland to work on his PhD. His scientific interests focus on green chemistry and sustainable catalysis to guide him in designing catalytic systems for utilization of CO_2, valorisation of waste and low grade chemicals for sustainable chemical production and environmental protection and remediation. In his current PhD project, under the supervision of Prof. Grzegorz Litwinienko, Dr. Michal Wojcik and Dr. Agnieszka Krogul-Sobczak, he is focusing on the synthesis of nanoclusters encapsulated in stable porous metal organic frameworks for efficient direct carboxylation of selected alcohols particularly glycerol and primary propargylic alcohols with CO_2 to form cyclic carbonates of high value.

Nattapong Thakham, Chang Ru Liu, Jui Chia Chang, Sung Chyr Lin*

Department of Chemical Engineering, National Chung Hsing University, Taichung, Taiwan

Preparation and application of modified loofah sponges for metal chelation, protein purification, and enzyme immobilization

The applications of modified loofah sponges for the removal of heavy metals from wastewater, the selective adsorption of His-tagged enzyme, and the integrated approach for the adsorption and immobilization of enzymes from unclarified cell homogenate will be discusses. Loofah sponge is the fibrous vascular reticulated system of the matured dried fruit of Luffa cylindrica. The conjugation of iminodiacetic acid to epichlorohydrin-activated loofah sponge was found to increase the metal chelation capacity by ca. 220% from 11.6 ± 0.017 mg/g to 37.9 ± 0.277 mg/g. Upon the grafting of hydroxyethyl cellulose, the adsorption capacity of the loofah sponge-based immobilized metal affinity adsorbent for His-tagged trehalose synthase was increased by ca. 60% from 1.51 mg/g to 2.45 mg/g. Similar results were also observed for delignified loofah sponge prepared by sodium chlorite-acetic acid pretreatment. Both the adsorption isotherms of the hydroxyethyl cellulose-grafted and the delignified loofah sponges followed the Langmuir isotherm model with dissociation constants, Kd, in the range of 10-6M. Bifunctional loofah sponge-based adsorbent with metal chelate groups for the selective adsorption of His-tagged proteins and epoxy groups for the subsequent covalent immobilization of the adsorbed proteins was prepared by partial iminodiacetic acid conjugation of epichlorohydrin-activated loofah sponge. Bifunctional loofah sponge-based adsorbent with an [epoxy groups]/[metal chelate groups] ratio of 0.75 exhibited both a protein adsorption capacity of 0.639 mg/g and an immobilization yield of 93%. The immobilized enzyme thus prepared exhibited superior operational stability in repeated-batch processes, retaining 96% of its initial activity after 20 cycles. The employment of the bifunctional loofah sponge can significantly facilitate the preparation of immobilized enzymes by consolidating protein purification and enzyme immobilization.

Audience Take Away Notes

- The diverse utilities of loofah sponge for biocatalysis, biosepartions, and wastewater treatment
- The enhancement of metal chelating and protein adsorption capacities by hydroxyethyl cellulose grafting and delignification of loofah sponge
- The potential of loofah sponge-based immobilized metal chelate adsorbents for the selective adsorption of His-tagged proteins from unclarified cell homogenates
- The integrated approach for the purification and immobilization of His-tagged enzymes with metal chelate-epoxy bifunctional loofah sponge-based adsorbents

Biography

Dr. Lin studied Chemical Engineering at National Cheng Kung University, Taiwan and graduated as BS in 1985. Upon completing the military service, he joined the research group of Prof. George Georgiou at the University of Texas at Austin, USA, where he received his PhD degree in 1993. He joined the Department of Chemical Engineering at National Chung Hsing University, Taiwan as an Associate Professor in 1994. He has published numerous papers in the fields biosurfactants, bioseparations, and enzyme immobilization in SCI journals.

Suresh C Ameta

Professor of Eminence, Department of Chemistry, Faculty of Science, Paher University, Udaipur-313024 (Raj) India

Photocatalysis: A promising green chemical pathway

The world is facing two major problems these days. These are: (i) Rapidly developing water and air pollution and (ii) Upcoming shortage of natural resources of energy. Advanced Oxidation Processes are green chemical pathways, where photocatalysis has emerged as one of the promising processes. It can provide a solution to both these burning issues and that too simultaneously. Hydrogen has been long advocated as a fuel of future as all conventional fuels are likely to be exhausted within coming two decades or so. It can be generated from photosplitting of water photocatalytically. Global warming is another existing challenge of concern, and here, the carbon dioxide has been considered as the main culprit. Carbon dioxide can also be reduced photocatalytically to some useful value added fuels. But many photocatalysts have two major limitations. In most of the cases, their activity is limited because of little or no absorption in visible range and rapid recombination of electron- hole pairs. Both these limitations can be overcome by increasing the photocatalytic activity through modifying semiconductors by use of cocatalysts, composite formation, metal or non-metal doping, sensitization, S-Scheme, Z-scheme, etc. This will be discussed with some other interesting applications of photocatalysis.

Biography

Prof. Suresh C. Ameta obtained his masters degree from University of Udaipur and was awarded gold medal-1970. He secured First position in M. Phil-1978 in Vikram University, Ujjain (M. P.). He also obtained Ph. D degree from this University in 1980. He has served as Professor & Head, Department of Chemistry, North Gujarat University, Patan (1994) and M. L. Sukhadia University, Udaipur (2002-2005) & Head, Department of Polymer Science (2005-2008). He also served as Dean, P.G. Studies for a period of four years (2004-2008). He has served as Dean, Faculty of Science, PAHER University, Udaipur for six years (2011-2017). Presently, he is working as Professor of Eminence (Distinguished Professor of Chemistry) in Pacific University, Udaipur. Prof. Ameta has occupied the coveted position of President, Indian Chemical Society, Kotkata (2000-2001) and is now lifelong Advisor (2002-continue). He was awarded a number of prizes during his career like National prize twice for writing Chemistry books in Hindi (1976 & 1978), Scientist of the Year Award (2002), Prof. M. N. Desai Award (2004), Prof. G. V. Bakore Award (2007), prof. W. U. Malik Award (2008), national Teacher Award (2011), and above all, Life Time Achievement Awards by Indian Chemical Society, Kolkata (2011), Indian Council of Chemists, Agra (2015), Association of Chemistry Teachers, Mumbai (2018), North Gujarat University, Patan (2022). He has successfully guided 110 students for Ph. D. Dr. Ameta has more than 450 research papers and 36 books to his credit. He has contributed Chapters in Books published by Trans-Tech, Switzerland: Nova Science, Taylor & Francis, and Apple Academic Press, USA. Three books on Green Chemistry, Microwave Assisted Organic Synthesis and Chemical Applications of Symmetry and Group Theory have been published by Apple Academic Press, USA. Two more books on Solar Energy Conversion & Storage and Photocatalysis; An Emerging Technology has been released by Taylor & Francis, USA and a book on Waste Water Treatments by AOPs by Elsevier. He has completed 5 Major Research Projects by DST, UGC, CSIR, and Ministry of Energy, Govt. of India. Prof. Ameta has delivered lectures and chaired sessions in National Conferences organized in almost every part of this country. He is also reviewer of number of international Journals. Prof. Ameta has an experience of more than 50 years of Teaching and Research. Indian Chemical Society, Kolkata has published a Special issue of Journal of Indian Chemical Society in December 2008 to felicitate him on his 60th birthday and has instituted an Award in his name as Prof. Suresh C. Ameta Award to be given to a senior chemist of repute from 2003 onwards. He has delivered Lectures in International Conferences at Tokyo, Japan Hangzhou & Kunming, China, Valencia, Spain, Boston, USA, and is invited to deliver lectures at Singapore, Hong Kong, Barcelona, Spain and Rome, Italy in 2024. Above all, he has pointed out some problems in h-index and proposed a complimentary index as Ameta or A-index for further improving h-index and for this, he was granted a copyright for this improvement.

Julius K Tangka[1]*, Jaff Maryline Bongmo[1], Agbor Esther Etengeneng[2], Folepe Esther Azemo[1]

[1]Renewable Energy Laboratory, FASA, University of Dschnag, Cameroon
[2]Department of Biochemistry, University of Dschang, Cameroon

Biodiesel feed stock potential and biochemical properties of defatted seeds of some tropical wild oleaginous plants

A sustainable biodiesel program must take into consideration food security issues. A study was carried out to estimate the biodiesel feedstock potential of four tropical oleaginous seeds. The bio availability of nutrients and toxicity of their defatted seeds were also investigated. The seeds selected were Ricinodendron heudelotii (njangsa), Cucurbita maxima (pumpkin), Citrullus lanatus (watermelon) and Raphia hookeri (raphia). Oil was extracted from the seeds using a manual hydraulic press at 200 bars and filtered using a filter paper of 400microns. About 100g of each oil sample was subjected to transesterification reaction with methanol (99.98% pure) in a proportion of 6:1 in the presence of sodium hydroxide as a catalyst (1g) for 1 hour, mixing at a rate of 500rpm, and at temperature between 60 and 65 °C. Nutrient availability and toxicity of the defatted cakes were investigated using weanling Wistar albino laboratory rats aged 21 – 23 days old. All four oil samples had high conversion rates to biodiesel ranging from 79 % to 96.5 %. Infrared Spectroscopy (FT-IR) of both the straight vegetable oils and produced biodiesel confirmed the conversion of triglycerides into methyl esters. The biodiesel quality parameters of the four methyl esters were: density (790.85 to 823.11 kg/m3), kinematic viscosity (0.88 to 2.03 Pa.S), saponification value (182.4 to 210.4 mgKOH/g), sulphur content (1054.0 to 1840.1 ppm) calorific value (40.5 to 41.4 MJ/Kg), cetane number (65.5 to 68) and flash point (188.5 to 192.7 °C). In vivo studies showed a general decrease in growth performance and haematological indices of the test groups (D1, D2, and D3) when compared to the standard (D4). No mortality was registered amongst the wistar rats fed with the test diets. The biodiesel results showed that all four oils have the potential to be used as alternative cheap feedstock for biodiesel production. The results from the defatted seeds showed no toxicity in the defatted cakes meaning that they can be used for human and animal nutrition.

Keywords: Oil Seeds, Biodiesel, Ricinodendron Heudelotii, Cucurbita Maxima, Citrullus Lanatus, Raphia Hookeri, Defatted Cakes, Oil, Transesterification, Bioavailability, Toxicity.

Biography

Prof. Julius Kewir Tangka was appointed as the new Director of Infrastructure, Planning, and Development (DIPD) at the University of Dschang, as per Presidential Decree N° 2021/497 on August 31, 2021. An Associate Professor in Mechanical [Agricultural] Engineering, Prof. Tangka previously held the same position from 2008 to 2017. He replaces Prof. Ali Ahmed and has a wealth of experience, having served as DIPD at the University of Bamenda from 2017 to 2020. Prof. Tangka's extensive training includes stints at the Arava Institute for Environmental Studies in Israel, 2iE in Burkina Faso, and Gansu Natural Energy Research Institute in China. He holds certificates in renewable energy, biofuel implementation, and solar energy application. Before his current role, Prof. Tangka served as the Director for Development of Infrastructure, Planning, and Development at the University of Bamenda and previously held the position at the University of Dschang. He has also been a visiting lecturer and held consultancy positions with organizations such as SHUMAS Cameroon and KUDOC. With a strong educational background, he has supervised numerous master's dissertations and Ph.D. theses, earning national and international awards. Prof. Tangka, a member of various professional societies, has authored around thirty publications, including theses and conference papers. Born on February 4, 1965, in Kumbo, North-West Region, Prof. Tangka is married with five children. His appointment is expected to align with the collective dynamic spirit promoted by the University's head, Prof. Roger Tsafack Nanfosso, contributing to the institution's progress in infrastructure and development.

Tirath Raj

Department of Agricultural and Biological Engineering (ABE), University of Illinois, Urbana Champaign, Illinois United States

Green deconstruction approaches for processing of lignocellulosic crops for sustainable production of production of fuels and chemicals

Biofuels are a drop-in, environmentally nontoxic, biodegradable, and less contaminating alternative to conventional fuels with comparable energy efficiency, with strong potential for lowering CO_2 emissions. Cellulosic biomass has immense potential as a renewable feedstock for global energy needs. Bioenergy from traditional biomass such as cereal grains, forestry, and other energy crops constitutes approximately 7% of total global energy consumption. Oils from plants are particularly valued since they can be easily converted to biodiesel and bio-jet, serving markets that are unlikely to be electrified. To this end, bioenergy crops such as sugarcane, energycane, sorghum, and miscanthus are being metabolically engineered to shift the carbon flux from sugar to lipid synthesis and accumulation in their vegetative tissues. The accumulation of energy-rich Triacylglyceride (TAG) molecules enhances the energy density of these transgenic bioenergy crops as compared to their wild-type varieties. These metabolically engineered transgenic bioenergy crops can be used to produce both fermentable sugars and lipids/oil. Moreover, extraction of sugars and lipids from cellulosic crops is considered as a limiting factor and involves high costly, non-economic pretreatment method. Thus, herein, we have introduced the concept of bioenergy crops, their natural recalcitrance, and mentioned certain green pretreatment processing methods to extract maximum amount of sugars and oils for sustainable energy development.

Biography

Dr. Tirath received his PhD in Chemistry from the Indian University of Petroleum and Energy Studies. He has more than 10 years of expertise in the field of environmentally friendly biomass processing for the generation of fuels and chemicals at the laboratory and pilot scale while working at the greatest laboratories in the world in India, South Korea, and the United States. Presently, he is working as a post-doctoral research associate at University of Illinois in Urbana-Champaign, Illinois, USA, where in majority he is involved involve in development of efficient bioprocess for conversion of bioenergy crops for chemicals, biofuels, and other bioproducts at CABBI, the fourth Bioenergy Research Center supported by the US Department of Energy. Scientifically, he has contributed >40 publications in peer-reviewed international review journals, co-invented 3 international patents, coauthored 3 books and has been serving as an editorial board member of three reputed Journals.

Tokeer Ahmad

Department of Chemistry, Jamia Millia Islamia, Jamia Nagar, New Delhi, India

Functional heterojunctions nanocatalysts for scalable hydrogen production

Functional nanostructures based photochemical and photoelectrochemical water splitting is an ultimate source of hydrogen generation as renewable green energy for tackling the ongoing fuel crisis. g-C_3N_4 is an ideal candidate for overall water splitting as a result of the excellent alignment of its band edges with water redox potentials. However, a single catalyst with a limited number of active sites does not exhibit significant photo/electrocatalytic activity for hydrogen production. Therefore, we have developed the semiconductor heterostructures of g-C_3N_4 with $CuFe_2O_4$, Cu_2O, CdSe, CdS and MoS_2 NPs and QDs as the highly efficient nanocatalysts for enhanced hydrogen evolution reactions. The monophasic heterostructures have been designed in different weight ratios with fairly uniform distribution of nearly spherical particles and high specific surface area which creates an interfacial charge transfer between two semiconductors. As prepared heterostructures showed significant hydrogen evolution which is evident by observing high apparent quantum yield, low onset potential, lower overpotential and high electrochemical active surface area that will be presented in detail.

Biography

Prof. Tokeer Ahmad is graduated from IIT Roorkee and Ph.D. from IIT Delhi. Presently, he is full Professor at Department of Chemistry, Jamia Millia Islamia, New Delhi. Prof. Ahmad has supervised 15 PhD's, 77 postgraduates, 9 projects, published 175 research papers, one patent and three books with research citation of 6215, h-index of 47 and i10-index of 127. Prof. Ahmad is active reviewer of 149 journals, delivered 150 Invited talks, evaluated 50 external doctoral theses and presented 128 conference papers. Prof. Ahmad is the recipient of MRSI Medal, SMC Bronze Medal, ISCAS Medal, Inspired Teacher's President Award, DST-DFG award, Distinguished Scientist Award, Maulana Abul Kalam Azad Excellence Award of Education, Teacher's Excellence Award and elected as Member of National Academy of Sciences India. Prof. Ahmad has been figured in World Top 2% Scientists for consecutive four years since 2020 in both coveted lists including career long by Stanford University, USA. Prof. Ahmad has been recently admitted as Fellow of Royal Society of Chemistry (FRSC), UK.

Vanessa Wegat[1,2]*, Samed Guner[2], Manuel Doring[2,3], Jonathan T Fabarius[1], Arne Roth[1], Volker Sieber[1,2,3]

[1]Fraunhofer Institute for Interfacial Engineering and Biotechnology, Straubing branch Biocat, Straubing, Germany
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Robot-aided high-throughput engineering of FLS enzyme to establish in vivo synthetic c1 metabolism

Climate change poses the greatest environmental threat humanity has ever faced, primarily driven by the combustion of fossil fuels, which accounts for over 85 % of global CO_2 emissions and contributes to the anthropogenic greenhouse effect. To mitigate these processes, it is essential to not only reduce the use of fossil fuels and lower emissions but also actively capture and convert CO_2 in the atmosphere. In the context of a sustainable circular economy, the capture and conversion of atmospheric and industrial CO_2 into chemical products via biotechnological processes represents a promising route.

One way to achieve this is the construction and engineering of synthetic methylotrophic microbes, which use CO_2-based methanol as their sole carbon source. However, a major challenge is the toxicity of formaldehyde, an intermediate product of the metabolic conversion of methanol, even in small quantities. To address this challenge, a synthetic enzyme called formolase is used to convert formaldehyde directly into dihydroxyacetone. This pathway requires the implementation of only two enzymes in synthetic methylotrophic host organisms for efficient methanol assimilation. So far, the parental formolase enzyme exhibits low activity, restricting its practical applications. To address this limitation, the enzyme was subjected to iterative rounds of directed evolution. The key to the success of the directed evolution process was a high-throughput screening approach utilizing an automated procedure. By subjecting the enzyme to this screening, a novel FLS variant with higher expression levels and improved tolerance to formaldehyde in E. coli was identified. Moreover, this variant displayed a 30 % decrease in KM for the formose reaction and exhibited increased thermostability by 5 °C. The implementation of the FLS pathway offers several advantages. Firstly, it enables the direct conversion of formaldehyde into dihydroxyacetone, eliminating the need for multiple intermediate steps. This simplification of the pathway not only reduces energy and resource requirements but also enhances overall efficiency. Secondly, the streamlined nature of the pathway, requiring only two enzymes, facilitates its integration into synthetic methylotrophic host organisms. The semi-rational approach employed in this study combined rational design and directed evolution, leveraging existing knowledge of the enzyme's structure and function to guide the design of mutations while allowing for random mutations to explore new possibilities. This balanced approach proved successful in generating a highly improved FLS variant.

Audience Take Away Notes

- The audience will understand the benefits of using synthetic enzymes and directed evolution techniques in enhancing enzyme performance for tailored applications
- This research provides a practical solution for improving the efficiency of methanol assimilation, which can benefit researchers working in the field of sustainable and resource- efficient biotechnological processes
- The presented work provides valuable insights and knowledge with respect to application of automated high-throughput processes, their optimization and their limitations

- Specifically, the identification of an improved FLS variant opens up possibilities for the production of CO_2-based products and fuels, contributing to the circular economy and reducing carbon emissions

Biography

Vanessa Wegat studied Biochemistry at the Julius Maximilian University of Wurzburg, Germany, and completed her Master of Science in 2017. After a brief excursion into the pharmaceutical industry, she joined the Fraunhofer IGB as a Ph.D student at the end of 2018. In collaboration with the Technical University of Munich, she successfully defended her doctoral thesis in November 2023. Since December 2022, she has been leading multiple projects focused on high-throughput screening of enzyme libraries and fermentation processes for the production of CO_2-based products.

Vasily Lutsyk[1,2], Vera Vorobjeva[1], Anna Zelenaya[1], Maria Parfenova[1]*

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Phase diagrams 3D computer models as a novel tool to design the catalytic materials

The method of assembling an isobaric phase diagram from surfaces and phase regions represents the construction of a 3D object in the coordinates "concentration (x-y) - Temperature (T)" in such a way that the result is a 3D computer model of the phase diagram constructed exclusively geometrically, as if without the use of thermodynamics, which is certainly not the case. Therefore, for brevity, the described approach is positioned as a geometric one, unlike the thermodynamic calculations in CALPHAD-technology. The thermodynamic description of a ternary system requires all the necessary data from special databases. A geometric 3D model can be constructed with a minimum of information: Based on hypothetical data, a virtual prototype model is constructed, which gradually turns into a perfect model of a real system phase diagram as new information becomes available. The prototype takes into account all surfaces and phase regions, including those that then are degenerated in a phase diagram of real system. Such degenerations lead to the errors, sometimes serious, and the use of a prototype helps to avoid these inaccuracies. Compounds are another problem that researchers encounter when using thermodynamic programs. The corresponding calculations cannot be performed if the required parameters are unknown, whereas geometrically a 3D model can be constructed from "invented", virtual values of temperature dependencies of its homogeneity boundaries, replacing them later with real ones. The computer models of phase diagrams have been elaborated on the basis of PD DESIGNER and NEDITOR software of the authors. They allow, in addition to the obvious tasks of excellent visualization, to perform calculations of mass balances at all stages of crystallization, to restore the history of the formation of microstructure by studying the qualitative and quantitative composition of coexisting phases, and, in general, to find out the conditions for the formation of a material with specified properties. Based on the models of phase diagrams, commercial products will be developed in the form of a special program for each system, equipped with options for visualizing both the phase diagram itself and the results of crystallization calculations occurring in the corresponding system. Work on each system will be carried out in 4 stages: 1) Critical analysis of the initial data; 2) Construction of 3D computer models for various variants of phase diagrams; 3) Development of a final, verified and consistent 3D model of the phase diagram (assembled from surfaces and phase regions) describing the formation of microstructure; 4) Digitization - creation of commercial products - 3D computer models of verified phase diagrams with the patent support. Thus, completed 3D model of each phase diagram will be made in the form of an independent object (including a commercial product protected by a patent), which can be offered to users in the form of a complete description of all possible phase transformations in a ternary system equipped with extensive capabilities for visualizing all fragments of the phase diagram and the results of calculations of crystallization processes occurring in the system. Examples for the catalytic materials will be shown.

Biography

Materials CAD Laboratory engineer and Ph.D. student in IPMS SB RAS. Participated in conferences: CALPHAD GLOBAL CONFERENCE: 14th Conference for Young Scientists in Ceramics (CYSC-2021), October 20-23, 2021. Novi Sad, Serbia; 10th International Conference on Materials Science (ICMS2021). November 19-20 2021. Ulaanbaatar, Mongolia; III International Scientific and Practical Conference «Society and Science. Problems and Prospects». January 25-28 2022, London, England; 2022 Sustainable Industrial Processing Submit, SIPS-2022., November 27 - December 1. Phuket, Thailand; V International Conference "Modeling of synthesis and destruction of advanced materials'' (MSDAM-2022) October 12-14, Minsk, Belarus.

Wenjie Wang, Liping Guo, Lijun Liao, Wei Zhou*
Shandong Provincial Key Laboratory of Molecular Engineering, School of Chemistry and Chemical Engineering, Qilu University of Technology (Shandong Academy of Sciences), Jinan, Shandong, China

The synthesis and modification of g-C_3N_4-based materials for photocatalytic applications

Photogenerated charge separation and migration is crucial for photocatalysis and thus how to enhance the charge migration efficiency attracts lots of attention. In this regard, based on the two substances with the same composition elements, C_4N quantum dots /graphite-phase carbon nitride nanosheets assemblies (C_4NQDs/g-C_3N_4NSs) were fabricated with different C_4NQDs content through a simple self-assembly process (Figure 1a). Through this method, the C_4NQDs was interacted with the C_3N_4NS tightly. The photocatalytic hydrogen production of the optimized C_4NQDs/C_3N_4NSs assembly was up to 1980 μmol·g-1·h-1 and the Apparent Quantum Yield (AQY) could reach 32% at 365 nm, which is two times higher than that of original g-C_3N_4 nanosheet (Figure 1b). It can be ascribed to the strong electron absorption activity of pyrazine nitrogen in C_4N quantum dots activating the conjugated structure of the whole complex skeleton and thus promoting the migration and separation of photogenerated charge carriers. More importantly, the obtained C_4NQDs/C_3N_4NSs assembly showed high stability even after 6 recycles, indicating the potential applications in field of energy. This work provides an effective synthesis strategy of organic homogeneous structure assembly with high photocatalytic performance.

Biography

Prof. Dr. Wei Zhou received his PhD degree in 2009 from Jilin University, China. Afterwards, he worked at Heilongjiang University, and he became a full professor in 2015. From 2019, he joined Qilu University of Technology as a full professor. His research interests include mesoporous materials, semiconductor nanomaterials for solar energy conversion, photocatalysis, photothermal and photoelectrochemical performance. He has published more than 160 research articles in SCI(E) journals.

Wilmar Osorio Viana*, Roger Sinfreu Bergues, Oriol Tomas Badell, Gemma Villorbina Noguera

Department of Chemistry, Physics, Soil and Environmental Sciences, Centre for Agri-food & Biotech Development DBA, University of Lleida, Lleida, Catalonia, Spain

Towards a circular economy with biorefineries: Forestry waste biomass in Catalonia as innovation source

A successful circular economy will depend on the consolidation of an industry that will be able to manufacture high-tech/high-quality products that come from local renewable or waste biomass, and also capable to reach strategic markets worldwide. These products must be fine and platform chemicals, and advanced and smart materials, effective in replacing and surpassing current existing products. This work presents current status of NextGenerationEU project CEBIOREF, whose goal is the valorization of residual and low-value wood in the region of Catalonia (Spain), applying a cascade biorefinery approach to obtain high-performance adhesives, biopolymers and platform biochemicals. The conceptual design of the biorefinery include a lignin-first approach to get technical lignins, regenerated celluloses and fractionated lignocellulose with natural deep eutetic solvents and ionic liquids. The project's multidisciplinary approach is outlined and relevant considerations for research/innovation, scale-up and industrial ecology with lignocellulosic biorefineries are discussed.

Audience Take Away Notes

- The audience will get a critical perspective to biorefinery design
- Case study to biomass processing will be valuable to practitioners
- Multidisciplinary insights to circular economy for stakeholders and managers

Biography

Dr. Osorio studied Chemical Engineering at the National University of Colombia and graduated as MSc in 2007. He then joined the research group of Prof. Gomez (PRISMA) and received his PhD degree in 2014 at the same institution. He is postdoctoral fellowship supervised by Prof. Villorbina at the DBA Laboratory, Catalonia (University of Lleida), working in the field of biomass valorization, particularly in the issues related to scale-up of chemical process from lab to pilot plant, installation, start-up and operation of pilot plants for biorefinery operations using green chemistry and process intensification strategies.

Yangyang Guo[1]*, Tingting Liu[1], Lei Luo[1], Meng Ye[1], Tingyu Zhu[1,2]

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Interactive adsorption mechanism and product distribution of impurity gases on CO_2 adsorption over amine-grafted ZSM-5/SBA-16 adsorbent

Amine-grafted micro-mesoporous ZSM-5/SBA-16 adsorbents were synthesized in this work to improve the CO_2 adsorption capacity and investigate the effect of impurity gases on CO_2 adsorption. The interactive adsorption mechanism and the product distribution were systematically reported for the first time. A series of characterization methods, including X-Ray Diffraction (XRD), Thermogravimetric Analysis (TGA), N_2 adsorption and elemental analysis, were used to analyse the properties of the adsorbents. Amine grafting did not affect the crystal structure, and the organic amines were preferentially grafted to mesopores. ZS-A-2.0 had the highest CO_2 adsorption capacity of 41.39 mg/g and amine efficiency of 0.41. According to the co-adsorption experimental evaluation of multicomponent gases, the breakthrough curves of CO_2exhibited two stages at low concentration, showing that physical and chemical adsorption occurred simultaneously during the whole adsorption process. H_2O obviously promoted CO_2 adsorption, while SO_2 played a negative role in CO_2 adsorption, especially its physical adsorption. According to Temperature-Programmed Desorption (TPD) and in situ Fourier Transform Infrared Spectroscopy (FTIR) analysis results, CO_2 adsorption products have also been affected by impurity gases. The product of carbamate and $(RNH_3)_2CO_3$ increased by 19.6% in the presence of NO, while the CO_2 adsorption products were only 9.4% with SO_2 and H_2O. In addition, the interactive adsorption mechanism of CO_2 and impurity gases was further studied to support the actual flue gas application.

Audience Take Away Notes

- Understand the design of novel CO_2 adsorption materials
- Learn the competitive adsorption mechanism of different gas components
- Directing CO_2 capture from industrial flue gas

Biography

Yangyang Guo, Ph.D, Associate Professor. Dr. Guo was educated at Institute of Process Engineering, Chinese Academy of Sciences, where she earned her Ph. D degree in Environmental Engineering. For nine years, she worked on pollutants control and CO_2 capture for industrial flue gases, including six years as an associate professor with IPE working on catalyst technology and adsorption technology, directing research especially on SCR application and PSA capture technologies from flue gases.

Yitong Duan[1,2]*, Shirwa Awale[2], Matthew Russell[1], Klaus Suhling[2], Roland Fleck[1], Mark Green[2]

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[2]Department or Physics, King's College London, London, England

Biosynthesis of Quantum Dots (QDs) in Euglena gracilis

Many living cells isolated from heavy metal-rich environments have attracted increasing attention due to their ability to accumulate heavy metal ions and then form nano scale complexes for cellular detoxification. These include metal/metalloid chalcogenide Quantum Dots (QDs) which have wide applications including solar cells, optoelectronic sensors, photocatalysis, bioimaging and cancer treatment due to their unique optical-electrical properties. Although such naturally biosynthesized QDs always show excellent stability and biocompatibility when compared with traditional synthetic NPs, this is a relatively new and largely unfathomed field. The difficulty lies in finding suitable carriers to synthesize specific QDs and developing efficient techniques to discern them from intrinsic biological backgrounds. Herein, we exploited the natural biological process of Euglena gracilis (E. gracilis), a species of photosynthetic protozoa existing in most water bodies with an excellent ability to accumulate Cadmium (Cd) (5.23 mg/g dry weight) and great potential in Cd chalcogenides (CdE, E = S, Se, Te) QDs biosynthesis, however, has been rarely explored due to the interference from chlorophyll autofluorescence (emission wavelength 650-730 nm), to manufacture CdTe QDs as a by-product after the introduction of two metallic salts (CdC_{12} and Na_2TeO_3) that could result in a remedial toxic impact. So far, we determined the biosynthesis route, involving the thiol reduction of Tellurite and the detoxification of Cadmium in E. gracilis, facilitated the formation of luminescent nanomaterials in cells with emission wavelengths (550 nm) consistent with synthetic CdTe QDs. Fluorescence-lifetime imaging microscopy (FLIM) offered a unique method here for in situ detection of bio-QDs, effectively separating cells containing bio-QDs with much longer fluorescence decay lifetime (≈ 120 ns) from cells containing biological autofluorescence only (≤ 10ns). In this work, biosynthesized QDs was detected in E. gracilis cells by using fluorescence spectroscopy for emission wavelength of QDs and FLIM for fluorescence lifetime of cellular QDs. To further determine whether it's CdTe QDs, in future work we will employ TEM with EDS for localization and composition characterization of these bio-QDs. This work provides a promising model system with efficient characterization techniques to produce Cd chalcogenides bio-QDs with long emission lifetime.

Audience Take Away Notes

- The audience will gain insights into a green cell factory strategy which exploits two natural biological processes in living cells to yield nanomaterials as a by-product by exposing cells to simple inorganic salt precursors
- This work will bring photosynthetic cells, especially protist, into the vision of researchers who focus on Green Synthesis of Luminescent Nanomaterials. The interaction between luminescent nanomaterials and cell photosynthesis pathway provides the potential for the biosynthesis of such materials
- Microalgae play an important role in heavy metal bioremediation due to its low cost and environmental-friendly properties. This work provides a possibility of coupling bioremediation of heavy metals from environment and biosynthesis of metal-based valuable nanomaterials in the future using microalgae as carriers

- The audience will learn about efficient techniques to detect bio-QDs cellularly without a relatively high yield to make the fluorescence of QDs stand out from the complex biological background fluorescence

Biography

Yitong Duan studied Horticulture at China Agricutural University and graduated as BSc in 2017. She then joined the research group of Prof. Hong Lv at Fudan University to conduct high-efficiency secretory expression of heterologous enzyme proteins in yeast and graduated as MSc in Genetics in 2020. From 2021, she joined the Biological Physics Across Scales Centre for Doctoral Training (BiPAS CDT) at King's College London as a PhD student in physics supervised by Prof. Mark Green and Prof. Roland Fleck.

Yoshinori Mishina
Individual Researcher, Tokyo, Japan

Are potential reductions in CO_2 emissions via hybrid electric vehicles actualized in real traffic? The case of Japan

This presentation is based on the original paper with the same title by the presenter (Misina, Y., Muromachi, Y., 2017. Transportation Research Part D 50, 372-384) and includes recent study results. The number of private passenger Hybrid Electric Vehicles (HEVs) in use in Japan has increased rapidly since 2009. One of the advantages of HEVs over conventional passenger vehicles lies in the higher fuel economy obtained by recent technological innovations, which helps reduce carbon dioxide (CO_2) emissions from transport. However, are the potential reductions in CO_2 emissions via HEVs actualized in real traffic in Japan? To answer this question, this study estimates the regional gap between on-road fuel economy and fuel economy in the regulated test procedures (test fuel economy) of HEVs and regional direct rebound effects of HEV use during 2010–2013. To estimate the direct rebound effects, a methodological framework of the Modified Laspeyres Index (MLI) decomposition is proposed to quantify the contribution of kilometers traveled per vehicle to aggregate the differences between CO_2 emissions per HEV and those per standard/ small vehicle. The results show that the potential reductions in CO_2 emissions offered by the higher test fuel economy of HEVs have been offset markedly by the deterioration in test fuel economy and the direct rebound effects in real traffic over the period. An increase in fuel prices by implementing a fuel tax increase would be one method to improve the on-road fuel economy of HEVs and reduce the direct rebound effects. However, equity policies would be required for urban and rural regions.

Audience Take Away Notes

- Although this study focuses on the transportation sector, the study approach would present helpful information to researchers and policy makers and planners wishing to limit the environmental damages caused by emissions not only in the transportation sector but also in other sectors including chemistry and energy
- The methods of index decomposition analysis used in this presentation would yield more valid analysis results

Biography

Yoshinori Mishina studied Environmental Engineering at Tokyo Institute of Technology and received his Ph.D. degree from the same university in 2013. He is currently an independent researcher and an advisor to a Japanese engineering company. His recent published book is "Climate Change Countermeasures in the Transportation Sector (in Japanese)" co-authored.

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Production of petroleum-like hydrocarbons on rock particles with H2O and carbon compounds

H_2O can be dissociated on solid acids with the aid of thermal energy to form H and OH radicals, and eventually to become H_2 and O_2[1]. Furthermore, when carbon compounds are added to H_2O and reacted on sloid acids, H radical, and unstable hydrocarbon species and radicals can also be formed. Consequently, when H_2O reacts with inorganic and/or organic carbon compounds on solid acids, various kinds of aliphatic and aromatic hydrocarbons, as seen in petroleum reserves, can be produced. In a similar manner, H_2 and diversified hydrocarbons can also be produced on rock particles through reactions between H_2O and carbon compounds, because rocks consist mainly of solid acids such as SiO_2, Al_2O_3, and $CaCO_3$. Herein, we show that rocks play a catalytic role in H_2 formation via H_2O dissociation and in producing diversified hydrocarbons through synthesis reactions between H_2O and inorganic/organic carbons. The results of this study imply that petroleum-like hydrocarbons have been produced from the prebiotic era on Earth, and some rocks nearby hot springs or volcanic areas can be utilized to convert CO_2 into hydrocarbons.

Keywords: Catalytic Capability of Solid Acids and Rocks, Production of Diversified Hydrocarbons, CO_2 Utilization, H_2 Production.

Biography

Dr. Young Sang Cho studied chemical engineering at Seoul National University for BS in 1973. He further studied chemical engineering at Washington University in St. Louis, USA for MS in 1979 and D. Sc in 1981. He experienced industrial work at Lummus in New Jersey for 1 year. Then He worked for KIST from 1982 to 2015 as a researcher and became emeritus researcher from 2016 on. He has published about 50 research articles in SCI(E) journals.

Yousef Alqahs Alanezi[1]*, Choti Daches[2], Muthanna Al'Dahhan[2]

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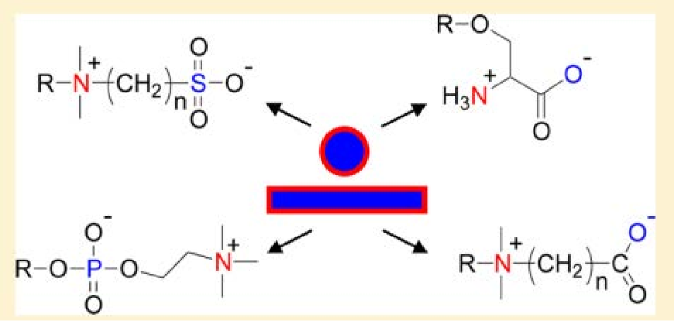
Surface functionalized ceramic membrane using super hydrophilic catalysis to enhance of oil in water separation

Coating surfaces with thin or thick films of zwitterionic material is an effective method to reduce or eliminate nonspecific adsorption to the solid/ liquid interface. The coating of the membranes was done in place i.e., while the membranes were fixed in the membrane housing connected to the filtration rig. 1 M cysteic acid solution was prepared using distilled water in the feed tank and preheated to 65°C. The filtration rig was then run with the permeate side open for 12 hours at a temperature of 85°C. Conductivity measurements from the permeate side were taken and when four approximately equal two alpha-alumina microfiltration membranes operated in crossflow mode were tested with feed water containing 1000 ppm mineral oil. The ceramic membranes have a mean pore size of 0.2 μm and are multichannel with tubular configuration.



Keywords: Microfiltration, Ceramic Membrane, Crossflow, Surface Functionalized, Cysteic Acid.

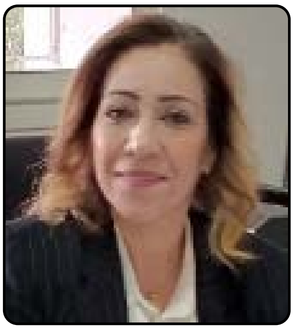
Audience Take Away Notes

- The use of zwitterions to protect surfaces is expected to raise, for example would be protecting membranes from fouling by particles and organics
- Because zwitterion interactions are reduced with exposure to aqueous NaCl, they are ideally suited for physiological or marine conditions and applications
- Stable oil-in-water emulsion was treated using surface modified ceramic microfiltration membranes in crossflow mode
- The ceramic membranes were surface treated with cysteic acid ($HO_3SCH_2CH(NH_2)CO_2H$) in order to improve their performance evaluated by flux monitoring and oil rejection efficiency
- The cysteic acid is not intended to create a separation layer on the membrane surface but enhanced the hydrophilic feature of the membrane
- The ceramic membranes showed high hydrophilicity by attaining a steady sustained flux in a short time indicating reduced membrane fouling
- The flux was monitored under constant pressure operation and results showed that the membrane performance was improved significantly

- The membrane efficiency was found to be greater than 99% with permeate quality of less 5mg/L oil concentration
- The cysteic acid coating when compared to other coating materials like nano-TiO_2 and nano-ZrO_2, exhibited a superior capability in improving membrane performance

Biography

Dr. Yousef studied Chemical Engineering at Leeds University (UK) for both Bachler degree and Master of Integrated Design of Chemical Plant. Then he worked as an inspection engineer for Desalination plant at Water Resecures and Development centre in Kuwait. Then he moved to Equate Petrochemical Company as daily production specialist in MEG plant in Kuwait. Then He joined the research group of Prof. Ricard Wakeman at Loughborough University in UK. He received his PhD degree in 2009 at the same institution. He worked as Assistant Professor in Chemical Engineering Department at CTS, PAAET, in Kuwait. In 2018, He took a sabbatical year, where he was scholar visitor at Department of Chemical & Biochemical Engineering, Missouri University of Science and Technology, Rolla, MO, USA. Aso, We conduct this research at Professor Al Dahhan's Lab, multiphase reactor lab (mFReact).



Zoubida Belmahi[1]*, Khadija Bakhy[2], Majid Mounir[3], Hanaa Abdelmoumen[4], Fatima Gaboun[2], Ghizlane Diriya[2]

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Study of genetic diversity of thymus satureioides in based on morphological traits and molecular markers ISSR

Thymus satureioides Coss. is an endemic and medicinal plant of Morocco, widely distributed in the arid and semiarid habitats. Communally used in traditional medicine to treat various infections. It is the most used and exported rare borneol thyme. Unfortunately, the degradation of the natural habitats and the climate Change are most factors for its conservation and domestication. There is no information on the intraspecific variations of the morphological and molecular features of this species. 12 Inter-Simple Sequence Repeats (ISSR) primers combined with 11 agro-morphological traits were applied to evaluate the intra- and inter variation. 60 accessions of T. satureioides collected from 10 spontaneous sites covering most geographical area, cultivated in two experimental stations Khemisset and Rabat. Phenotypic Variation Coefficient (CV) of the studied traits varied from 2.99 to 47.37% among biomass and number of inflorescence/ stems. ANOVA showed very highly significant differences between accessions for all the studied traits ($p < 0.0001$). PCA plot showed that 90.39% were the most six variable morphological characters. Among 80%, Cluster analysis grouped the accessions into two major clusters based on their morphological resemblance. AMOVA revealed that the Molecular variation within and between accessions was demonstrated to 82% and 18% respectively. The UPGMA dendrogram revealed two major groups, with a similarity of 80%. The number of bands is ranged from 12 for primer UBC825 to 28 for primer UBC4, those amplified 119 band and generating 739 amplicons. The UPGMA dendrogram, established through Nei's genetic distances, exhibited two groups. PCoA plot revealed two major groups of populations and consistent with genetic relationships derived from Cluster analysis. Tamssount region recorded high values of genetic diversity (He= 0,182), Percentage Polymorphic Loci (PPL=63.03%) and Shannon information index (I=0.283). These results highlighted a variability that will be useful for the breeding programme aiming at improving the productivity, conservation, and domestication of Thymus satureioides.

Keywords: Thymus Satureioides, Endemic, Polymorphism, Phenological, Molecular Analysis, Issr Markers, Primer, Genetic Diversity.

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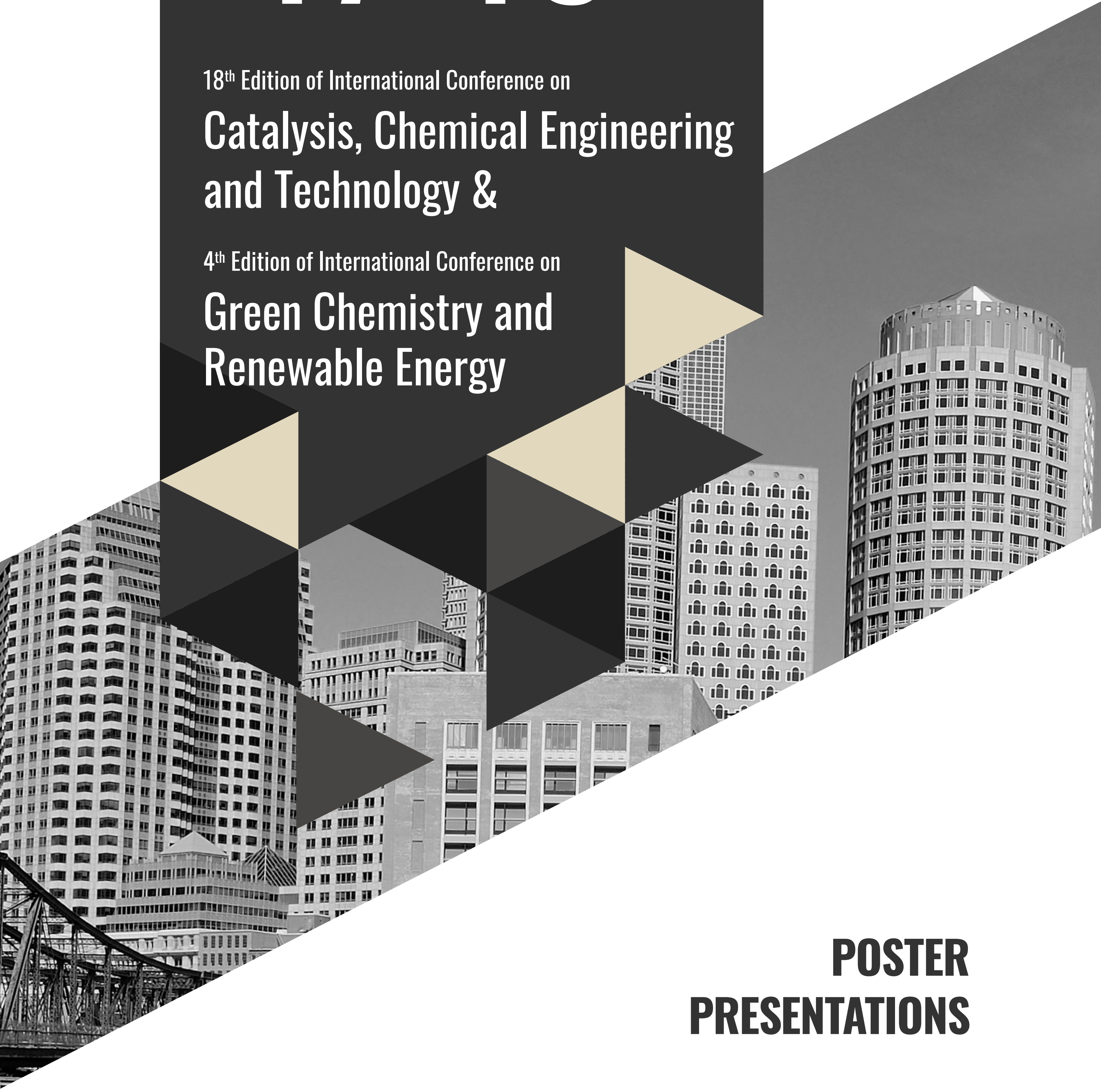

POSTER PRESENTATIONS

A Alghamdi[1]*, A Abdul Jameel[1,2,3]

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[2]Center for Refining & Advanced Chemicals, King Fahd University of Petroleum & Minerals

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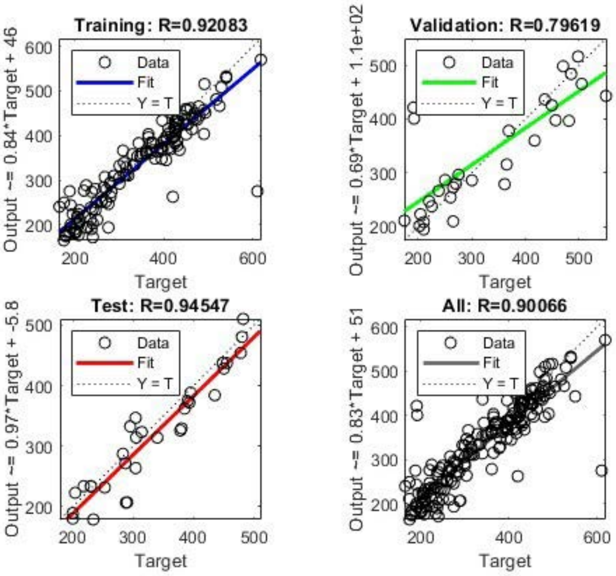
Autoignition temperature prediction using machine learning

Fuels, serving as primary energy sources, encompass diverse hydrocarbons and organic compounds, with Autoignition Temperature (AiT) being a critical property indicating flammability. Accurate AiT measurement is vital for safe fuel handling. This report explores experimental methods for AiT determination, emphasizing liquid and gaseous substances. Factors influencing AiT in gas mixtures, including pressure and molecular structure, are discussed. The study delves into the phenomenon of autoignition, differentiating between "hot flame ignition" and "cold flame ignition." Additionally, alternative approaches, such as Quantitative Structure-Property Relationship (QSPR) models and Support Vector Regression (SVR), are explored for AiT prediction. A dataset of 204 pure organic compounds, categorized by functional groups, is utilized. Molecular Weight (MW) and Branching Index (BI) are key parameters. An Artificial Neural Network (ANN) model, employing the Levenberg-Marquardt algorithm, is developed. The ANN architecture comprises input, hidden, and output layers. Evaluation metrics include Mean Squared Error (MSE) and Correlation Coefficient (R). The ANN models, trained with MW, BI, and functional groups, exhibit satisfactory accuracy, with the 20-layer model showing the highest correlation coefficient (R). The dataset's diversity is emphasized, suggesting the inclusion of mixtures and blends for improved accuracy. The study concludes that incorporating such complexities can enhance AiT prediction models.

Keywords: Autoignition Temperature, Artificial Neural Network, Fuel Safety, Branching Index, Levenberg-Marquardt Algorithm.



Audience Take Away Notes

- Enhancing safety protocols by accurately measuring and understanding AiT for different fuel compositions
- Implementing experimental methods, especially in the assessment of liquid chemicals, for reliable AiT predictions
- Addressing the complexities involved in determining AiT for gas mixtures, considering various influencing factors
- Exploring alternative approaches like QSPR models and SVR for AiT prediction, providing additional tools for researchers and practitioners
- Leveraging ANN models, particularly the 20-layer variant, to enhance AiT predictions using a combination of molecular features
- Improving accuracy in AiT predictions, crucial for safe handling and storage of fuels
- Offering insights into diverse fuel compositions, assisting in risk assessment and management
- Providing alternative methodologies, such as QSPR and SVR, for AiT prediction, expanding the toolkit for researchers and industry practitioners
- Introducing ANN models as a practical tool for AiT prediction, potentially streamlining the evaluation of flammability characteristics
- This research provides a comprehensive exploration of AiT measurement methods and prediction techniques, offering valuable insights for faculty engaged in research and teaching in the fields of chemical engineering, fuel technology, and safety protocols
- Absolutely, the application of ANN models and alternative prediction methodologies simplifies the AiT prediction process, making it more efficient for designers and professionals involved in fuel-related industries
- The research enhances accuracy in AiT predictions, providing crucial information for designing safety protocols, storage facilities, and handling procedures for different fuel compositions
- Some of the other benefits
    - Increased safety in fuel handling and storage
    - Diverse methodologies for AiT prediction cater to different contexts
    - Insights into gas mixture complexities offer a broader understanding of flammability
    - Application of AI models contributes to the advancement of predictive capabilities in fuel-related industries

Biography

Amru Alghamdi, born in January 2003, is a driven junior chemical engineering student at King Fahd University of Petroleum and Minerals. His academic journey is complemented by a fervent engagement in extracurricular activities. Actively participates in various student clubs and also holds the position of president in the chemical engineering club. Passion for research through involvement in undergraduate research initiatives. In academic pursuits, ventured beyond the conventional, as demonstrated by my success in the CHEMATHON 2023 Arabian Gulf Research Competition. This accomplishment signifies my commitment to chemical sciences. Have a keen interest in artificial intelligence (AI) and machine learning.

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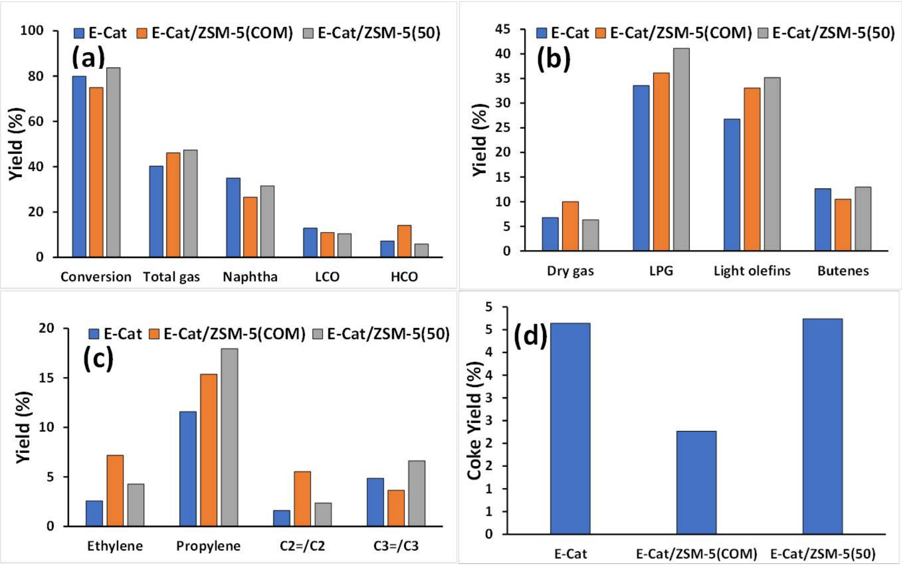
[2]Interdisciplinary Research Center for Refining and Advanced Chemicals, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia

Catalytic conversion of low-density polyethylene/HVGO blend to light olefins over

Three mesoporous ZSM-5 catalyst additives with different Si/Al ratio were synthesized using simple hydrothermal rapid ageing synthesis approach. The ZSM-5 additives were mixed with Equilibrium Catalyst (E-Cat) in the ratio of 85%E-Cat:15%ZSM-5. The catalysts were used for the catalytic cracking of 2.5%LDPE/HVGO at 600 oC in Micro Activity Test (MAT) unit. The results of these tests were compared with commercial ZSM-5 additive (E-Cat/ZSM-5(COM)). The 2.5%LDPE/HVGO cracking over E-Cat/ZSM-5(COM) shows low conversion (of 74.95%) than the E-Cat catalyst (with conversion of 79.91%), and this was ascribed to the diffusion limitation that result due to the pore size of ZSM-5(COM) additive. In the case of mesoporous ZSM-5(50) additive, the conversion increases to 83.68%. The total gas yield increases from 40.3% in E-Cat to 47.4% in E-Cat/ZSM-5(50), where the light olefins yield increases from 26.78% in E-Cat to 35.17% in E-Cat/ZSM-5(50). The ethylene and propylene yields increase from 2.58% and 4.27% in E-Cat to 11.58% and 17.95% in E-Cat/ZSM-5(50). The increase performance due to the ZSM-5(50) additive is ascribed to its textural properties that minimizes the diffusion limitations observed in the case of ZSM-5(COM). Similarly, the activity of ZSM-5 additive with various Si/Al ratio was further compared. The cracking of 2.5%LDPE/HVGO over ZSM-5(25) result in conversion of 75.5%, which increases to 81% in the case of ZSM-5(75), and the total gas yield increases from 39.24% to 51.14%, where the light olefins increases from 29.82% to 38.44%. The ethylene and propylene yields increase from 3.55% and 14.65% to 4.79% and 19.91% respectively. The improved performance of ZSM-5(75) over the other zeolites was due to its suitable acid sites and textural properties. This approach offers a sustainable solution for reducing plastic waste and decreasing carbon emissions, while also advancing the chemical industry towards a more sustainable future.



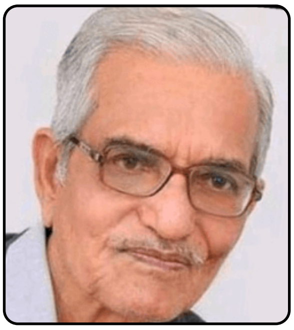
Keywords: Fcc, Cracking; Zsm-5, Hvgo, Light Olefins, Plastic.

Audience Take Away Notes

- The audience will gain insights into the effects of different mesoporous ZSM-5 catalyst additives, specifically focusing on their Si/Al ratio, on the catalytic cracking process of 2.5%LDPE/HVGO. They'll learn about the performance enhancements observed due to variations in textural properties and acid sites
- **Optimizing Catalytic Conversion:** They will learn about the optimized ratio (85%E-Cat:15%ZSM-5) for mixing these catalysts and how this mixture positively influences the conversion rates of LDPE/HVGO, particularly in generating higher yields of light olefins like ethylene and propylene
- **Sustainable Solutions for Plastic Waste Reduction:** Insights into utilizing these catalyst additives as a sustainable approach for reducing plastic waste and decreasing carbon emissions will be highlighted, showcasing their potential impact on advancing the chemical industry towards a more sustainable future
- This knowledge will benefit professionals in the chemical industry involved in catalysis and refining processes. They can apply these findings to optimize catalytic converters, design more efficient catalysts, and improve the yield of desired products like light olefins, thereby enhancing their performance in catalytic cracking operations
- Other faculty members involved in research or teaching related to catalysis, chemical engineering, or sustainable technologies could use this research as a reference to expand their own studies. It provides insights into the impact of catalyst properties on conversion rates and product yields, aiding in the exploration of similar or diverse catalyst systems
- Yes, this research provides a practical solution by introducing optimized mesoporous ZSM-5 catalyst additives. These additives enhance catalytic cracking processes, potentially simplifying the design of more efficient catalysts for industries involved in refining processes, thereby contributing to increased efficiency and reduced waste
- It improves the accuracy of catalytic converter designs by providing specific insights into the effects of different catalyst properties on conversion rates and product yields. Additionally, it offers new information on how mesoporous ZSM-5 catalyst additives with varied Si/Al ratios can influence the efficiency of the catalytic cracking process
- Some of the other benefits:
    - Contributing to environmental sustainability by proposing a method to reduce plastic waste and carbon emissions
    - Advancing knowledge in catalysis and refining, potentially leading to more sustainable and efficient industrial processes
    - Offering a pathway for further exploration and innovation in designing catalysts for improved conversion rates and product yields

Biography

Abdulaziz Alghamdi, a junior Chemical Engineering student at KFUPM, demonstrates fervor for chemical catalysts and personal development. His proactive nature extends beyond academics, fostering skills and relationships. A pivotal moment arose from a prestigious Gulf research competition, where he showcased talents, shared innovative ideas, and connected with peers. This experience mirrors Abdulaziz's commitment to excellence and ambitions in chemical engineering and sustainability contributions.



D C Joshi

Principal Scientist (Retired) ICAR- Central Arid Zone Research Institute, Jodhpur
Rajasthan, India

Sustainable management of sodic water irrigated arid soils: Issues and strategies

The farming system in arid region of Rajasthan (India, rainfall zone of 200- 250 mm) in mainly rainfed but in pockets brackish ground water occurs, which is commonly used for irrigation. Brackish water, characterized by low calcium, magnesium and sulphate ions and high sodium, carbonate and bicarbonate ions and high Residual Sodium Carbonate (RSC) create sodicity in soil. Internationally, water containing RSC more than 2 m moles L^{-1} (Eaton, 1950; Wilcox et al. 1954) and in arid Rajasthan RSC more than 5 m moles L^{-1} (Joshi and Dhir, 1989) has been considered unsafe for irrigation. Irrigation with water of higher RSC (10-20 m moles L^{-1}) and high Sodium Adsorption Ratio (SAR 20-35) and moderate salinity (3.5- 4.6 dSm^{-1}) causes severe sodicity in soil resulting in development of alkalinity pH (9.2- 10.5) and high exchangeable sodium percent (40-50) in soils.

Issues: High sodium in irrigation water causes precipitation of Ca^{2+} from soil exchange complex and increase adsorption of Na^{+} ions, which result in development of sodicity in soil. Clay particles are dispersed because of alkaline pH. These dispersed clay particles choke the macro and micro pores of soil resulting in unusual hardness, reduced water infiltration and difficult soil working. Surface soil crusting hindering seedling emergence, growth of crop plants is stunted, because of reduced aeration, root growth is limited to few centimetre depth, poor and patchy crop and low yields. Rain and irrigation water remain ponded on the surface. considerable reduction in crop yield. Even rainfed kharif crop is not possible on soils. Frequent plowing during rainy season and application of higher doses of farm yard manure/ organic manure do not help. Farmers switchover to new land with same water. In spite of their adverse effects on soils and crops, brackish water is the only source of irrigation to support agriculture for years to come.

Strategies: For sustainable management of soils irrigated with these problematic water research work has been carried out on farmers' fields and techniques developed. Keeping these facts in mind the technology has been developed for sustainable management of soils with high RSC irrigation water. Essential ingredients of technology are (a) use of amendments, (b) in situ conservation of rain water, and (c) growing tolerant species. Gypsum application is necessary for neutralisation of adverse effect of sodium on soil exchange complex. At a number of sites on farmers' fields, treatments viz. (1) G_2: 100% 0f soil Gypsum Requirement (GR) + the quantity of gypsum required to neutralize RSC in excess of 5 me L^{-1}; (2) G_1: 50% of soil GR + quantity of gypsum required to neutralize RSC in excess of 10 me L^{-1}, and (3) Go: no gypsum application were applied for plot size 40 m x 40 m for each treatment.

Field studies were taken at five locations on farmers' fields for amelioration and management of loamy sand, sodic soils (pH 8.8-9.7, EC 0.2–1.3 dSm-1, SAR 20.9-55.2) with brackish water (pH 7.7 – 8.5, EC 2.4 – 6.6 dS m^{-1}, RSC 6.0-20.6 me L^{-1}, SAR 25.6 – 55.8) irrigation (Table).

Farmers' fields Sites	Irrigation water			Irrigated soils			
	EC (dS m^{-1})	SAR	RSC (m moles L^{-1})	pH	EC (dS m^{-1})	SAR	Gypsum requirement (m eq 100 g^{-1} soil)
I	2.9-5.1	35.7-56.6	13.8-20.6	9.3-9.5	0.4-1.1	31.9-55.2	2.0-4.2
II	5.9-6.6	37.7- 55.8	6.0- 12.3	8.8-9.5	0.3-0.8	26.3- 26.6	0.4-3.6
III	4.4- 5.1	26.4-37.2	7.2- 9.4	8.8-9.1	0.6-0.8	12.4- 15.6	0.4-2.4
IV	3.1- 4.7	26.2-44.5	7.6- 14.2	9.0-9.4	0.2-0.7	8.9- 17.4	0.2- 6.0
V	2.4-2.5	25.6-46.6	14.6-15.0	9.3-9.7	0.8- 1.3	20.9- 41.9	4.2- 5.4

At each site 1.5 ha area was divided into different treatment plots. The quantity of gypsum applied to each plot was based on soil Gypsum Requirement (GR) and amount of gypsum needed to neutralize excess RSC in irrigation water. The quantity (depth) of irrigation water for the wheat crop was taken 35 cm. quantity of gypsum for three treatment was calculated as: G_2: gypsum @ 100 % of soil gypsum requirement + quantity of gypsum to neutralize RSC in excess of 5 m moles per litre (ii) G_1: gypsum @ 50% of soil gypsum requirement + quantity of gypsum to neutralize RSC in excess of 5 m moles per litre. iii) G_0: no gypsum application. Wheat crop was raised as per farmers' practice.

After harvest of crop soil analysis revealed that as the result of G_2 treatment significant decrease in the soil pH by 0.3 – 0.4 units and SAR values of the soils. There was more decrease in SAR values of G_2 plots than G_1 and G_0 plot soils. Gypsum treatment resulted in higher plant density (76 to 164/ m^2) and tillers/ plant (91.6 to 6.3) than the fields, where gypsum was not applied (plant density 70 to 122/ m^2 and 1.5 to 3.5 tillers /plant). There was significant improvement in yield of wheat grain. Significant decrease in the soil pH and SAR values was reflected in grain yield increase. After harvest of crop the accumulated (cm/ 90 minutes) and equilibrium infiltration rate (cm/ hr) at sites were $G_2 > G_1 > G_o$. Once the soils have been reclaimed, small application of gypsum are needed to avoid further sodification.

Biography

D. C. Joshi (1943) did M.Sc. Ag. (1966) and Ph.D. (1976) in Soil science. During 1966- 1976, as Research Assistant and Assistant Soil Survey Officer, Department of Agriculture, Government of Rajasthan, and During 1976-2000 with ICAR- Central Arid Zone Research Institute, Jodhpur, as scientist/ senior scientist/ Principal Scientist in the Natural Resources and Environment Division, on Soil resources appraisal, Micro-nutrients : status, availability, land degradation and desertification, On farm research "Amelioration of soils degraded due to saline/ high RSC water irrigation and sustainable management", and at RISSAC, Budapest (Hungary) in Indo-Hungarian intergovernmental collaborative project (1999-2001) on mapping of salt affected soils and management of soils irrigated with saline/high RSC (carbonate) water. During 2000- 2003, Principal Production System Scientist, Arid Agro-ecosystem, National Agriculture Technology Project. Since 2003, retirement after super annuation, as consultant and writing research papers and books. Published research papers 115, books 19, book chapters 52, total publications 295.

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Nanocomposites based on Fe_3O_4 and $BaTiO_3$ in oxidation of benzyl alcohol and 1-phenylethanol using different energy inputs

Green chemistry focuses on developing environmentally friendly processes that minimize waste and reduce the use of hazardous substances. In this regard, this abstract explores the oxidation of alcohols, specifically benzyl alcohol and 1-phenylethanol, using unconventional methods such as microwave and ultrasound irradiation and nanocomposites based on Fe_3O_4 and $BaTiO_3$ as heterogeneous catalysts.

The oxidation of primary and secondary alcohols is a significant transformation in organic synthesis. Benzaldehyde and acetophenone products of the oxidation of benzyl alcohol and 1-phenylethanol, respectively are versatile compounds with wide industrial applications more concretely used in dyes, perfumes, and pharmaceuticals.

Barium titanate ($BaTiO_3$) and magnetite (Fe_3O_4) are promising materials to use on different energy inputs due to their properties, once the ceramic one ($BaTiO_3$) presents ferroelectric, piezoelectric, and dielectric behaviours, meanwhile the iron oxide exhibit ferromagnetism, meaning it becomes magnetized in the presence of a magnetic field and retains its magnetization when the field is removed.

Microwave irradiation provides rapid heating due to the interaction of electromagnetic waves with the reaction mixture, leading to accelerated reactions. Ultrasound irradiation generates cavitation bubbles that enhance mass transfer and promote reaction kinetics. Both methods offer efficient ways to carry out alcohol oxidations with improved selectivity and reduced energy consumption.

Acknowledgments: This work was supported by the Fundacao para a Ciencia e Tecnologia through project 2022.02069.PTDC, and by the Instituto Politecnico de Lisboa with the IPL/2023/SMARTCAT_ISEL project. LC is also grateful for the Ph.D. grant UI/BD/152790/2022.

Audience Takeaway Notes

- Green chemistry emphasizes environmentally friendly processes that minimize waste and hazardous substances.
- Utilizing unconventional methods like microwave and ultrasound irradiation, along with nanocomposites as catalysts, enhances the oxidation of alcohols such as benzyl alcohol and 1-phenylethanol
- The resulting products, benzaldehyde and acetophenone, are versatile compounds with wide industrial applications in dyes, perfumes, and pharmaceuticals
- Barium titanate ($BaTiO_3$) and magnetite (Fe_3O_4) exhibit unique properties making them promising materials for various energy inputs, contributing to efficient and sustainable chemical processes

Biography

Elisabete C.B.A. Alegria received her PhD in Chemistry in 2006 (IST, University of Lisbon, Portugal). Researcher at Centro de Quimica Estrutural (Coordination Chemistry and Catalysis) and Professor in Instituto Superior de Engenharia de Lisboa (ISEL, Portugal). She has authored 90 papers in international peer review journals, 4 patents and 8 book chapters. Editorial board member, Guest Editor and Reviewer in several scientific journals. Her main research interests' range over Coordination and Sustainable Chemistry, Homogeneous and Supported Catalysis, Stimuli-Responsive Catalytic Systems, Green Synthesis of Metallic Nanoparticles for Catalytic and Biomedical Applications. Mechanochemistry (synthesis and catalysis) and Molecular Electrochemistry.

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SLCA methodology applied to bio-based fertilizers from fisheries/ aquaculture waste in the scope of the Sea2land project

The United Nations' 17 Sustainable Development Goals advocate for a circular economy, addressing social, environmental, and economic aspects of sustainability. Within this framework, the Horizon 2020 Sea2Land project endeavors to transform wastes and sidestreams from fisheries/aquaculture into bio-based fertilizers. While environmental life cycle assessment standards are established, the methodology for social Life Cycle Impact Assessment (sLCA) is still evolving. The UNEP guideline provides a foundation for rigor and comprehensiveness in data collection and treatment. It primarily uses qualitative or semi-quantitative indicators related to the well-being of all the stakeholders involved in the value chain of the life-cycle of a product. Our sLCA, adopting a UNEP type 1 or reference scale based method aligns indicators with recognized social standards or benchmarks. BBF production in the foreground level involves 3 or 4 organizations: the aquaculture/fishery, the fish processor/transformer, the BBF formulator and farmers. Leveraging tools like the Social HotSpot Database (SHDB) and common global and european databases, we obtain generic data, supplemented by semi-specific and specific data through expert viewpoints and stakeholder surveys. For (bio)-fertilizer producers to address social hotspots, the entire BBF production supply chain is considered, including suppliers of chemicals, biological materials and energy. Thus, for a BBF produced in France, certain generic indicators relating to health & safety, unemployment and migrant labor require special attention for both energy and chemical sectors. To focus on fertilizer companies, more fine-grained data can be obtained through specific public sources documenting social certifications such as the IFA (International Fertilizer Association), collective conventions, public commitments. The data collected also show that the price given to fish waste has a significant contribution to the social impact of BBFs as does the origin of the other ingredients in biobased fertilizers. In a first approach, fish waste is considered as burden-free and should not endorse the social impacts of this sector. However, adherence to standards and certifications such as ASC (aquaculture stewardship council), MSC (Marine Stewardship Council), BAP (Best Aquaculture Practices), GRI (Global Reporting Initiative) is a good indicator of social compliance. In conclusion, our sLCA methodology, rooted in recognized standards, offers a broad perspective on the social impacts of BBF production, acknowledging the involvement of diverse stakeholders and the significance of responsible sourcing.

Audience Take Away Notes

- Audience could apply the presented methodology for other case studies, being more aware of responsible sourcing of their raw materials
- Audience can become more sensitive to social impacts and could improves many aspects of social impact categories as health & safety procedures, working conditions
- If another faculty is teaching sustainability this research deals with concrete case studies that could serve a more practical teaching
- By integrating sLCA in global sustainability assessment, it is possible to remove barriers in the acceptance of their products
- This will provide new information and help getting better accuracy in sLCA studies

Biography

Dr. Jean François Fabre studied physical and chemical sciences in the graduate school of Chemistry and Physique of Bordeaux. He then joined the Laboratory of Agro-Industrial Chemistry in Toulouse where he participated in several projects linked to oleochemistry (extraction, chemical transformation, valorization of molecules of interest, notably lipids) in a circular economy, zero-waste frame. After his PhD degree, he also learned about life cycle assessment, applying it to new projects and teaching it to Master's students. He was also formed in social life cycle assessment and taken the responsibility of applying it to produce more sustainable bio-based fertilizers in the Sea2Land project. He received in 2023 an award of best young scientist from the Toulouse Chemical Institute based on his pHD and subsequent works. He has published 24 research articles in SCI(E) journals.

Iva Oliveira Tavares[1], Marco Antonio Gaya de Figueiredo[2]*, Jose Marcos Ferreira[1], Cristiane Assumpcao Henriques[3]

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Technology roadmap: Trends in the use of fluidized bed catalytic cracking catalysts in bio-oil co-processing in refineries

The need to decarbonize the energy matrix based on fossil fuels has led different segments to seek alternatives through the use of biofuels. The present work proposes, using the prioritization technique called Roadmap, to analyze the trend regarding the use of catalysts in different operations carried out in refineries (Fluid Catalytic Cracking, and others), for the co-processing of renewables (bio-oil) in their units. Based on the technique, maps of the short-term situation will be shown based on the analysis of approved patents and what has already been carried out, a map with the medium-term trend, based on patent applications and a final long-term map considering the information extracted from articles available on different platforms (Scopus, Science Direct, among others). The study will consider a time span of 10 years. The roadmap methodology consists of temporal assessment, enabling the identification of associations between different institutions (companies and universities or research centers). It uses, to analyze the taxonomy identified when reading all the material, allowing to evaluate the state of the art in terms of types or developments of catalysts used and types of processing, whether co-processing occurs in Fluid Catalytic Cracking (FCC), in the Hydro Thermal Processing (HDT) or Catalytic Hydrocracking (HCC).

Preliminary results indicate that in terms of refining processing, FCC has been the most used step, whether in bio-oil co-processing or in biomass cracking. Next, HDT is the second most used option, as for the catalyst, ZSM5 has been most cited in the references analyzed so far.

Audience Take Away Notes

- Knowledge of technology trends in the short/medium and long term helps guide research in the line of catalysts for the co-processing of renewables in catalytic cracking
- For those who work in the processing of petroleum and derivatives, it will show aspects related to operational conditions and co-processing yields, for researchers, aspects related to the type of catalyst used
- The present work is related to a master's thesis, its recommendations serve as a basis for new research in the segment
- The work does not present practical solutions, it only indicates the direction to be considered in the line of catalysts for the co-processing of renewables in oil refining units
- The work will provide information that can help study the difficulties identified in the co-processing of renewables in refineries

Biography

Dr. Marco Antonio Gaya de Figueiredo, graduated in Chemical Engineering from the State University of Rio de Janeiro, worked at the Petrobras Research Center (CENPES), completed his master's degree in 1993, doctorate in 1997 from the Federal University of Rio de Janeiro (UFRJ). He has been professor at the State University of Rio de Janeiro for 25 years. He is a full professor at the Institute of Chemistry and coordinator of the Petroleum and Petrochemical Engineering and Technology Laboratory, who works on research in different areas (polymers, fertilizers and petroleum fractions), has published more than 45 articles in journals in the area.

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Screening of Ionic Liquids (IL) and Deep Eutectic Solvents (DES) through COSMO-RS for the efficient lignocellulosic fractionation of peach stone cover

Peach stone is a major waste in the food processing industry. However, the shell contains a high lignocellulosic content (80 % of lignin, cellulose and hemicellulose) which make it a potential valuable by-product. The increasing shift towards circular bioeconomy requires not only reintroduce waste into the production chain, but also to find green alternatives to conventional extraction methods. The lignocellulosic fractionation is a challenging step needed for the separation of their components prior to their use as platform chemicals, carbon fibers or textile fibers (among others). In the recent years, Ionic Liquids (IL) and Deep Eutectic Solvents (DES) have emerged as sustainable alternatives to conventional fractionation methodologies, such organosolvent, acidic or alkaline pretreatment. The combination of different low-cost IL/DES with the software COnductor-like Screening Model for Realistic Solvents (COSMO-RS) lead us to an efficient screening for the selection of the best candidates for the lignocellulosic fractionation of peach stone shell. By applying two different approaches, one for each type of solvent, based on the Kamlet-Taft parameters, we were able to test more than 20 IL and DES and find three of them with similar or even greater extraction efficiency than the well-known triethylammonium hydrogen sulphate, used as a reference. The analytical techniques such as FTIR, GPC and 31P-NMR confirmed the extraction products as carbohydrate rich fraction (containing mainly celluloses and hemicelluloses) and a lignin rich fraction, showing differences among solvents in terms of yield, composition and structure. This work provides an efficient methodology to screen solvents for the fractionation of lignocellulosic materials, regardless the starting material, and peach stone shell as a potential valuable by-product.

Audience Take Away Notes

- The audience will learn that peach stone can be a valuable resource
- The research will add knowledge on the screening of potential solvents for lignocellulosic fractionation
- The COSMO-RS application could lead to a simplified screening methodology
- The fractionation products can lead to new potential applications

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Synthesis and anti-hypoxia activity of salidroside

High altitude reaction is a common disease unique to the plateau area, with common symptoms such as dizziness, headache, insomnia, loss of appetite, fatigue, and difficulty in breathing. In China, especially in Tibet, the plant has been an important source of substances for the treatment of various diseases, especially those related to oxidative stress. Rhodiola rosea is a traditional herb used in Chinese Tibetan medicine to treat plateau hypoxia. Modern research shows that salidroside is the main active ingredient of Rhodiola rosea, which has pharmacological activities such as improving blood microcirculation, reducing myocardial oxygen consumption and anti-fatigue. Due to the scarcity and low content of natural resources as well as the complexity of the extraction process, it can be obtained by chemical synthesis, biosynthesis, and biocatalytic (enzymatic) synthesis. The key step of chemical synthesis is the coupling of substituted phenylethanol with glucose pentaacetate, which is a low-cost and fast method, and is a feasible measure to advance the industrial production of salidroside. The in vitro study revealed that the HUVECs and EA.hy 926 cells treated with conditioned medium from osteoblast cells (MG-63 cells) treated with salidroside or treated directly with salidroside showed enhanced proliferation, migration and capillary structure formation. However, supplementation with an anti-VEGF antibody during the treatment of Endothelial Cells (ECs) significantly reversed the pro-angiogenic effect of salidroside. Moreover, salidroside upregulated HIF-1α expression and increased its transcriptional activity, consequently upregulating VEGF expression at the mRNA and protein levels. In addition, in vivo analysis demonstrated that it can stimulate endothelial sprouting from metatarsal bones. Thus, the experimental results show that the pro-angiogenic effects of salidroside involve HIF-1α-VEGF signalling by coordinating the coupling of angiogenesis-osteogenesis in the bone environment. Based on the structure of salidroside, it is promising to carry out the design of novel compounds and the evaluation of anti-hypoxia activity, and then develop new and efficient drugs for the prevention and treatment of plateau hypoxia injury.

Audience Take Away Notes

- Common symptoms and treatment of high altitude reaction
- Methods of constructing models of hypoxic injury and studying the mechanism of action of anti-hypoxic injury
- Stimulate research thinking and open up new research areas

Biography

Dr. Li studied Chemistry at the Zhengzhou University, China and graduated in 2008. She then joined the research group of Prof. Lei Xiaoguang at the National Institute of Biological Science (NIBS), Beijing & Tianjin University, Tianjin, China. She received her PhD degree in 2014 and joined the Tianjin Key Laboratory for Prevention and Control of Occupational and Environmental Hazards, China. She was recognized as an Associate Professor in 2019. Her specific research interests include the following: Development of new catalytic reactions for the efficient construction of substituted cyclohexanes, total synthesis of structurally complex and bioactive natural products, exploring the mechanism and target of action of anti-hypoxia active natural small molecules.

Xia Li*, Zeyun Xiao, Kai Li, Yaxiao Li

Tianjin Key Laboratory for Prevention and Control of Occupational and
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Catalytic asymmetric diels-alder reaction of 2'-Hydroxychalcone as a dienophile with VANOL-borate ester comple

A large number of natural products have been isolated from various Moraceous and related plants, in which more than forty classes of prenylflavonoid and related Diels-Alder (DA)-type natural products have been characterized. Due to their potent biological activities, including anti-inflammatory, anti-anticancer, anti-HIV and anti-malarial, and so on, the Diels-Alder natural products are intriguing synthetic targets. One of the most effective method for the syntheses of these DA-type natural products is the Diels-Alder cycloaddition of substituted chalcones and diene substrates. In our previous studies, an efficient method for the asymmetric Diels-Alder cycloaddition of 2'-hydroxychalcones with acyclic or cyclic dienes has been successfully developed. The Diels-Alder cycloaddition is mediated by a chiral boron complex with VANOL, affording the corresponding products in high yields and with excellent diastereo- and enantioselectivities. It's worth stating that the chiral VANOL/BH_3/AcOH catalyst complex was used in stoichiometric amount (1.2-2.5 equivalent). Herein, we reported an efficient catalytic asymmetric Diels-Alder cycloaddition of 2'-hydroxychalcone and its derivatives using catalytic amount in situ generated chiral R-VANOL-Borate complex. To probe the effect of catalyst loading on the reaction yield and enantioselectivity, different equivalents of LA4 were screened under the above optimal conditions ($PhCF_3$, 100 oC). The result suggested that 10 mol % of $B(OPh)_3$/R-VANOL complex is sufficient to promote this asymmetric reaction efficiently. A bright orange color change was observed when the borate catalyst and 2'-hydroxychalcone were combined, indicating the potential generation of an active borate complex that has been previously confirmed by single X-ray crystal structure analysis and density functional theory calculations.

Audience Take Away Notes

- A method for catalytic asymmetric synthetic methodology and its application
- The reactivity and enantioselectivity depend on the in situ generated chiral boron complexes
- The researchers will be able to apply this catalytic approach in their scientific research

Biography

Dr. Li studied Chemistry at the Zhengzhou University, China and graduated as MS in 2008. She then joined the research group of Prof. Lei at the National Institute of Biological Science (NIBS), Beijing & Tianjin University, Tianjin, China. She received her PhD degree in 2014 and joined the Tianjin Key Laboratory for Prevention and Control of Occupational and Environmental Hazards, China. She was recognized as an Associate Professor in 2019. Her specific research interests include the following: Development of new catalytic reactions for the efficient construction of substituted cyclohexanes, total synthesis of structurally complex and bioactive natural products, exploring the mechanism and target of action of anti-hypoxia active natural small molecules.

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