CIMEE22

4th International Symposium on Materials, Electrochemistry & Environment

22 - 24 September, 2022
LEBANON

Theme: Advanced Green Chemistry & Sustainable Technology for Environmental Enhancement


BOOK of ABSTRACTS & PROGRAM

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BOOK OF ABSTRACTS, FOURTH INTERNATIONAL SYMPOSIUM, CIMEE22

MATERIALS, ELECTROCHEMISTRY & ENVIRONMENT

BEIRUT, LEBANON, SEPTEMBER 22-24, 2022




THE WORLD EVENT IN INNOVATION CHEMISTRY & SUSTAINABLE ENVIRONMENTAL REMEDIATION

CIMEE22, THE CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS

SYMPOSIUM PARTNERS

- Laboratory of Applied Chemistry & Environment, National School of Applied Sciences, ENSA, University of Ibn Zohr, Agadir, Morocco
- Laboratory of Electrochemistry, Molecular Engineering and Redox Catalysis, Faculty of Technology, University of F. Abbas Sétif-1, Algeria
- Center of Materials Technology and Photonics, Hellenic Mediterranean University, Heraklion, Crete, Greece
- Laboratory of Environmental Engineering and EcoTechnology, National School of Engineering of Sfax, ENIS, University of Sfax, Tunisia
- Department of analytical Chemistry, Faculty of Pharmacy, Ankara University, Turkey

With the support of Agence Universitaire de la Francophonie, AUF

Book of Abstracts & Program

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Fourth International Symposium on Materials, Electrochemistry & Environment
FPH, DSST, Lebanese University, Lebanon

Printed in Lebanon

WELCOME MESSAGE FROM THE SCIENTIFIC COMMITTEE CHAIR

Dear colleagues and friends,
Good morning,
I am very happy to be with you in this fourth edition of the international conference CIMEE, on Materials, Electrochemistry and the Environment.
The CIMEE International Scientific Conference is a forum for researchers, allowing them to present and discuss the results of their research in the different fields of chemistry and environmental science following 6 research axes
CIMEE22, is organized by the Lebanese University in partnership with universities, laboratories and research centers in North Africa, the Middle East and Europe.
The conference aims to provide a forum of the knowledge on recent advances in key areas of chemistry and environmental science as well as meet certain application requirements in the framework of studies in fields related to energy, nanotechnology, and materials.
The main objective of this meeting is to initiate the exchange of new studies and results through plenary lectures, oral communications and posters. All the interventions that will be scheduled will aim to launch scientific debates on the choice of electrochemical methods, materials with low environmental impact and respectful of the environment.
Special sessions, poster, and oral presentations will be included to the conference program. Presentation language will be in French or English.
We very much appreciate if you can spread this Symposium to your colleagues and students. If you have any questions, please email us at cimee16@ul.edu.lb

On behalf of the organizing committee, we are looking forward to welcoming you in Lebanon on September 22, 2022.
Scientific Committee Chair

WELCOME MESSAGE FROM THE SCIENTIFIC COMMITTEE CHAIR (FRENCH)

Chers collègues et amis,
Bonjour,
Je suis très heureux d'être parmi vous dans cette quatrième Edition du colloque international CIMEE, sur les Matériaux, l'électrochimie et l'environnement.
La Conférence Scientifique Internationale du CIMEE est un forum pour les chercheurs, leur permettant de présenter et de discuter les résultats de leurs travaux de recherche dans les différents domaines de la chimie et science de l'environnement suivant 6 axes de recherche
Cette quatrième édition de la conférence internationale sur les sciences des matériaux, l'électrochimie et leur impact sur l'environnement et de leurs applications dans les domaines de l'énergie, des sciences matériaux, de l'environnement et du développement durable et de la biotechnologie, CIMEE22, est organisée par l'Université Libanaise en partenariat avec des universités, laboratoires et centre de recherches de l'Afrique du nord, de Moyen Orient et l'Europe
La conférence a pour but de faire le point sur les connaissances acquises et de fournir des informations d'experts sur les progrès récents dans les domaines clés de la chimie et de science de l'environnement ainsi que répondre à certaines exigences d'applications dans le cadre des études dans les domaines liés à l'énergie, la nanotechnologie, et les matériaux
L'objectif principal de cette rencontre est d'initier l'échange de nouvelles études et résultats à travers des conférences plénières, des communications orales et des posters. Toutes les interventions qui seront programmées auront pour but le lancement de débats scientifiques sur le choix des méthodes électrochimiques, des matériaux à faible impact environnemental et respectueux de l'environnement.
Des sessions spéciales, des poster et des présentations orales seront incluses dans le programme de la conférence. La langue de présentation sera le français ou l'anglais.
Nous apprécions beaucoup si vous pouvez diffuser ce symposium à vos collègues et étudiants. Si vous avez des questions, veuillez nous envoyer un courriel à cimee16@ul.edu.lb
Au nom du comité d'organisation, nous nous réjouissons de vous accueillir au Liban le 22 septembre 2022.
Président du comité d'organisation.
***Comité scientifique du colloque** CIMEE22*

WELCOME MESSAGE FROM THE CONFERENCE CHAIR

Ladies and gentlemen,

Dear Colleagues, Hello everyone,

On behalf of the organizing committee, I am pleased to welcome all colleagues from the Lebanese University (Doctoral School for Science and Technology, DSST, Lebanese CNRS, Faculty of Science and Faculty of Agricultural Engineering and Veterinary Sciences and all the Algerian, Tunisian, Moroccan, Greek and Turkish partners as well as their guests at the fourth CIMEE22 Symposium, which will be held at the Centre Numerque Francais, CNF from September 22 to 24, 2022.

In recent years, agricultural regions all over the world have been subject to increasing water stress. Severe droughts in the Mediterranean have affected agricultural production and reduced surface and groundwater reserves. These and other extreme weather events like floods and storms are also expected to become more frequent. Climate change is predicted to increase variability in precipitation and surface water supplies, reducing snow cover and glacier area and affecting crop water requirements.

In addition to these changes, farmers in many parts of the world will face increased competition from other non-sector users due to expanding urban populations, as well as demand for water from the industrial sector. Water quality is also expected to deteriorate in many regions as a result not only of increased polluting activities, but also of salinization induced by sea level rise and changes in water availability.

This situation is perhaps exacerbated by the question of the existence of a complex relationship between the water, energy and food sectors, as these resources may experience a serious shortage. The competitive demand for freshwater resources for agriculture, energy and human consumption is also expected to increase. Agriculture is already responsible for absorbing 70% of the planet's total fresh water, making it the sector that uses this resource the most.

In this context, we find that understanding the management of natural resources is of fundamental importance. Hence emphasis on all efforts towards the sustainable management of natural resources, such as fresh water, as well as the emphasis on resource efficiency for agriculture, such as treatment, exchange and productive water, and other types of water. Priority will also be given to improving irrigation efficiency and agricultural water productivity as a means of addressing water scarcity in developing countries. As well as water production for agriculture, remote sensing and geographic information system applications, as well as surface and groundwater modeling to determine water balance and agricultural production.

This conference aims to give the opportunity to researchers and experts in the fields of applied chemistry, biotechnology and various environmental sciences to form research teams at the national, regional and international levels, and highlights the central role that nature plays in our lives and in sustainable development.

Our meeting today is attended by researchers and representatives from more than 25 countries to launch the fourth edition of the international conference (in person and online) for 3 three days. This conference attracts a large number of participants from different organizations, including decision-makers and leaders from all sectors in the region and the world because of its significant impact on agriculture, the environment, chemistry and the economy.

Based on this situation, we will work in cooperation with all partners to support applied research and projects related to green economy, circular approach, biodiversity, green chemistry and environment.

Therefore, we invite the CIMEE Steering Committee to organize this conference annually, during the month of September 2023.

The Call for Papers will be extended to October 30, 2022 to receive manuscripts from all participants.

Finally, we would like to thank all those who contributed to the success of this conference, in particular the Agence Universitaire de la Francophonie for technical support, as well as all the partners from universities and scientific institutions in the Maghreb and Europe.

Looking forward to seeing you all in the next CIMEE Symposium on September 2023

El Moll Ahmad

Conference Chair

WELCOME MESSAGE FROM THE CONFERENCE CHAIR (FRENCH)

Mesdames et messieurs,
Chers et chères collègues, Bonjour à toutes et à tous,
Au nom du comité organisateur, j'ai le plaisir d'accueillir tous les collègues de l'université Libanise (Ecole Doctorale en Science et Technologies, EDST, CNRS libanais, faculté de sciences et La faculté du génie agronomique et des sciences vétérinaires, Beyrouth et tous les partenaires Algériens, Tunisien, Marocains, Grecque et Turques ainsi leurs invités au quatrième Colloque CIMEE22, qui se tiendra au CNF de Tripoli du 22 au 24 Septembre 2022
Ces dernières années, des régions agricoles partout dans le monde ont été soumises à des contraintes hydriques de plus en plus importantes. De graves sécheresses en méditerranée ont affecté la production agricole et fait baisser les réserves d'eaux superficielles et souterraines. Ces phénomènes et d'autres événements météorologiques extrêmes comme les inondations et les tempêtes devraient aussi devenir plus fréquents. D'après les prévisions, le changement climatique va accentuer la variabilité des précipitations et des approvisionnements en eaux de surface, ce qui réduira la couverture neigeuse et la superficie des glaciers et aura une incidence sur les besoins en eau des cultures.

En plus de ces changements, les agriculteurs de nombreuses régions du monde auront à faire face à la concurrence accrue d'autres utilisateurs extérieurs au secteur du fait de l'expansion de la population urbaine, ainsi que de la demande d'eau émanant du secteur de l'énergie et de l'industrie. La qualité de l'eau devrait en outre se détériorer dans de nombreuses régions sous l'effet non seulement de la multiplication des activités polluantes, mais aussi de la salinisation induite par l'élévation du niveau des mers et des modifications des disponibilités d'eau déjà évoquées.
Cette situation est peut-être exacerbée par la question de l'existence d'une relation complexe entre les secteurs de l'eau, de l'énergie et de l'alimentation, ces ressources pouvant connaître une grave pénurie, selon les attentes des pays à faible revenu. On s'attend également à ce que la demande concurrentielle de ressources en eau douce pour l'agriculture, l'énergie et la consommation humaine augmente. L'agriculture est déjà responsable de l'absorption de 70 % de l'eau douce totale de la planète, ce qui en fait le secteur qui utilise le plus cette ressource.

Dans ce contexte, nous constatons que la compréhension de la gestion des ressources naturelles de sa gestion est d'une manière qui revêt une importance fondamentale. De là vient l'accent mis sur tous les efforts en faveur de la gestion durable des ressources naturelles, telles que l'eau douce, ainsi que l'accent mis sur l'efficacité de l'utilisation des ressources pour l'agriculture, comme le traitement, l'échange et l'eau productive, et d'autres types d'eau. La priorité sera également accordée à l'amélioration de l'efficacité de l'irrigation et de la productivité de l'eau agricole comme moyen de répondre à la pénurie d'eau dans les pays en développement. Ainsi que la production d'eau pour l'agriculture, les applications de télédétection et de système d'information géographique, ainsi que la modélisation des eaux de surface et souterraines pour déterminer le bilan hydrique et la production agricole

Cette conférence vise à donner l'opportunité aux chercheurs et experts dans les domaines de la chimie appliquée, de la biotechnologie et des diverses sciences de l'environnement de former des équipes de recherche aux niveaux national, régional et international, et met en lumière le rôle central que joue la nature dans nos vies et dans le développement durable. Notre réunion d'aujourd'hui est suivie par des chercheurs et des représentants de plus de 25 pays pour lancer la quatrième édition de la conférence internationale (qui se tiendra au Liban en personne et via Internet) pour 3 trois jours. Cette conférence attire un grand nombre de personnalités, dont des décideurs et des dirigeants de tous les secteurs de la région et du monde en raison de son impact important sur l'agriculture, l'environnement la chimie et l'économie.
Sur la base de cette situation, nous travaillerons en coopération avec tous les partenaires pour soutenir la recherche appliquée et les projets liés à l'économie verte, à l'approche circulaire, à la biodiversité la chimie verte et à l'environnement. Par conséquent, nous invitons le Comité permanent du CIMEE à organiser cette conférence annuellement, au cours du mois de septembre 2023.
Le Call for Papers sera prolongé pour le 30 Octobre 2022 afin de recevoir les manuscrites de tous les participants.

Enfin, nous tenons à remercier tous ceux qui ont contribué au succès de cette conférence, en particulier l'Agence Universitaire de la Francophonie pour l'appui technique, ainsi que tous les partenaires des universités et institutions scientifiques du Maghreb et d'Europe
Au plaisir de vous voir en septembre 2023
ElMoll Ahmad
Associate Professor, and Conference Chai
Lebanese University
Conference Chair

WELCOME MESSAGE FROM THE ORGANIZING COMMITTEE CHAIRS

Dear Authors,
Boosted by the success of the last three editions CIMEE16, CIMEE18 and CIMEE20 of these symposia, the Lebanese university, European and north African partner universities have once again come together to create a forum where scientists from Middle East and abroad can define the future trends in chemistry and the best solutions to the environment. Globally, we are witnessing increased interest in many researchers' academics and scientists, which require looking at innovative environmental solutions from different perspectives.
Further to that success, the CIMEE22 Advisory and review committee is proud to organize the Fourth International Symposium on Materials, Electrochemistry and Environment. Contributions dealing with any discipline promoting research in Environment materials, electrochemical environment and environmental analytical chemistry are welcome.

A record number of 112 papers were submitted, and 70 papers accepted for 13 sessions. Because the Conference is limited to three days, the Conference program is a result a rigorous selection procedure.
I would like to welcome all the participants, and especially, to express the warmest gratitude to all the presenters for sharing their valuable experiences with all CIMEE22 participants. Many thanks go to Advisory and review committee co-chair for his outstanding efforts. My special thanks go to my good friends and reviewers, without their help this conference would not have taken place.
Welcome to CIMEE22 and welcome to Lebanon!

Authors of the most outstanding contributions, as selected by the CIMEE22 advisory and review committee, will be invited to publish their work as a research article (maximum length of 6 pages), in a Special Issue of the collaborating journal.
On behalf of our dynamic editorial staff and active scientific committee, we warmly invite you to join us during this edition and we look forward to publishing your contribution.

Organizing committee Chair

WELCOME MESSAGE FROM THE TECHNICAL PROGRAM COMMITTEE CHAIRS

It is a great honor to welcome you to the Fourth International Symposium, CIMEE22, 22 – 24 September 2022, Lebanon. You will find an exciting technical program which composes 12 technical sessions.
The conference has originally received 110 abstracts from 23 countries, of which 70 have eventually been accepted. In addition, the program is enriched with exciting special sessions and of course our flagship plenary keynotes.

A Technical Chair we are very grateful to the incredible work of the Track Chairs who have worked to ensure a smooth delivery of the review process. Our thanks extend to the dedicated TPC members and all the reviewers. It is thanks to the efforts of our community that we delivered high quality reviews.

We would like to take this opportunity to express our sincere gratitude to the CIMEE22 chairs, tutorials chairs and technical program committee members and reviewers. Preparation of this outstanding program would not have been possible without their dedication and hard work.

We would also like to thank the authors of all submitted Abstracts/papers. If you are attending this year, do enjoy the high-quality presentations and don't forget to network! We are looking forward to an exciting conference with many stimulating discussions over keynotes, panels and technical sessions.

We hope that you will enjoy the technical program and we look forward to meeting you physically in Lebanon or virtually at CIMEE22.

Ahmad ElMoll Lebanese University, Lebanon
Konstantinos Plakas, CERTH, Thessaloniki, Greece
Technical Program co-chairs

SEPTEMBER 22 - 24, 2022 | BEIRUT, LEBANON

Symposium Partners

L AST UPDATED 29 09, 2022.

Scope & Topics

We have the honor to invite more than 30 distinguished experts as speakers to present their speech.
The event has the objective of creating an international forum for academics, researchers and scientists from worldwide to discuss worldwide results and proposals regarding to the soundest issues related to Materials/Nanomaterials, electrochemistry and Environment.
All of them reached very high scientific levels, giving to all the participants the opportunity of listening to the most celebrated world speakers presenting state of the art advances in chemical sciences and to discuss openly with the chemistry community.
We're pleased to announce the scientific program with several of Plenary, keynote and invited speakers that have confirmed their participation in the Symposium
In the meantime, if you have any questions or want to be at the scientific committee, please do not hesitate to contact us. Cimee16@ul.edu.lb

Theme: Advanced Green Chemistry and Sustainable Technology for Environmental Enhancement

The CIMEE22 is being built under the unifying theme of Chemistry the Central Science, focusing on the central role of chemistry at the interfaces with Geology, material and environmental sciences, both for the progress of humankind and for the solution of fundamental problems of modern societies. If you are interested in submitting a paper for consideration to present at the conference, please prepare and submit a manuscript (6 pages) before 30 October 2022. An exciting scientific program led by world class experts will develop around six main scientific topics:

T 1. MATERIALS & THE ENVIRONMENT
1.1. Nanomaterials, Nanostructures & Environment.
1.2. Nanomaterial-based biosensors for pollutants detection
1.3. Nanotechnology & Nanobiotechnology for Environmental Remediation
1.4. Carbon Nanotubes-Based Nanomaterials & Their Applications
1.5. Advanced Textile Materials for Composite Applications

T 2. ELECTROCHEMISTRY & ENVIRONMENT
2.1. Electrochemistry for the Environment
2.2. Electrochemical and environmental sensors, Biosensors technology
2.3. Organic electrochemistry & Bioelectrochemistry
2.4. Electrochemical nanosensors and their application

T 3. ATMOSPHERIC CHEMISTRY & ENVIRONMENTAL POLLUTION
3.1. Air quality monitoring and Climate Change
3.2. Tropospheric Aerosols and chemistry of the atmosphere-hydrosphere
3.3. Aerosol chemical, biological composition, transport, sampling methods

T 4. STRUCTURAL, ANALYTICAL & PHYSICAL CHEMISTRY
4.1. Environmental chemistry, Analytical chemistry
4.2. Air pollution, Pesticides & environmental monitoring,
4.3. Bioremediation & Phytoremediation of environmental Pollutants.
4.4. Remediation Technologies Applied in the Environment.

T 5. AGRO GEOENVIRONMENT & AGROCHEMISTRY
5.1. AgroGeoenvironment & Geomaterials
5.2. Biomaterials, Waste & biomass valorization
5.3. Atmospheric Chemistry, Geochemistry & Earth Materials
5.4. Agro-materials, & Environmental geochemistry.

T 6. CLIMATE CHANGE, MARINE & COASTAL ECOSYSTEM
6.1. AgroGeoenvironment & Geomaterials
6.2. Impacts of climate change in coastal marine systems
6.3. Global warming, Marine and Coastal Environment

L AST UPDATED 29 09, 2022.

SCIENTIFIC PROGRAM

CIMEE22 Scientific Program	
Day 1 - Thursday 22 September 2022	
(Morning session)	
Opening Session	
Chairs: Najla Fourati, ElMoll Ahmad	
08h30 – 09h00	Registration / poster installation
09h00 – 10h00	Official Opening Ceremony
10h00 – 10h30	Opening Keynote, KL1: Innovative solutions for the promotion of non-conventional water reuse and management in the Mediterranean region **Konstantinos V. Plakas** Centre for Research and Technology, Hellas (CERTH), Thessaloniki, Greece
10h30 – 11h00	Opening Keynote, KL2: Extracellular Polymeric Substances from marine microalgae: application for water and wastewater treatment processes **Jihen Elleuch** Director of National School of Engineers of Sfax, University of Sfax, Tunisia
11h00 – 11h20	KL3: Use of simple, low cost and environment friendly techniques for the growth of thin films, nanostructure layers, nanomaterials, nanocomposites and suspensions. **Emmanuel Koudoumas** Department of Electrical and Computer Engineering, Hellenic Mediterranean University, Greece
11h20 – 11h40	KL4: Agroecology as new approaches to the transition towards sustainability **El Moll Ahmad** Faculty of Public Health, faculty of Science, DSST, Lebanese University, Lebanon
11h40 – 13h00	***Coffee break and refreshement***
(Afternoon session)	
ORAL SESSION 1: ELECTROCHEMISTRY & ENVIRONMENT (T2)	
Chairs: ElMoll Ahmad, Dalila Hammiche	
13h00 – 13h20	Invited speaker, PL1 : On the road to Zero Waste Treatment Technologies: Regeneration of Spent Adsorbents through Advanced Oxidation Processes **Marta Pazos** Department of Chemical Engineering, CINTECX, University of Vigo, Spain
13h20 – 13h40	PL2: Trends and perspectives in surface acoustic wave sensors **Najla Fourati** Conservatoire National des Arts et Métiers, Cnam, Paris, France
13h40 – 13h55	OC 1 : Nanostructures Based Electrochemical Sensors: the Future of Medicine and Disease Diagnosis **Ahmed Barhoum** National Centre for Sensor Research, School of Chemical Science, Dublin City University, Dublin, Ireland
13h55 – 14h10	OC 2 : Synthesis, crystal structural, electrochemistry behavior study of a ligand hybrid **Mourad Latoui** Laboratoire d'Electrochimie, d'Ingénierie Moléculaire et de Catalyse Redox (LEIMCR), Abbas Sétif-1 University, Setif, Algeria
14h10 – 14h25	OC 3 : Corrosion inhibition potential of Cactus juice for carbon steel in hydrochloric acid medium **Oubahou Mohammed** Laboratory of Physical Chemistry of Materials, Faculty of Sciences Ben M'Sick, Hassan II University of Casablanca, Morocco.
14h25 – 15h00	***Coffee break & refreshments***

ORAL SESSION 2: AGRO GEOENVIRONMENT & AGROCHEMISTRY (T5)	
Chairs : Najla Fourati, ElMoll Ahmad	
15h00 – 15h20	KL5 : Bio-based fertilisers (BBF) in agriculture - achievements and trends **Marzena Smol** Mineral and Energy Economy, Research Institute, Polish Academy of Sciences, Poland
15h20 – 15h40	PL3 : Waste and biomass valorization for use as Bio fillers for biocomposites **Dalila Hammiche** Laboratory of Advanced Polymeric Materials, Faculty of Technology, University A. Mira- Bejaia, Algeria
15h40 – 15h55	OC 4 : Kraft lignin functionalization as an alternative to phenol-formaldehyde resins through enzymatically generated hydroxyl or phenoxy radicals **Emmanuel Bertrand** UMR1163, Biodiversité et Biotechnologie Fongiques, Aix Marseille - Université, INRAE, Marseille, France
15h55 – 16h10	OC 5 : RoDuoEnergy: RoDuoEnergy: modern biomass energy system **Mihail-Alexandru Stanescu** University Politehnica of Bucharest, Romania
16h10 – 16h25	OC 6 : Selective condensation of small sugars by reconstructed Hydrotalcite towards the synthesis of polyol-based flame retardants **Fatima Rammal** CSCE, Katholieke Universiteit Leuven, Celestijnenlaan 200F, Leuven 3001, Belgium
16h25 – 16h35	***Coffee break and Poster session***
ORAL SESSION 3: MATERIALS & THE ENVIRONMENT (T1)	
Chairs: Merzougui Moufida, Ahmad ElMoll	
16h35 – 16h55	PL4 : Antimicrobial Effectiveness of Engineered Photocatalysts **Giusy Lofrano** University of Rome "Foro Italico", Italy
16h55 – 17h15	PL5 : Surface Engineering at Nanoscale - Design and Applications **Sajan Daniel George** Department of Atomic and Molecular Physics, Manipal Academy of Higher Education Manipal, Karnataka, India
17h15 – 17h30	OC 7 : Low-cost and ecological materials applied to decentralized wastewater remediation: the multi soil layering biotechnology **Ali Mohssine** Laboratory of Process Engineering and Environment, Faculty of Sciences and Technology, University Hassan II, Mohammedia, Morocco.
17h30 – 17h45	OC 8 : Nanomaterial based on β-Cyclodextrin-Graphene oxide-PLA and vegetal reinforcement for the development of ultrafiltration membrane **Naima Djellouli** Laboratoire des Sciences et Techniques de l'Environnement LSTE-Département Génie des Procédés de l'Environnement, École Nationale Polytechnique, 10 Rue des frères Oudek El Harrach, Alger, Algérie.
17h45 – 18h00	OC 9 : Experimental Design Approach for the Removal of Heavy Metals using Activated Glebionis Coronaria L. **Hanan Tounsadi** Université Hassan II de Casablanca, Faculté des Sciences et Techniques, Laboratoire de Chimie Physique et de Chimie Bioorganique, BP 146, Mohammedia, Morocco
18h00 – 18h30	Round table - Coffee break and Poster session

CIMEE22 Scientific Program	
Day 2 - Friday 23 September 2022 **(Morning session)**	
ORAL SESSION 4: STRUCTURAL, ANALYTICAL & PHYSICAL CHEMISTRY (T4)	
Chairs: Konstantinos Plakas, Ahmad ElMoll	
08h30 – 09h00	Registration
09h00 – 09h20	PL6 : Environmental surveillance with Mössbauer spectrometry, magnetic methods, and modern gravimetry **Tadeusz Szumiata** COMW, Department of Physics, University of Technology and Humanities in Radom, Poland.
09h20 – 09h40	PL7: Biodiversity as a tool box for environmental cleanup with emphasis on resource recovery. **Majeti Narasimha Vara Prasad** School of Life Sciences, University of Hyderabad, Hyderabad, India
09h40 – 10h00	PL8: Fungal laccases for environnemental applications **Susana Rodríguez-Couto** Department of Separation Science, Lappenranta-Lahti School of Engineering Science, Lappenranta-Lahti University of Technology (LUT University), Finland
10h00– 10h15	OC 10 : A novel unsymmetrical Schiff base oxovanadium complex: Catalytic bromine dynamics of phenol red in water **Moufida Merzougui** Laboratory of Electrochemistry, MERC, Faculty of Technology, University of Ferhat Abbas Sétif, Algeria
10h15 – 10h45	***Coffee break & Poster session***
ORAL SESSION 5: AGRO GEOENVIRONMENT & AGROCHEMISTRY (T5)	
Chairs: Ahmad ElMoll, Marta Pazos	
10h45 – 11h05	Invited Speaker, PL9: Waste-to-Energy: Recent developments and future perspectives towards circular economy **Abd El-Fatah Abomohra** New Energy & Environmental Laboratory, Chengdu University, China
11h05 – 11h25	Invited Speaker PL10: Recovery of high value resources from wastewater treatment a forgotten assignment, challenges and opportunities **Carlos A. Arias** Department of Biology, Aquatic Biology Ole Worms Allé 1, Aarhus University, Denmark
11h25 – 11h45	Invited Speaker PL11: Environmental management of geothermal water by membrane processes **Nalan Kabay** Ege University, Izmir, Turkey
11h45 – 12h00	OC 12 : Bio-oil purification from fine char particles by ceramic microfiltration **Vasilis P. Chatzis** Centre for Research and Technology, Hellas (CERTH), Thessaloniki, Greece
12h00 – 12h15	OC 12 : Environmentallly friendly upcycling approach to increase impact resistance of reinforced concrete structures **Bilal Esmer** Buca Municipality Kızılçullu Science and Art Center, Turkey
12h15 – 12h30	OC 13: Exploration of fungal diversity for 5-hydroxymethylfurfural detoxication, selective production of its oxidized derivatives and immobilization of selected enzymes **Emmanuel Bertrand** UMR1163, Biodiversité et Biotechnologie Fongiques, Aix Marseille - Université, INRAE, Marseille, France
12h30 – 12h45	OC 14 : : Glucose conversion to gluconic acid over Au/C catalysts **Mahdi Achour** LGPC, Department of Chemical Process Engineering, Farhat-Abbas Sétif-1 University, Setif, Algeria
12h45– 13h00	***Lunch break***
(Afternoon session)	

ORAL SESSION 6: MATERIALS & THE ENVIRONMENT (T1)	
Chairs: Najla Fourati, Ahmad ElMoll	
13h30 – 13h50	PL12 : Benign-by-design strategies for a more sustainable future: from (bio)materials to electrochemistry and environmental remediation **Rafael Luque** Departamento de Quimica Organica, Universidad de Cordoba, Campus de Rabanales, Edificio Marie Curie (C 3), Ctra Nnal, Spain
13h50 – 14h10	PL13 : Lattice Reactions in Displacive Transformations in Shape Memory Alloys **Osman Adiguzel** Firat University, Department of Physics, Elazig, Turkey.
ORAL SESSION 7: ELECTROCHEMISTRY & ENVIRONMENT (T2)	
Chairs: Kamel Ouari, Ahmad ElMoll	
14h10 – 14h40	PL15: Nanoscale Electrocatalysis for Energy Conversion, Water Splitting and Synthetic Fuels **Khurram S. Joya** IUM, Madinah and King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia. Research Head, LabTech and HSE services, 1st Floor, 47th-Commercial Area, Cavalry Ground, Lahore Cantt 54810, Pakistan.
14h40 – 15h00	PL16: Layered oxides as convenient electrochemical energy storage materials for Li- and Na-ion batteries **Ismael Saadoune** IMED-LAB, University Cadi Ayyad, Marrakech, Morocco
15h00 – 15h15	OC 15: Determination of age in foods with a carbon dioxide monitoring sensor **Alya Ünsal,** Buca Municipality Kızılçullu Science and Art Center, İzmir-Turkey
15h15 – 15h30	OC 16: New d'imidazo[1, 2-a]pyridin derivatives as eco-friendly inhibitors against corrosion of mild steel: synthesis, characterization, electrochemical analysis , **Walid Daoudi** Laboratory of Molecular Chemistry, Materials and Environment (LCM2E),Departement of chemistry, Multidisciplinary Faculty of Nador, University Mohamed I, 60700 Nador, Morocco
15h30 – 15h45	OC 17 Synthesis, Spectroscopic Studies, electrochemistry and catalytic activity of Oxovanadium (IV) and Iron (III) Schiff base complexes **Boucherabine Djihed** Laboratory of Electrochemistry, Molecular Engineering and Redox Catalysis,(LEIMCR), Faculty of Technology, University of Ferhat Abbas Sétif-1, Algeria
15h45 – 16h00	OC 18 Electrochemical study of inhibition performance of a pyrazole Derivative on carbon steel in 1M HCl **Belhadi Mimoun** Laboratory of Engineering Processes and Environment, Higher School of Technology, Hassan II University, Eljadida Road, Km7, Casablanca, Morocco.
16h00– 16H30	***Coffee break and Poster session***

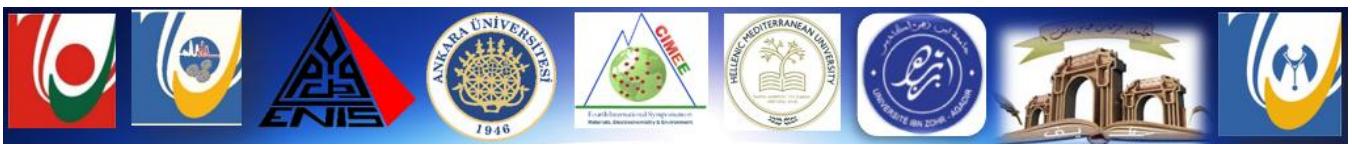
CIMEE22 Scientific Program	
Day 3 - Saturday 24 September 2022 **(Morning session)**	
ORAL SESSION 8: STRUCTURAL, ANALYTICAL & PHYSICAL CHEMISTRY (T4)	
Chairs: Konstantinos Plakas, Ahmad ElMoll	
08h30 – 09h00	Registration
09h00 – 09h20	Plenary Lecture, PL17 : Biopesticides: A fundamental research towards industrial exploitation **Slim Tounsi** Laboratory of Biopesticides, Centre of Biotechnology of Sfax, University of Sfax, Tunisia.
09h20 – 09h40	Plenary Lecture, PL18: Recent application of plasma technology for environment **Rajneesh Kumar** Department of Physics, Institute of Science, Banaras Hindu University, Varanasi, India
09h40 – 10h00	Plenary Lecture, PL19: Risk assessment & risk management of functionalized nanomaterials **Bensu Karahalil** Head of Toxicology Department, Faculty of Pharmacy, Gazi University, Turkey
10h00– 10h15	OC 19 : Monitoring of pesticide residues in tomatoes and cucumbers, and risk assessment for the Lebanese consumer during economic crisis **Israa Hassan** Faculty of Agronomy, Plant protection department, Lebanese university, Dekweneh, Lebanon
10h15– 10h30	OC 20 : Removal of Rose Bengal Dye using domestic waste "Watermelon peel" **Naima Gherbi** Laboratoire De L'Ingénierie Des Procédés D'Environnement, Université de Constantine 3, Algeria
10h30– 10H45	***Coffee break and Poster session***
ORAL SESSION 9: ATMOSPHERIC CHEMISTRY & ENVIRONMENTAL POLLUTION (T3)	
Chairs: Konstantinos Plakas, Ahmad ElMoll	
10h45 – 11h05	PL 20 : Monitoring long-term and large-scale deposition of air pollutants in the framework of the UNECE ICP vegetation **Marina Frontasyeva** Joint Institute for Nuclear Research, Dubna, Moscow Region, Russian Federation
11h05 – 11h25	PL 21 : Nanomaterials in Circular Economy and Sustainability: New Opportunities and Future Perspectives **ElMoll Ahmad** Faculty of Public Health, DSST, Faculty of Science, Lebanese university, Lebanon.
11h25 – 11h45	***Coffee break & Poster session***
ORAL SESSION 10: AGRO GEOENVIRONMENT & AGROCHEMISTRY (T5) **5.2. Biomaterials, Waste & biomass Valorization**	
Chairs: Konstantinos Plakas, Ahmad ElMoll	
11h45 – 12h45	Special session: Reuse of Wastewater in Mediterranean Region: challenges and future opportunities **Konstantinos Plakas** Centre for Research and Technology, Hellas, Greece Integrated Resources Management Company Ltd. (IRMCo), Malta Regional Entity for Wastewater Sanitation and Treatment in Murcia, ESAMUR, Spain Water Research and Technologies Center, CERTE, Tunisia Plataforma Solar de Almeria (PSA), Energy Department, Solar Treatment of Water Unit, Spain Tunis International Center for Environnemental Technologies, CITET, Tunisia
12h45– 13h00	Coffee break and Poster session
Saturday 24 September 2022 **(Afternoon session)**	
ORAL SESSION 11: AGRO GEOENVIRONMENT & AGROCHEMISTRY (T5)	
Chairs: Ahmad ElMoll, Kamel Ouari	
13h00 – 13h20	PL22 : Biogeochemistry of poorly studied trace elements **Irina Shtangeeva** Institute of Earth Sciences, Department of Soil Science & Soil Ecology, St Petersburg University, Russia.
13h20 – 13h40	PL23 : Nanobiocatalysis: Challenges and applications **Ashok Kumar Nadda** Department of Biotechnology and Bioinformatics, Jaypee University of Information Technology, India

13h40 – 14h00	PL24: Green technology and environmental sustainability: challenges and future opportunities **ElMoll Ahmad** Faculty of Public Health, DSST, Department of Science, Lebanese university, Lebanon
13h40 – 14h00	OC21: Advanced membrane technologies for wastewater management in recycled paper processing industry **K.M. Atziaras** Chemical Process and Energy Resources Institute, Centre for Research and Technology – Hellas (CERTH) Thessaloniki, Greece
14h15 – 14h30	Coffee break and Poster session
ORAL SESSION 12: CLIMATE CHANGE, MARINE & COASTAL ECOSYSTEM (T6)	
Chairs: Konstantinos Plakas, Ahmad ElMoll	
14h30 – 14h50	PL25 : The pollution of the Adriatic Sea by marine litter and microplastic presence in the fish stomach **Jerina Kolitari** Department of Aquaculture and Fishery, Faculty of Agriculture and Environment, Agricultural University of Tirana, Albania.
14h50 – 15h10	PL26 : Energy Power Plants Accidental Environmental Impact in Wartime vs. Peacetime **Massimo Zucchetti** Dipartimento di Energia, Politecnico di Torino, Torino, Italy Massachusetts Institute of Technology – MIT, Cambridge (MA), USA
15h10 – 15h30	PL27 : New complementary biotechnologies for sustainable development adopted to Climate change and COVID-19 Pandemic **Jan W. Dobrowolski** AGH-University of Science and Technology Open University, Team of Environmental Biotechnology and Ecology, Poland
15h30– 15h45	OC23 : First Time Non-Target Screening of Emerging Organic Pollutants in Sediments and Fish from the Eastern Mediterranean Coast (Lebanon) **Mariam Zayter** IPREM-UMR5254 / Institut Pluridisciplinaire de Recherche en Chimie Analytique et Physico-Chimie pour l'Environnement et les Matériaux, France And National Centre for Marine Sciences, CNRS, Lebanon

Poster Session: STRUCTURAL, ANALYTICAL & PHYSICAL CHEMISTRY (T4)	
Chairs: Konstantinos Plakas, Ahmad ElMoll	
15h45 – 16h00	PC1 :. Study of molecular interactions in the binary mixture containing alkan-2-ol by Density, dynamic viscosity and refractive index measurements at 298.15 K **Manel Zaoui-Djelloul Daouadji** VPRS Laboratory, KASDI Merbah University, Ouargla, 30000, Algeria
16h00– 16h15	PC2 : Efficient ultrasonic assisted adsorption of organic pollutants employing of Biomass **Samiya Telli** Laboratory sciences and technical water and environment, Faculty of Science and Technology, Mohamed Cherif Messaadia University, Souk-Ahras, Algeria.
16h15 – 16h30	PC3 : Arsenic (V) removal from water using magnetic nanoparticles synthetized by polyol method **Mirjana Petronijević** University of Novi Sad Faculty of Technology, Bulevar cara Lazara 1, Serbia
16h30 – 16h45	PC4: Application of sodium citrate for corrosion inhibition **Rizun Yulia** Karpenko Physico-Mechnical institue of National Academy of Science of Ukraine, Ukraine

Closing Session

16h45 – 17h30	Ahmad ElMoll, Dalila Hammiche, Moufida Merzougui, Najla Fourati, Nalan Kabay, Konstantinos Plakas, Kamel Ouari, Rachid Salghi



IMPORTANT DATES

All participants are invited to submit abstracts for scientific communications. Please ensure your submission meets the conference's strict guidelines for accepting scholarly papers. Download the template abstract and abstract registration form at the website.
The submitted abstracts will be peer-reviewed for acceptance by the Scientific Committee and, out of the submitted proposals.

Conference Dates	Abstract Deadline	Registrations Deadline
Abstract Submission Opens:	**First Round Submission:**	**Early Bird Registration:**
March, 2021	October 15, 2021	October 30, 2021
Authors notified of results	**Second Round Submission:**	**Mid Term Registration:**
Within 10 days after the submission	**March 30, 2022**	April 30, 2022
Announcement of the conference program	**Final Round Submission:**	**On Spot registration:**
August 31, 2022	June 30, 2022	September, 2022

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CIMEE22 OFICIAL OPENING CEREMONY

Opening Ceremony

The first day of the conference featured an Opening Ceremony. This session welcomed all participants to the Fourth edition of the International Symposium and officially started the 3-day program.

The Fourth international Symposium was officially opened in the large conference hall of the CNF; around 60 participants were present. The program began with the Lebanon's national anthem & Lebanese University.

The next speaker was Dr. ElMoll Ahmad, CIMEE22 Scientific Committee Chair & Chairman

The final speaker was Pr. Slim Abdelkafi, Director of National School Engineering of Sfax, ENIS, Tunisia

Opening Ceremony

Discours à l'ouverture du Colloque International, CIMEE22

السيدات والسادة الحضور الكريم، نرحب بكم أجمل ترحيب

يعتبر الاستخدام المستدام والفعال للموارد المائية من أهم التحديات التي تواجه منطقة حوض المتوسط حيث تتسم الموارد الطبيعية بأهمية كبرى خصوصا في البلدان النامية التي تعاني من شح كبير في المياه. بالإضافة الى ذلك، يضع التغير المناخي والنمو السكاني، إلى جانب عوامل أخرى، مزيداً من الضغط على الموارد الحيوية من قبيل المياه العذبة ما يضعف الأمن المائي والغذائي لدى المجتمعات التي تعيش في هذه البلدان النامية خصوصا في حوض المتوسط التي تعاني من الجفاف. ومن المشاكل الأخرى التي تواجهها هذه المجتمعات تدهور الأراضي، بما في ذلك تدني خصوبة التربة والتملح، الأمر الذي يؤثر في الزراعة التي تعتبر مصدر المعيشة الرئيسي للمجتمعات الريفية، ما يتسبب في أضرار جسيمة على الصعيدين الاجتماعي والاقتصادي.

ولعل ما يزيد من هذه الحال صعوبة هو مسألة وجود علاقة معقدة بين قطاعات المياه والطاقة والغذاء، حيث قد تشهد هذه الموارد نقصاً حاداً تبعاً للتوقعات في كثير من البلدان ذات الاقتصادات المنخفضة والمتوسطة الدخل. كما من المرتقب أن يزداد الطلب التنافسي على موارد المياه العذبة من أجل الزراعة والطاقة والاستهلاك البشري. فالزراعة أصلاً مسؤولة عن استجرار 70 في المائة من إجمالي المياه العذبة على مستوى العالم، ما يجعل منها القطاع الأكثر استخداماً لهذا المورد.

وفي هذا السياق، نجد أن فهم إدارة الموارد الطبيعية وحسن وإدارتها بصورة أفضل يحمل أهمية جوهرية، حيث تبذل المزيد من الجهود على كلّ من مستويات إدارة الموارد الطبيعية لضمان الاستدامة على المدى البعيد، فضلاً عن ضمان الأمن الغذائي، وكذلك ضمان الطاقة والمياه في البلدان النامية.

من هنا يأتي التركيز على كل الجهود في سبيل الإدارة المستدامة للموارد الطبيعية كالمياه العذبة، فضلاً عن التركيز على كفاءة استخدام موارد المياه البديلة لصالح الزراعة كالمياه العادمة المعالجة ومياه الصرف والمياه المنتجة وغيرها من أنواع المياه بما في ذلك المياه المرتجعة من عملية التحلية ومياه البحر. كما ستعطى أولوية أيضاً لتحسين كفاءة الري وإنتاجية المياه الزراعية كوسيلة للاستجابة لندرة المياه في البلدان النامية. وكذلك على إنتاج المياه المخصصة للزراعة والاستشعار عن بعد وتطبيقات نظام المعلومات الجغرافية، فضلاً على نمذجة المياه السطحية والجوفية لتحديد الموازنة المائية والإنتاج الزراعي على شتى المستويات .

ويهدف هذا المؤتمر إلى توفير فرصة لالتقاء الباحثين والخبراء في مجالات الكيمياء التطبيقية والتقنيات الحيوية وعلوم البيئة المختلفة، لتشكيل فرق بحثية على المستوى الوطني والإقليمي والدولي، ويسلط الضوء على الدور المحوري الذي تلعبه الطبيعة في حياتنا وفي التنمية الاجتماعية والاقتصادية والبيئية المستدامة.

مجموعة من الشركاء الدوليين التي تشكل نواة شبكة الباحثين الدوليين CIMEE من عدد من الجامعات :الجزائر المغرب تونس تركيا اليونان تعمل من خلال خبراتها على معالجة المياه والتربة والهواء باستعمال الطرق الكيميائية وعلوم المواد والجيولوجيا الزراعية والبيئية

اجتماعنا اليوم هذا يحضره باحثون وممثلون من أكثر من 30 بلداً لإطلاق النسخة الرابعة من المؤتمر الدولي (الذي يعقد في لبنان بالحضور الشخصي وعبر الإنترنت) المستأنف لمدة ثلاثة أيام. ويستقطب المؤتمر عدد كبير من الشخصيات بمن فيهم صناع القرار والقادة من جميع قطاعات في المنطقة والعالم لما له من تأثير مهم على الزراعة والبيئة والاقتصاد

انطلاقا من هذا الوضع، سنعمل من أجل منطقة متوسطية أكثر ابتكارا واستدامة بالتعاون مع جميع الشركاء لدعم البحوث التطبيقية والمشاريع المتعلقة بالاقتصاد الأخضر، والنهج الدائري والتنوع البيولوجي وحماية البيئة.

لذلك نتوجه بدعوة اللجنة الدائمة ل CIMEE لتنظيم هذا المؤتمر بشكل سنوي لتكون النسخة الخامسة خلال شهر أيلول 2023

في الاخير نتقدم بجزيل الشكر الى جميع الشركاء في لبنان ولكل من ساهم في تنظيم ونجاح هذا المؤتمر الدولي وخصوصا الوكالة الجامعية الفرنكوفونية للدعم التقني والشكر أيضا لجميع الشركاء في الجامعات والمؤسسات العلمية في المغرب العربي والشرق الأوسط وأوروبا

آملين من الله أن يوفقنا واياكم الى كل خير

د.أحمد عبد الرؤوف المـــل

Opening Ceremony

Welcome message from the Director of ENIS, Tunisia

Dear Colleagues, Dear friends, Distinguished Guest Speakers.

Good morning and I hope you are doing well. Thank you to each and every one of you for being here with us today. It is a great pleasure for me to participate in opening ceremony CIME22. I would like to welcome the participants who came here to exchange experience and work together a few days on this exciting field. Specific thanks go to Prof. Ahmad El Moll for his effort in organization of this event. Besides, I wish to extend the greetings of the Board;

Concerning my institution (ENIS), is a center of excellence involving seven disciplines of high-level engineering study interested in the next breakthrough technology and about thirty research structures (25 labs). We offer challenging, meaningful work in an open environment that celebrates diversity in all its forms and at different levels (national and international). The school is broken down into 7 departments and with its research potential and its center of innovation and technology transfer, it supports an important part of the smaller learning community experience for our students.

Our focus is on creating a positive work environment that attracts and retains excellent employees through a combination of competitive compensation, opportunities for career growth, and a unique organizational culture.

Our vision is defined in three goals: (i) A Tunisian leader of engineering schools (TOP 5); (ii) International recognition in the training of Engineers; (iii) Center of excellence in research. A major center of higher education and research in the south of the country, ENIS is one of the Tunisian major schools in which all area of knowledge is supported. ENIS wishes to define inter-regional research for Mediterranean recognition. The aim is to bring up Sfax as a leading region for research, development and innovation on a national and international scale. Our policy at ENIS is to internationalize research by establishing the outgoing mobility of engineering students, master's students, doctoral students and incoming researchers by developing the reception of researchers and visiting professors. In this context, the school signs Cooperation Agreements with Universities from Countries across the world, to promote education and scientific cooperation and create mobility and exchange programs for teachers, researchers and students.

Before finishing my welcome speech, I would like to point out that conferences are not only important for our researchers but also to improve the ranking of the university which is based on international publications and number of highly cited papers as well as global research reputation and visibility. Indeed, this type of event mainly enhance the visibility of the Mediterranean universities.

Sincerely, I hope you will enjoy today and the next two days of debate and networking. Thank you for your participation, thus welcome and enjoy the meeting.

Pr. Slim Abdelkafi,

Day 1- Thursday 22 September 2022

Keynote Lectures

Opening keynote

Konstantinos V. Plakas, Centre for Research and Technology, Hellas (CERTH), Thessaloniki, Greece
KL1: Innovative solutions for the promotion of non-conventional water reuse and management in the Mediterranean region

Jihen Elleuch, National School of Engineers of Sfax, University of Sfax, Tunisia
KL2: Extracellular Polymeric Substances from marine microalgae: application for water and wastewater treatment processes

Emmanuel Koudoumas, Department of Electrical and Computer Engineering, Hellenic Mediterranean University, Greece.
KL3: Use of simple, low cost and environment friendly techniques for the growth of thin films, nanostructure layers, nanomaterials, nanocomposites and suspensions.

El Moll Ahmad, Faculty of Public Health, faculty of Science, DSST, Lebanese University, Lebanon
KL4: Agroecology as new approaches to the transition towards sustainability

KEYNOTE LECTURES

(Keynote abstracts)

Opening Keynote, KL1

4th INTERNATIONAL SYMPOSIUM ON
MATERIALS, ELECTROCHEMISTRY & ENVIRONMENT
www.cimee-science.org

Innovative solutions for the promotion of non-conventional water reuse and management in the Mediterranean region

Konstantinos V. Plakas

Centre for Research and Technology, Hellas CERTH, Thessaloniki, Greece

E-mail : kplakas@certh.gr

Thematic Area: MATERIALS & THE ENVIRONMENT

Abstract

The Mediterranean area is one of the most vulnerable to "water crisis" and to the impacts of global warming. Despite some encouraging progress, current water-use efficiencies in the drinking water and irrigation sectors still represent a challenge for the area. It is therefore, an emerging need to tackle these issues by taking actions and adopting strategies through a collective response involving public/private stakeholders: government, academia, business & civil society at local, national and regional level. In this context, MEDWAYCAP project, funded by the 2014-2022 ENI CBC MED programme, is presented as the first capitalization project of the programme towards improving the water efficiency in the Mediterranean area. As a capitalization project MEDWAYCAP aims at a) transferring the outcomes & outputs resulting from ENI-CBC MED standard projects and other EU programs on the utilization of non-conventional water resources (NCWRs) in the agricultural & domestic sector, thus mitigating the fresh water needs, b) rolling out results into broader policies, strategies, and action plans at national and regional level, c) focusing upon broadening the audience/target groups/relevant stakeholders through a coherent & continuous cross-border dialogue and process including a sustained awareness-raising of public authorities & policy-makers at regional/national level, d) capacity building of related staff, e) easy access to the information, and f) friendly use of tools for mutual learning. In order to reach effective results at cross-border level, a systemic analysis of multiple partners committed to foster water policies is necessary by means of a cooperation approach, to address them toward a shared methodology reacting collectively towards Mediterranean NCWR challenges.

Keywords: capitalization, best practices, non-conventional water supply, water efficiency

Acknowledgements: This publication has been produced with the financial assistance of the European Union under the ENI CBC Mediterranean Sea Basin Programme.

Opening Keynote, KL2

4th INTERNATIONAL SYMPOSIUM ON
MATERIALS, ELECTROCHEMISTRY & ENVIRONMENT
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Extracellular Polymeric Substances from marine microalgae: application for water and wastewater treatment processes

Jihen Elleuch[1], Imen Frendri[2], Slim Abdelkafi[1]

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Thematic Area: AGRO GEOENVIRONMENT & AGROCHEMISTRY, Biomaterials, Waste & biomass valorization

Abstract

Releases of heavy metals due to anthropogenic activities are threatening ecosystem, health and sustainability. Heavy metals are dangerous chemicals as they accumulate not only in individual organisms but in entire food chains. Conventional technologies used to remove heavy metals from aqueous systems include adsorption, chemical precipitation, ion exchange, and membrane and ultrafiltration processes. Except adsorption, however, other methods were confronted with expensive equipment and reagents as well as the increasing cost for sludge disposal. Accordingly, biopolymers derived from algae, plants and microorganisms find applications in this field. In fact, biopolymers are considered a potential alternative to conventional chemical polymers because of their ease of biodegradability, high efficiency, non-toxicity and non-secondary pollution. Recently, extracellular polymeric substances (EPS) produced microalgae have been reported as a potential flocculant that can be applied in various water, wastewater and sludge treatment processes. EPS are a complex blend of high molecular weight microbial biopolymeric secretory by-products. These biopolymers mostly consist of polysaccharides, uronic acids, proteins, humic substances and lipids. EPS acts as a primary constituent for the production of different bio-based products such as bioflocculants, biofouling of reverse osmosis membrane, sludge dewatering processes and formation of biofilm matrix.
In this context, much effort has been devoted to the development of environmentally friendly and cost-effective processes to produce EPS from marine's microalgae with high emulsifying and flocculation activities. One of the most important aspects is the chemical composition as well as the structural details of the EPS in terms of carbohydrates, proteins, extracellular DNA, lipids and humic substances. Biochemical tests, GC-MS, FTIR and RAMAN analyses are useful tool for EPS structural characterization to predict their engineering properties such as adsorption, biodegradability, hydrophilicity/hydrophobicity. Important factors could affect EPS production including growth phase pH, temperature, carbon and nitrogen sources and ratio. Flocculability and heavy metal biosorption ability are the most attractive engineering properties of the EPS matrix. The flocculation mechanism was proved to depend on cations presence, EPS concentration, protein and carbohydrate content of EPS, molecular weight of EPS and pH of the suspension. It was allowed by charge neutralization mechanism involving both polysaccharides and protein contents. In addition, the role of EPS in heavy metal chelating has been highlighted and optimized using the Box-Behnken design.

Keywords: Bioflocculants, Microalgae biopolymers, Extracellular polymeric substances, Heavy metal Pollution control.

Acknowledgements: This work performed in the framework of the PHC Maghreb Project EXPLORE 2019-2021, 19MAG36, with the financial support of Tunisian Ministry of Higher Education and Scientific Research.

Opening Keynote, KL3

4th INTERNATIONAL SYMPOSIUM ON
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Use of simple, low cost and environmental friendly techniques for the growth of thin films, nanostructure layers, nanomaterials, nanocomposites and suspensions.

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Abstract

The progress of the technology today requires a new generation of materials and devices, exhibiting the same or even superior performance, lower cost, environmental friendliness and better physical properties than that currently used.

In that respect, the activities of the Smart Functional Materials group, of the Center of Materials Technology and Photonics of the Hellenic Mediterranean University are focused on the exploitation of advanced coatings, nanostructures, suspensions and nanocomposites suitable for applications like solar control coatings, electromagnetic shielding photocatalysis, antifouling, Li ion batteries, nanodielectrics, food packaging etc. In particular, the current scientific achievements of the group concern:
(a) The development of water or alcohol based formulations of conductive paints, containing carbon nanotubes, graphite, carbon black, Fe_3O_4, Fe ore, and PEDOT: PSS in various ratios and combinations, specially designed for electromagnetic interference shielding (EMI) in the GHz frequency range
(b) The development of composite materials based on Graphene Nanoplatelets (GNPs) and Multiwall Carbon Nanotubes (CNTs) embedded in Polypropylene (PP) for Electromagnetic interference (EMI) in the GHz frequency range
(c) The development of new composite materials based on HDPE and Cu:TiO_2 nanoparticles, exhibiting antifouling properties for aquaculture nets
(d) The use of simple, low cost and environmental friendly spray techniques for the development of WO3 nanostructured thin films exhibiting good electrochromic activity and reasonably good durability.
(e) The development of composite food packaging based on PLA and encapsulated natural extracts, exhibiting antimicrobial performance

Keywords: Functional Materials, nanotubes, graphite, Graphene Nanoplatelets, GNPs, composite materials, composite food packaging,

Opening Keynote, KL4

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Agroecology as new approaches to the transition towards sustainability

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Abstract

Faced with population growth, increased pressure on natural resources, in particular soil and water, the impoverishment of biodiversity and uncertainties related to climate change, it has become necessary to operate a transition towards agroecology, a scientific discipline exploring the intimate links between agriculture, ecology and society,

Indeed, agriculture covers more than half of the Earth's land surface and contributes to about a third of global greenhouse gas emissions, thus agroecology participates in the fight against climate change through the agricultural sector by taking into account the issues relating to water, soil and agricultural and rural development.

In addition, agroecology provides a robust set of solutions to environmental pressures by decreasing the carbon footprint of agriculture, promoting the recovery of biodiversity, preventing air and water pollution, restoring the fertility of soils, and increasing the economic resilience of farms that produce healthy and affordable food

We focus in this presentation specifically on Agroecological principles and elements and their implications for transitioning to sustainability to present the beneficial of agroecology as a key part of the global response to water shortages, biodiversity loss, soil depletion, greenhouse gas emissions and deforestation

In the second part of this presentation, we describe a strategy and research priorities to better support agroecological transitions by using these catalysts of change as entry points.

Keywords: agroecology, natural resources, water shortages, climate change, soil, pollution

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ORAL SESSION 1:

ORAL SESSION 1: ELECTROCHEMISTRY & ENVIRONMENT (T2)

Chairs: ElMoll Ahmad, Dalila Hammiche

Session description: This session presents the latest achievements in nanotechnology and advances in electrochemical methods for pollutant remediation, recycling and sensing. Additionally, applications of these methods in the wastewater and water, and for disinfection from leading researchers in Maghreb, Europe, and beyond. are presented. Internationally recognized experts share their knowledge and key results on topics ranging from electrochemistry to environmental applications.

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On the road to Zero Waste Treatment Technologies: Regeneration of Spent Adsorbents through Advanced Oxidation Processes

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Thematic Area: Remediation Technologies Applied to the Environment

Abstract

Over recent years, Advanced Oxidation Processes (AOPs) have been successfully applied for the demotion of emerging contaminants in the aquatic environment. Nevertheless, the enormous volumes to be treated in the wastewater treatment plants and the low concentration of these pollutants are a bottleneck for the implementation of these remediation processes at an industrial scale. On the other hand, adsorption processes by using new designed and low-cost materials can effectively decrease levels of micropollutants in raw water, but the regeneration of the adsorbents with the complete elimination of the contaminants is not achieved. Thus, the spent adsorbent becomes a polluted waste that requires to be managed. In this communication, the last accomplishments for the synthesis and use of selective adsorptive materials will be presented in order to achieve the rapid removal of the micropollutants from wastewater [1,2,3]. Additionally, the regeneration of the spent adsorbents by AOPs will be disclosed. The advantages and disadvantages of the different developed adsorbents and their regeneration will be discussed. These results help to overcome the main treatment process limitations and focus the attention on the points where the efforts should be concentrated in order to increase the TRL to make these combined processes competitive and widely applied in the improvement of the water quality.

Keywords: adsorption, AOP, hydroxyl radical, organics

Acknowledgements: This research has been financially supported Project PID2020-113667GB-I00 funded by MCIN / AEI /10.13039/501100011033 and PDC2021-121394-I00 funded by MCIN / AEI /10.13039/501100011033 and by the European Union Next Generation EU / PRTR

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Trends and perspectives in surface acoustic wave sensors

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Thematic Area: Structural, Analytical & Physical Chemistry

Abstract

Surface acoustic wave (SAW) sensors' principle is based on the use of interdigital transducers (IDTs) to generate acoustic waves along a given piezoelectric substrate. Changes to the features of the propagation path affect the amplitude and velocity of the SAW and can thus provide accurate information on analytes detection by an appropriate recognition layer, deposited between the two sets of IDTs. Compared to the classical quartz crystal microbalances, SAW sensors operating frequencies range from a hundred MHz to several GHz, resulting in higher sensitivities and lower limits of detection.

SAW sensors offer many other advantages, mainly miniaturization, label-free and real-time analytes detection [1-2] and the possibility of wireless integration.

Trends and perspectives in surface acoustic wave sensors range from the design and nature of piezoelectric substrates [3] to the type of recognition layers and multi-detection of different types of chemical molecules. In recent years, research has focused on combining gravimetric transduction, via SAW sensors, with electrochemistry [4] or surface plasmon resonance technology [5]. The aim is to overcome possible experimental biases and to better meet the current requirements of environmental standards. SAW sensors are therefore probably the most important piezoelectric devices for chemical sensing applications.

Keywords: Surface acoustic wave sensors, Chemical sensing

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Nanostructures Based Electrochemical Sensors: The Future of Medicine and Disease Diagnosis

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Abstract

Electrochemical sensors represent a powerful strategy for the detection of chemical substances, that combines a recognition element (e.g., imprinted polymers, enzyme, DNA probe, antibody) with a physicochemical detector. To date, various electrochemical (bio)sensors using detection approaches such as potentiometry, amperometry, impedance, electrochemiluminescence as well as photoelectrochemistry, which leads to many application areas. Nanostructured materials enable electrochemical sensors to be constructed with the desirable properties (high sensitivity, selectivity, flexibility, short response time, and long lifetime) for targeted detections. In the CIMEE22 Conference, we will present some of our new research directions: (1) Membrane-based nanomaterials for electrochemical detection of antibiotic drugs (Levofloxacin) detection in pharmaceutical samples (Levoxin®); (2) Molecularly imprinted polymers for electrochemical detection of heart failure drugs (Ivabradine hydrochloride) in biological samples (urine and blood serum) and pharmaceutical samples (Savapran®); (3) Carbon nanomaterials based electrochemical sensors for determination of Alzheimer's disease drugs (Galantamine Hydrobromide) using carbon paste electrodes; and (4) Rapid electrochemical detection of coronavirus SARS-CoV-2. Finally, we will highlight our recent research on electrochemical impedance and electrochemiluminescence (ECL) biosensors for the detection of cancer biomarkers.

Keywords: Electrochemical sensors, Nanostructured materials, electrochemical detection

Acknowledgment:
A. Barhoum and R. Forster would like to thank the Irish Research Council for finical support (Grant number GOIPD/2020/340) at the School of Chemical Sciences, Dublin City University.

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Synthesis, crystal structure, electrochemical behavior study of a ligan hybrid

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Thematic Area: Electrochemistry for the Environment

Abstract

2,4,6-triamino-1,3,5-triazine commonly known as melamine, it enables the production of a large number of products. Moreover, many of its derivatives are used as industrials, pharmaceutical products and coordination chemistry. The extraction of metals and their recycling in the environment have a significant effect in the recovery of metals. In this context, we have synthesized a new ligand hybrid based on melamine. Its structure was investigated by single-crystal X-ray diffraction analysis, also it was characterized by UV-Vis, FT-IR, FT-Raman. Further, we have studied its electrochemical behavior by cyclic voltammetry in an aqueous medium.

Keywords: melamine, organic-inorganic, electrochemical, environment, cyclic voltammetry

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Corrosion inhibition potential of *Cactus juice* for carbon steel in hydrochloric acid medium

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Thematic Area: ELECTROCHEMISTRY, BIOELECTROCHEMISTRY & ENVIRONMENT

Abstract

Traditional inhibitors are known of their high toxicity, the development of a green and effective alternative to traditional corrosion inhibitors is an urgent task. Cactus juice has the potential to solve this problem due to its natural source and its richness in several heterocyclic organic compounds. Herein, electrochemical techniques such as electrochemical impedance spectroscopy (EIS) and potentiodynamic polarisation (PDP) have been used to investigate the inhibition effectiveness of CJ extract for carbon steel in 1M HCl. Based on the electrochemical analysis, CJ acts as mixed type inhibitor and its adsorption on the steel surface obeyed the Langmuir adsorption isotherm. Results of Fourier transform infrared spectroscopy and scanning electron microscopy confirm the adsorption of CJ on the surface of the metal.

Keywords: Steel, Cactus, Corrosion inhibition, EIS, PDP

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ORAL SESSION 2:

ORAL SESSION 2: AGRO GEOENVIRONMENT & AGROCHEMISTRY (T5)

Chairs : Najla Fourati, ElMoll Ahmad

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Bio-based fertilizers (BBF) - Achievements and trends

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Thematic Area: AGRO GEOENVIRONMENT & AGROCHEMISTRY,

Abstract

A great concern of future agriculture is the increasing rate of extracting the Earth's natural resources including reserves of fossil fuels and phosphate rock. Fossil fuels are used in an energy-intensive process of nitrogen-based fertiliser production while phosphorus deposits are a non-renewable resource and there is a high risk of their exhaustion. In order prevent from the depletion of nutrient-based raw materials, critical in the food production industry and on the other hand mitigate eutrophication, it is crucial to replace mineral (named also as synthetic or chemical) fertilisers with highly bioavailable for plants bio-based fertilisers (BBFs). Paper presents revision of achievements and trends in the production of BBFs.

The BBFs, originating from living organisms (as manure, sewage sludge and biowaste), are urgently needed. Introducing BBFs to the market, requires an analysis of the economic, social, law and environmental conditions, as well as opportunities and barriers that may accelerate of slow down transition to the circular economy (CE) is required.

Keywords: bio-based fertilisers (BBFs), biowaste, agriculture, circular economy (CE)

Acknowledgments: This publication was prepared based on results obtained under Subvention of the Division of Biogenic Raw Materials in the Mineral and Energy Economy Research Institute, Polish Academy of Sciences and project LEX4BIO which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 818309 (www.lex4bio.eu).

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Waste and biomass valorization for use as Bio fillers for biocomposites

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Abstract

Natural fibers are particularly important for preserving the environment and limiting the use of fossil resources. Nevertheless, residues from the textile industry and agriculture raise a significant amount of fiber waste. It is therefore extremely important to develop a new process to reuse and rationally use these resources, especially in the field of composites.

The valorization of food processing by-products and agricultural waste is gaining increasing importance due to the great interest in the development of new sustainable materials. Indeed, natural fibers from agricultural residues represent an ecological and inexpensive alternative to traditional petroleum-based materials. Environmental concerns become a subject of the international community. Agricultural biomass feedstocks can be used either as a replacement or in addition to other fibers in various applications.

This is why part of this presentation is devoted to this type of waste, and among these agricultural residues there is olive husk flour (OHF), rice, cotton, and wool.

Keywords: Natural fibers, valorization, environment, fossil resources.

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Kraft lignin functionalization as an alternative to phenol-formaldehyde resins through enzymatically generated hydroxyl or phenoxy radicals

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Thematic Area: Biomaterials, Waste & biomass valorization

Abstract

Phenol-formaldehyde resins are widely used as binders in the design of bio-based composite materials such as chipboard wood panels prevalent in all homes. Because formaldehyde is a proven human carcinogen, an alternative is being sought to protect human health from this toxic chemical [1]. For this study, our main goal is to functionalize kraft lignin, a by-product of the pulp and paper industry by a treatment combining a laccase and/or a dehydrogenase (glucose and cellobiose dehydrogenase). Following the production of the necessary enzymes (three laccases and two dehydrogenases), using the recombinant strains of Pichia pastoris and Aspergillus niger in Erlenmeyer and in 2-liter instrumented bioreactors and their purification by affinity chromatography on nickel column, ion exchanger and steric exclusion chromatography, Kraft lignin was treated under different conditions. The analyses carried out on these enzymatically treated lignins are steric exclusion chromatography by HPLC (THF solvent on PLGel column) and FTIR infrared spectroscopy. FTIR spectra of the treated lignins showed interesting differences between the treatments confirming the hypothesis that hydroxyl radical and phenoxy radicals have different actions on Kraft lignin [2]. We hypothesize that it is due tu the tridimentional structure of the lignin as well of the steric encombrement and hydrophobicity of the aromatic groups of the phenoxy-radicals. Some of the most promizing samples were then successfully valorized by our partners to generate hardboard wood panels or opalescent coating with interesting hydrophobicity properties.

Keywords: laccases, cellobiose-dehydrogenase, kraft-lignin, radicals, phenol-formaldehyde resins

Acknowledgements:

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RoDuoEnergy: modern biomass energy system

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Not presented

Thematic Area: Biomaterials, Waste & biomass valorization

Abstract

The "RoDuoEnergy" project represents a set of innovative ideas, which are based on the notions of exact sciences and entrepreneurship. More specifically, the project proposes a way by which the rural environment can be developed in a sustainable way, using renewable energy from biomass [1].
Currently, globally, especially in the underdeveloped and developing countries, a large part of the rural areas still live rudimentarily, without being able to reach truly sustainable development urban [2].
Through the 2030 Agenda, the UN has tried to improve the status of populations. This project is based on a modern cogeneration plant (compared to the classical one, it is digitally monitored) using biomass, through which both thermal and electrical energy is produced, a way of using CO2 because of its emission (using it). in the field of aquaculture through the cultivation of edible aquatic plants, as well as by fish farming) [3] [4]. For all these, we have also conducted a feasibility study in the largest commune in our county, Ciorani commune. The results of this study are quite interesting and can suggest an opening gate in investments in the energy and recyclable sectors.

Keywords: biomass, energy, networking, aquaculture, entrepreneurship

Acknowledgements: Carmen Argesanu -PhD Chemistry, Norica Raduta - physics teacher, Rodica Popa – geography teacher (all of them from "Nichita Stanescu" National College from Ploiesti, Romania)

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Selective condensation of small sugars by reconstructed Hydrotalcite towards the synthesis of polyol-based flame retardants

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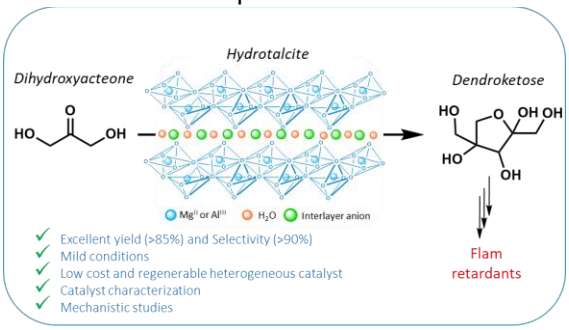
Not presented

Thematic Area: Biomass valorization

Abstract

Aside from their use as precursors in a variety of chemical materials ranging from surfactants and plasticizers to polymer crosslinkers, branched polyols have gained additional interest due to their ability to be converted by esterification into lubricants and moisturizers or, more importantly, into green flame retardants by phosphorylation reaction as a direct replacement for bromine and chlorine-containing alternatives [1].
Therefore, the development of an efficient and sustainable approach for the synthesis of branched polyols is of great interest. Thus, the objective of this work is to realize the condensation of dihydroxyacetone into branched sugars (dendroketose) by means of a stable and robust heterogeneous catalysis in order to obtain the corresponding branched polyols via hydrogenation. In terms of heterogeneous basic catalysts, hydrotalcite is one of the most important candidates to realize the base-catalyzed condensation of dihydroxyacetone. This is due to their interesting structural properties, their ease of synthesis, and the various active sites that lead to a selective aldolization [2].
Our approach consists in studying the activity and selectivity of hydrotalcite in condensation chemistry as a function of its composition, layered structure, and porous characteristics. These different parameters define the strength, nature, and accessibility of the different active basic sites which have been investigated by means of FT-IR spectroscopy, CO2 temperature-programmed desorption, nitrogen physisorption, and XRD measurements. Interestingly, additional optimization studies were conducted in order to improve the stability of the catalyst and subsequently promote a successful hydrogenation process.
Thus, the gain in mechanistic insights allowed the selection of an adapted pretreatment process that improves the properties and stability of hydrotalcites as heterogeneous catalysts, which was successfully applied for the formation of branched sugars under mild conditions and suitable for late-stage functionalization. The catalyst characterization, as well as mechanistic studies, will be discussed in this presentation



Keywords: Branched sugars, reconstructed Hydrotalcite, Selective aldolization

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ORAL SESSION 3

ORAL SESSION 3: MATERIALS & THE ENVIRONMENT (T1)

Chairs: Moufida Merzougui, Ahmad ElMoll

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Photocatalytic and Antimicrobial Activity of Smart Textiles

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Abstract

In recent years, the research and development of multifunctional textiles, so called smart textiles, has gained growing interest because of the need to reduce waste production and increase reusability, like in the case of safety masks. Textiles are excellent substrates for the potential growth of microbes. Several multifunctional agents have been employed to improve textiles characteristics and behaviours, such as quaternary ammonium compounds [1], chitosan [2], triclosan [3], bioactive plant-based products [4] and nanoparticles of noble metals, and metal oxides [5–6]. Nanoparticles can provide to textiles different functions including coloration, conductivity, ultra-violet blocking, antibacterial activity, photocatalytic and self-cleaning activity. However, some aspects related to their full implementation must be still seriously evaluated. For instance, to modify the surface of textiles to attach more nanoparticles and improve laundering durability, chemical binders have to be applied, potentially leading to undesirable effects on human body and the environment on a one health basis.
This study presents recent advances on smart textiles and discusses the main advantages and drawbacks of the application of multifunctional agents. The possibility to obtain green surface modifications is also explored.

Keywords: Photocatalysis, Nanoparticles, Textiles, Antimicrobial activity

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Surface Engineering at Nanoscale - Design and Applications

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Not presented

Theme: Materials and the Environment

Abstract

Nature-inspired biomimicking of the surfaces at the micro-nano scale has been attracting much attention recently, owing to their widespread applications in diverse fields including sensing to biomedical sciences. In this talk, the research work on physio-chemical surface engineering of the materials and their applications will be discussed. We show that by properly defining the structural features via physical methods like femtosecond laser patterning or chemical methods like chemical etching, it is possible to create the desired surface wettability properties. Such surface engineered surfaces can demonstrate properties like superhydrophobicity, superhydrophilicity, anti-adhesion, etc. We exploit these properties to create self-cleaning surfaces, digital microfluidic platforms, flexible surface-enhanced Raman scattering substrates, platforms for splitting a microliter droplet into sub microliter droplets, plasmonic droplet assay platforms, underwater air bubble collection and transport, oil-water separation, and anti-corrosion behavior. These approaches can find a wide range of applications in biomedical sciences, photonics, anti-corrosion, etc.

Keywords: Surface Engineering, Physical and Chemical Methods, Applications

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Low-cost and ecological materials applied to decentralized wastewater remediation: the multi soil layering biotechnology

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Thematic Area: Materials for the environment/ Materials sciences & environment management

Abstract

For decades, wastewater treatment was considered a burden for its producers due to the exorbitant charges to implement intensive facilities and properly operate. Unfortunately, a large amount of decentralized wastewater from remote and scattered areas far from sewage pipelines is randomly discharged into the surrounding environment without any pretreatment. Hence the paramount need to develop affordable wastewater treatment technologies, based on eco-friendly and low-cost materials.

In the early 90s in Japan, a group of scientists has developed a novel extensive Ecotechnology named "the multi-soil layering system (MSL)", a soil-based system ingeniously designed to overcome limitations such as clogging throughout wastewater treatment [1]. Compared to similar technologies, the MSL system is an odorless, noiseless, affordable, and easy to construct with a minimal space occupation, and maximal lifespan offering the on-site reuse for treated wastewater. The MSL system is composed of a succession of porous permeable layers (zeolite, gravel, or pumice particles) and soil mixture layers (soil, organic materials (sawdust, charcoal…), and iron scarp) in a brick-like configuration [2]. The MSL system was tested to treat a panoply of wastewater types and contaminants among the world. The main advantage is that the MSL can be built based on locally available materials [3], whence the challenge to acclimate the system to the African context under arid/ semi-arid climate while maintaining attractive purification performances. The present work is a short review to introduce the MSL biotechnology as a viable alternative for decentralized wastewater reclamation within the African context, discusses several sustainable approaches to optimize treatments, and exposes the preliminary results of material choice for a vertical flow MSL intended for posterior treatment of a decentralized dairy effluent.

Keywords: Multi soil layering, sustainable wastewater treatment, low-cost materials.

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Nanomaterial based on β-Cyclodextrin-Graphene oxide-PLA and vegetal reinforcement for the development of ultrafiltration membrane

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Thematic Area: Nanomaterials, Nanostructures and Environment

Abstract

In this work, a biocomposite membrane was developed using nanomaterials based on graphene oxide grafted with β-cyclodextrin in a polymeric matrix. Graphene oxide was synthesized in the laboratory by the improved Tour method, and then functionalized with β-cyclodextrin. The membrane was obtained by solvent evaporation technique: PLA was dissolved in the chloroform, then amounts of graphene oxide-β cyclodextrin nanomaterial were added. The polymeric matrix was then reinforced with vegetal fibers.

The XRD analysis confirmed a good grafting of β-cyclodextrin to graphene oxide. The granulometric study show an increase of the active surface area from 0.532 m^2/g to 0.864 m^2/g. The resulting membranes (a 23.5 µm thin membrane) are ultrafiltration membranes. The filtration tests on a sample of water/protein solution resulted in a permeability of 1557 L/m^2.h.bar which is higher than the filtration performance of composite membranes of this nature in the literature [1].

Keywords: Graphene oxide, β-cyclodextrin, biocomposite, PLA, membrane.

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Experimental Design Approach for the Removal of Heavy Metals using Activated *Glebionis Coronaria L.*

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Not presented

Abstract

Heavy metals are the current outstanding problem in the field of environmental pollution. Most metals are non-biodegradable and mobile in aqueous systems, which, tend to accumulate in living tissues and cause diseases and disorders if not removed. Subsequently, due to the pervasiveness, high toxicity and persistence of different heavy metal species, especially cadmium and cobalt ions, the treatment of heavy metal effluents is of great interest.
This study investigates the preparation of activated carbons from *Glebionis Coronaria L.* biomass by phosphoric acid activation for heavy metals removal. The effects of four factors controlling the activation process, such as carbonization temperature, activation temperature, activation time and impregnation ratio (g H_3PO_4/g carbon) were established. Further, full factorial experimental design at two levels was carried out in order to achieve optimal conditions for the preparation and the removal of cadmium and cobalt ions from aqueous solutions. Therefore, the removal of cadmium onto activated carbons was more influenced by the interaction between carbonization temperature and impregnation ratio with a positive effect. Although, the greatest interaction influencing the cobalt removal was the interaction between activation temperature, activation time and impregnation ratio. According to statistical data, the best conditions for the removal of cadmium and cobalt by prepared activated carbon samples were investigated. The greater sorption capacities for cadmium and cobalt were investigated. These sorption capacities were greater than those of a commercial activated carbon used in water treatment.

Keywords: Activated carbon; cadmium; cobalt; experimental design*; Glebionis Coronaria L.*; phosphoric acid

Day 2 - Friday 23 September 2022

ORAL SESSION 4:

ORAL SESSION 4: STRUCTURAL, ANALYTICAL & PHYSICAL CHEMISTRY (T4)

Chairs: Konstantinos Plakas, Ahmad ElMoll

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Environmental surveillance with Mössbauer spectrometry, magnetic methods, and modern gravimetry

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Thematic Area: Environmental monitoring, Mössbauer spectrometry, magnetic & gravimetric methods

Abstract

Technogenic magnetic particles (TMPs), produced during various industrial processes, are released into the atmosphere as dust and settle on the surrounding topsoil. The mineralogical and structural differences of PMTs produced by different technological processes should be reflected in their spectroscopic and magnetic properties, and thus indicate the sources of industrial pollution [1,2]. The topsoil samples were taken near four European steelworks, located in three different countries (Poland, Norway and the Czech Republic), as well as near an opencast iron mine, an iron ore processing plant and in a strong magnetic natural environment. Analysis of the hyperfine parameters of the Mössbauer spectra revealed that PMTs are "magnetite" type minerals with very low stoichiometry - the ratio of the contributions of iron ions in the B (octahedral) and A (tetrahedral) sites in the spinel structure of magnetite, which is well below 2.0 (theoretical value for stoichiometric magnetite). The distinctive property of PMTs collected near ancient metallurgical works was the high contribution of surface components probably related to surface oxidation/maghemitization of fine-grained magnetite.

Keywords: Environment, Mössbauer spectroscopy, magnetism, gravimetric analysis

Acknowledgements: Special acknowledgements for financial support to: UTH Radom, National Science Centre – Poland, RADWAG - the Balances.

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Prevention of pollution and resource recovery (cash from trash) using biodiversity as tool box

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Theme 3.3. Bioremediation and phytoremediation of environmental pollutants

Abstract

Prevention of pollution and resource recovery involving wide variety of biological interventions using biodiversity is an emerging area of science i.e. biobased economy. Bioeconomy relates to the "invention, development, production and use of biological products and processes". Bioeconomy has the potential to sustainably enhance global well being. Bioeconomy focuses on biotechnology applications for prevention of pollution and resource recovery, production of renewable resources, agriculture, forestry, healthcare and industry involving biodiversity.

This lecture will highlight the importance of biodiversity such as plant growth promoting bacteria, pteridophytes, and higher plants that accumulate and hyper accumulate heavy metals. Brassicaceae, Cyperaceae, Cunoniaceae, Caryophyllaceae, Fabaceae, Flacourtiaceae, Euphorbiaceae, Lamiaceae, Poaceae and Violaceae are predominated by metallophytes. Often these occur as endemics in metal rich areas such as ultramafic and serpentine soils. Therefore, metallophytes are also called as "serpentinophytes". Serpentine soils (= soil shine like the skin of snake) are distributed all over the world. In India Andaman and Nicobar islands is one of the classic examples. In general serpentine soils contain heavy metals in including nickel (averaging 10 mg per gram soil), cobalt, chromium, iron and magnesium with low nutrient levels.

Metallophytes plants serve as invaluable plant resources for phytoextraction of metals. Recently Noccaea caerulescens and Anthyllis vulneraria have been used as starting raw materials to prepare novel poly-metallic catalysts that have been found to be useful for Lewis acid catalyzed reactions. The synergetic catalysis of these systems leads to efficient syntheses of complex biomolecules. These new polymetallic catalysts bring new possibilities in Green Catalysis, and are named as "Ecological Catalysis"

In this presentation the following examples Alternanthera philoxeroides, Astragalus racemosus, Azolla pinnata, Brassica juncea Ceratophyllum demersum, Cynodon dactylon, Datura innoxia, Eichhornia crassipes Elodea densa. Lemna minor, Lemna polyrrhiza, Phragmites australis, Pteris vittata, Typha latifolia, Vallisneria spiralis, Vetiveria zizanoides including some selected medicinal plants shall be discussed for their role in turning toxins into treasure.

Keywords: Bio remediation, Phytoremediation, Air, Water, Soil, Cash from Trash

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Fungal laccases for environnemental applications

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Abstract

Laccase enzymes (E.C. 1.10.3.2; *p*-diphenol: dioxygen oxidoreductases, lignin oxidases family 1, http://www.cazy.org/Auxiliary-Activities.html) are multicopper oxidases that catalyse the one-electron oxidation of a broad range of substrates using molecular oxygen as the final electron acceptor and producing water as the only by-product (Bourbonnais and Paice, 1990). Laccases are ubiquitous in Nature and, thus, they have been found in bacteria, fungi, higher plants (Dwivedi et al., 2011), insects (Xu, 1999) and algae (Otto and Schlosser, 2014) with different physiological functions and redox potentials. Fungal laccases present the highest redox potentials, especially those produced by the white-rot basidiomycete fungi. Also, recently the mechanism of O_2 reduction for high–redox potential laccases has been described and was found that, contrary to the low-redox potential laccases, the T1 copper reduction was very fast (Sekretaryova et al., 2019). In addition, fungal laccases often present glycosylation conferring them conformational stability and protection from proteolysis and radical inactivation (Senthivelan et al., 2016). Hence, fungal laccases are promising versatile, sustainable and environmentally friendly catalysts for water and soil bioremediation.

Keywords: laccase, white-rot fungus, biocatalysis, pollutant, bioremediation

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A novel unsymmetrical Schiff base oxovanadium complex: Catalytic bromine dynamics of phenol red in water

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Thematic Area: Structural, Analytical and physical chemistry

Abstract

In this work, we report a new oxovanadium (IV) complex (VOL) containing N_2O_2 donor Schiff base ligand. The ligand and the corresponding oxovanadium complex were characterized by CHN analysis, ^1H and ^{13}C NMR, UV-Vis and FT-IR spectra. The crystal structure of the VOL complex, investigated by the single crystal X-ray diffraction analysis, explored a distorted square pyramidal geometry of the vanadium center. The electrochemical characterization of the VOL complex was carried out by using the cyclic voltammetry (CV). The vanadium center gives a quasi-reversible redox couple near 550 mV corresponding to $V^{IV}/^{V}O$ process. Bromination reaction activity of the VOL complex, in water solution/phosphate buffer with phenol red as organic substrate in the presence of H_2O_2 and Br, has been evaluated by UV/Vis spectroscopy. The results indicate that the VOL catalyst can be considered as a potential functional model vanadium-dependent bromoperoxidases.

Keywords: Oxovanadium complex; Single crystal, Electrochemical; Bromination in water.

Acknowledgements: The authors gratefully acknowledge financial support from the Algerian Ministry of Higher Education and Scientific Research. They also acknowledge the help of Dr Jean Weiss from the CLAC laboratory for the access to the Microanalysis, NMR Facility and radio crystallography Services at GDS 3648 of the University of Strasbourg - CNRS – France

ORAL SESSION 5

ORAL SESSION 5: AGRO GEOENVIRONMENT & AGROCHEMISTRY (T5)

Chairs: Ahmad ElMoll, Marta Pazos

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Waste-to-Energy: Recent developments and future perspectives towards circular economy

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Not presented

Thematic Area: Agro-GeoEnvironment & Agrochemistry

Abstract

In the context of energy consumption, over 85% of the current total energy consumption comes from non-renewable fossil resources. Developing new renewable energy resources, especially biofuel production from wastes, has received increasing attention. Although production of energy from waste is not new aspect, there are many advanced technologies have been developed to harness the energy recovery from waste. On the other hand, many countries established regulatory guidelines for proper waste management and raised pollution control measures. Most of the applied routes are waste dumping, composting or direct discharge in water bodies without adequate pretreatment, which seriously threaten the environment and humans. Thus, proper waste segregation and separation provide an efficient option for waste conversion into energy. *Waste-to-energy* is nowadays a widely used statement for efficient waste management, which is getting much attention. Therefore, recent advances in *waste-to-energy* and the necessity to achieve a circular economy is a timely topic that deserves in-depth discussion. This speech aims to cover the recent updates in *waste-to-energy* field, starting from waste generation to large-scale application in biofuel production. In addition, the necessity of integrating different conversion routes will be discussed in order to introduce all the latest novel technologies for a circular bioeconomy.

Keywords: Waste, energy, energy recovery, biofuel, circular economy

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Environmental management of geothermal water by membrane processes

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Thematic Area: AGRO GEOENVIRONMENT & AGROCHEMISTRY T5, Biomaterials, Waste & biomass valorization

Abstract

Geothermal water is used mostly for heating purposes, greenhouses, agriculture, for generation of warm water, therapeutic and recreational purposes and to generate electricity in power stations. After extracting the thermal energy, the cooled water turns to be a problematic fluid due to its salinity and contents of some substances such as boron, arsenic, fluoride, heavy metals, hydrogen sulphide etc. Management of geothermal water is a great challenge due to the stringent environmental regulations.
In this research, we focused on application of pressure driven membrane processes such as nanofiltration and reverse osmosis for reclamation of geothermal water using pilot-scale membrane treatment systems such as nanofiltration (NF) and reverse osmosis (RO). Our target is to produce water for both agricultural irrigation and process water for various industries.

Keywords: Geothermal water, membrane processes, agricultural irrigation

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Bio-oil purification from fine char particles by ceramic microfiltration

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Thematic Area: Remediation Technologies Applied in the Environment

Abstract

Membrane-based separations (micro-filtration, ultra-filtration and nano-filtration) constitute a unique category of innovative, promising and "green" separation processes which are designed and developed to provide efficient and economic solutions to a broad range of environmental issues related to wastewater treatment as well as water and energy utilization. The present study deals with the removal of char particles smaller than 10 μm from bio-oils produced by contaminated plant-based biomass pyrolysis, while the research also extends to the possible removal of water from the bio-oil to be treated. For this purpose, a Cross-Flow Micro-Filtration [MF] pilot-scale unit was designed and built. First, tests were carried out of eight selected ceramic membranes, with an active layer of TiO_2, ZrO_2 and Al_2O_3 (of pore size 0.8, 0.2, 0.05, 0.02 and 0.01 μm), to determine their clean water permeability. Subsequently, a membrane by atech innovations gmbh (i.e., Al_2O_3/TiO_2 19/3.3; 0.8 μm) was employed, before and after the hydrophobic modification of its surface, to perform reference experiments using glycerol – water solutions (75/25 % w/w) and tests with bio-oil sample produced from contaminated plant-based biomass that underwent Slow Pyrolysis [SP]. The results of filtration tests (under constant transmembrane pressure) showed a complete removal of solid particles and relatively moderate MF membrane fouling, assessed through the filtrate flux reduction with filtration time. Moreover, it was concluded that the Al_2O_3/TiO_2 19/3.3; 0.8 μm (atech innovations gmbh) and Al_2O_3/TiO_2 19/3.5; 0.01 μm (Guochu Technology, Xiamen, Co., Ltd) membranes are suitable for such processes considering the stability of transmembrane pressure and permeate mass flow throughout the whole process. Finally, before hydro-phobization treatment of the Al_2O_3/TiO_2 membranes (of pore size of 0.8 and 0.01 μm), insignificant water separation from a bio-oil/water mixture was observed, whereas after such membrane treatment, limited water separation was obtained, due to the highly water-soluble compounds of the examined bio-oil sample.

Acknowledgement: The work has received financial support through the project CERESiS - ContaminatEd land remediation through energy crops for soil improvement to liquid biofuel strategies, funded through HORIZON2020 (GA No. 101006717).

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Environmentally friendly upcycling approach to increase impact resistance of reinforced concrete structures: use of industrial waste as conservation material

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Thematic Area: Agro Geoenvironment & Agrochemistry

Abstract

Within the scope of sustainable cities and responsible consumption, which are among the goals of sustainable development, it is aimed to contribute to life safety, defense industry, protection from disasters and economy with the new generation environmental building technologies and materials to be developed in the field of construction. It is a critical issue to protect reinforced concrete structures, piers, bridge piers, overpasses against impacts, and to reduce the damages and economic losses in disaster situations. Reinforced concrete scaffolding is the load-bearing component of the structure and its impact resistance is crucial to the overall safety of the concrete structure. Therefore, there is a need to develop technologies that can protect structures against explosion and impact loads.

Within the scope of the study, environmentally friendly and low-cost concrete materials with industrial waste glass, aluminum, plastic material additives, which can be used in columns, which are the most important part in the strength of reinforced concrete structures to prevent explosion and impact damage, were produced and their strengths were analyzed. The use and design of these materials in the strength of concrete creates the originality of the study. When the results obtained in the study were examined, it was observed that the steel fiber concretes with the addition of waste glass, aluminum ring, disc, beverage can and plastic bottle were resistant to high pressure when compared with the control groups without additives, and the change in surface height after the impact test, visual analysis and load-time graphics showed this. It is seen that the additives have a cushioning effect against the impact, absorbing the energy against the force by 87.6% and increasing the strength significantly.

In this study, where it is aimed to increase the strength of concrete structures by using the impact energy absorption feature of waste glass, plastic and aluminum, products with high added value are developed, contributing to the literature and the construction sector. With the large-scale use of the study, the costs spent on the disposal of waste materials will be reduced, the upcycling based on re-using the waste products will be contributed, and the loss of life and property due to impacts and explosions will be prevented.

Keywords: Impact, Waste, Building durability, Upcycling

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Exploration of fungal diversity for 5-hydroxymethylfurfural detoxication, selective production of its oxidized derivatives and immobilization of selected enzymes

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Not presented

Thematic Area: 5.2 - Biomaterials, Waste & biomass valorization

Abstract

5-Hydroxymethylfurfural (5- HMF) is one of the key platform chemicals that can be produced from biomass feedstocks. However, this molecule is also known for its toxicity and as a fermentation inhibitor. Sustainable development makes the conversion of petrochemical processes to bioprocesses a priority. The production of furan dicarboxylic acid (FDCA) from biobased 5-HMF via a cascade of enzymatic reactions has attracted attention in recent years. Glyoxal Oxidases (Glox), Aryl Alcohol Oxidase (AAO) are fungal enzymes already used for the production of FDCA via sequential oxidations. The study aims to explore the diversity of fungal polyporales to identify the mechanisms used for detoxication of 5-HMF and investigate the mechanisms of enzymatic biocatalysis for a more efficient biotransformation of HMF to FDCA. The limiting step is the final oxidation of the 5-formyl-furancarboxylic acid (FFCA) intermediate to FDCA, which depends on the degree of hydration of the initial and produced aldehyde groups. It might even be an interesting alternative to the based catalyzed Cannizzaro reaction converting furfural into 2-furoic acid and agreener way to obtain bifunctional furan-derivatives from 5-hydroxymethylfurfural with potential applications in the bio-polymer sector [1]. In our study we have highlighted the original action of Glucose Dehydrogenase (GDH) on HMF and have further valorize the enzymatic activities by using different immobilization techniques making the whole bioconversion process more sustainable.

Keywords: 5-hydroxymethylfurfural, furan-dicarboxylique acid, bioplastics, enzymatic immobilization, green-chemistry

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Glucose conversion to gluconic acid over Au/C catalysts

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Not presented

Thematic Area: Chemical reaction engineering & Catalysts (Biomass valorization).

Abstract

The gradual diminution of fossil fuel resources and the increasing demand for fuels and fine chemicals have stimulated important scientific efforts toward the development of new renewable and sustainable resources. Among renewable resources, the lignocellulosic biomass has received much attention owing to its natural availability, non competitive with food most of time and chemically interesting with a carbohydrate-rich composition, which enables its conversion into valuable fuels and/or platform molecules [1-3].

The aim of this work was the controlled preparation of gold-based catalysts by colloidal deposition of gold nanoparticles stabilized by polyvinyl chloride, PVA in carbon (Au/C), using different ratios, PVA: Au and $NaBH_4$: Au. The prepared catalysts were tested in the oxidation of glucose to gluconic acid. The characterization results confirmed the formation of small and well-dispersed gold nanoparticles on the support. The size of the gold particles formed is between 4 and 22 nm. Therefore, the effect of particle size on the glucose oxidation reaction was studied. Overall interesting results of catalytic activity in the oxidation of glucose is obtained with a conversion that varies between 70 and 83%, however, a better catalytic performance is obtained on the 9 nm average gold particle size catalytic system. As far as the selectivity in gluconic acid is concerned, our desired product is 100% on all catalysts.

Keywords: Gold nanoparticles, PVA, Carbon, glucose.

Acknowledgements: This work was financially supported by Scientific Research and Technological Development (DGRSTD) of Algerian Ministry of Higher Education (MESRS).

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ORAL SESSION 6:

ORAL SESSION 6: MATERIALS & THE ENVIRONMENT (T1)

Chairs: Najla Fourati, Ahmad ElMoll

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Benign-by-design strategies for a more sustainable future: from (bio)materials to electrochemistry and environmental remediation

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Thematic Area: Nanomaterials, Nanostructures & Environment

Abstract

The design of benign and environmentally sound methodologies has been the driving force of scientists in recent years. Attractive and innovative protocols that nowadays are even part of industrial ventures including biomass-derived porous carbonaceous materials, designer nanomaterials for electrochemical applications and catalytic strategies for biomass/waste conversion into useful materials, chemicals and fuels as well as environmental remediation have been recently developed in our group in recent years. These topics have extensively covered innovative valorization strategies from a range of biomass and waste feedstocks including food chain waste for the production of materials, chemicals and fuels.

In this lecture, we aim to provide an overview of recent efforts from our group in leading the future of global scientists from chemical engineers to (bio)chemists, environmentalists and materials scientists including some key industrial projects in the development of advanced biorefinery concepts for food chain waste valorization to valuable chemicals, fuels and advanced materials in our aim to stimulate and promote entrepreneurial activities within the academic and student community.

Keywords: Nanomaterials, electrochemical applications, biomass/waste

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Lattice Reactions in Displacive Transformations in Shape Memory Alloys

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Thematic Area: Nanomaterials, Nanostructures & Environment

Abstract

Shape memory alloys take place in a class of smart materials by exhibiting a peculiar property called shape memory effect. This phenomenon is initiated with thermomechanical treatments on cooling and deformation and performed thermally on heating and cooling, with which shape of the materials cycles between original and deformed shapes in reversible way. Therefore, this behavior can be called Thermoelasticity.

Shape memory effect is governed by displacive thermal and mechanical transformations in atomic level, called 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 planes of austenite matrix, along with lattice twinning reactions and ordered parent phase structures turn into twinned martensite structures. Twinned structures turn into detwinned martensite structures by means of stress induced martensitic transformations with deformation. On heating after these treatments, detwinned martensite structures turn into the ordered parent phase structures, by means reverse austenitic transformation. These alloys exhibit another property, called superelasticity, which is performed in only mechanical manner with stressing the materials in elasticity limit at a constant temperature in the parent phase region, and shape recovery occurs instantly upon releasing by exhibiting elastic material behavior. Superelasticity is performed in non-linear way in the stress-strain diagram, stressing and releasing paths are different, and hysteresis 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. Thermoelasticity and superelasticity is results of displacive martensitic transformations, and lattice twinning reactions play important role at the transformations, and memory behavior of shape memory alloys.

Copper based alloys exhibit this property in metastable beta-phase region. Lattice twinning is not uniform in these alloys and cause the formation of unusual complex layered structures.

In the present contribution, x-ray diffraction and transmission electron microscopy (TEM) studies were carried out on copper based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns reveal that both alloys exhibit super lattice reflections inherited from parent phase due to the displacive character of martensitic transformation.

Keywords: Shape memory effect, martensitic transformation, thermoelasticity, superelasticity, lattice twinning, detwinning.

ORAL SESSION 7:

ORAL SESSION 7: ELECTROCHEMISTRY & ENVIRONMENT (T2)

Chairs: Kamel Ouari, Ahmad ElMoll

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Nanoscale Electrocatalysis for Energy Conversion, Water Splitting and Synthetic Fuels

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Not presented

Thematic Area: Electrocatalysis, Electrochemical sensors

Abstract

With the advent on innovative science, chemical research and technology, nanoscale materials can be engineered and programmed to perform specified function at macro level applications. The innovation in chemical science, nanomaterials, catalysis, and electrochemical processes for Water Splitting has a lead now for solar and chemical energy conversion. These systems can be implemented as surface immobilization along with thin-films for catalytic processes, sensing applications and for energy conversion schemes. We have invented, discovered and developed specialized methods, and exploited various thin-film nanoscale materials for catalytic water splitting, CO_2 conversion/reduction, and recently for electrochemical sensing, biomass catalysis and solar energy conversion. Now we implement and developing new methods for making advanced electrofunctional nanomaterials and nanoclusters derived from thin-films molecular assemblies, inorganic nanomaterials and metal-oxides displaying great potential to be used in high performance water splitting catalysis and for chemical energy conversion and storage schemes. In this discussion we also highlight the challenges in chemical energy conversion and the possible way forward.

Keywords: electrocatalysis, water splitting, CO_2 conversion, electrochemical sensors

Acknowledgements: Funding from HEC, Pakistan is highly acknowledged.

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Mixed Structure Layered Oxide as a New Cathode Material for Sodium-ion batteries

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Not Presented

Abstract

Rechargeable sodium-ion batteries (SIBs) have recently attracted renewed interest as an alternative to Li-ion batteries for electric energy storage applications, because of their low cost and wide availability of sodium resources. Thus, the electrochemical energy storage community has been devoting increased attention to designing new cathode materials for sodium-ion batteries. Among them, layered transition-metal oxides ($NaMO_2$, M= transition metal) have attracted wide attention, as promising cathode materials for sodium ion batteries because of their potential high capacity, rate capability as well as high electronic conductivity (1).

The cathode materials $Na_{0.7}Co_{0.50-x}Mn_{0.33}Ni_{0.16+x}O_2$ (x= 0,0.1,0.2) were prepared by a Co-precipitation method. The XRD measurement demonstrated that $Na_{0.7}Co_{0.50}Mn_{0.33}Ni_{0.16}O_2$ (x=0) has a pure P2 phase. However, further increase of nickel content in expense of cobalt content $Na_{0.7}Co_{0.40}Mn_{0.33}Ni_{0.26}O_2$ (x=0.1) and $Na_{0.7}Co_{0.30}Mn_{0.33}Ni_{0.36}O_2$ (x=0.2) results in mixed structures including P3 and P2 phases (2). The cycling performances of the three samples were tested in the voltage range of (2-4.2V) at a rate of C/10. The results show that P3/P2-$Na_{0.7}Co_{0.30}Mn_{0.33}Ni_{0.36}O_2$ has a high capacity yet a low-capacity retention compared to P2-$Na_{0.7}Co_{0.50}Mn_{0.33}Ni_{0.16}O_2$ as shown in figure 1.

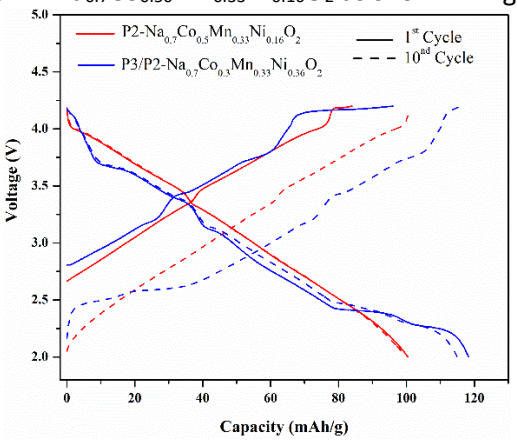

Figure 1. Cycling performances of P3/P2-$Na_{0.7}Co_{0.30}Mn_{0.33}Ni_{0.36}O_2$ and P2-$Na_{0.7}Co_{0.50}Mn_{0.33}Ni_{0.16}O_2$ during the first and tenth cycles.

Acknowledgements

This work has been supported by the Swedish Research Council (contract 2017-05466), and the strategic research area StandUp for Energy.

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Determination of age in foods with a carbon dioxide monitoring sensor

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Thematic Area: Electrochemistry & Environment

Abstract

Foods that are ready for consumption reach the consumer by going through many stages from production to sale. Although the cold chain is a very good means for delivering fresh food to the consumer, delays and various disruptions that can be experienced both in production and in the cold chain cause food to spoil. Spoiled foods lead to negative situations such as poisoning of the consumer or encountering various health problems. Especially in a period when the world population increases rapidly and food production is difficult, food spoilage constitutes a great risk for human health

The biggest disadvantages seen in the systems that detect food spoilage in the literature are; The difficulties in using the device, inability to give quick results, lack of food compatible materials, high equipment cost, time and labor loss [1-3]. Considering these shortcomings, in this project, it is aimed to design a device that monitors the CO_2 gas formed due to the formation of microorganisms in food over time and determines how many days have passed since the production of the food. Measurements were made with different foods such as milk, cheese types, eggs, and a library was created according to these measurement results and added to the device. With the loaded data, how many days the food is can be determined from the amount of carbon dioxide.

The designed device stands out with the CO_2 sensor and software used. It is simple and practical to use since it can be measured directly by holding onto the food. Can be used over and over again. It can determine the amount of carbon dioxide accumulated on the food without the need for any extra processing. There is no study in the literature that makes age determination in foods. The most important innovation brought with the device is that it can determine how many days have passed since the production of the food. Thus, by preventing the consumption of expired foods, it protects the consumer against food poisoning and ensures that the consumer reaches healthy food.

Keywords: Carbon dioxide, sensor, food, age, microorganism

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New d'imidazo[1, 2-a]pyridin derivatives as eco-friendly inhibitors against corrosion of mild steel: synthesis, characterization, electrochemical analysis,

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Thematic Area: Green Chemistry, Electrochemistry

Abstract

In the context of developing a new bioactive entity, we have evaluated the synthesis of a new series of Schiff bases belonging to the family of imidazo [1,2-a] pyridines named: (E) 2-methoxy-4-(((2-phenylimidazo[1,2-a]pyridin-3-yl)imino)methyl)phenol (IM1), and (E)-4-(((2-phenylimidazo[1,2-a]pyridin-3-yl)imino)methyl)phenol (IM2). The molecular structures were confirmed by spectroscopic methods such as infrared (FT-IR), nuclear magnetic resonance (^{1}H and ^{13}C NMR), melting poin tand mass spectroscopy (MS) coupled to (HPLC). The synthesized ligands having shown significant inhibitory efficiencies against the corrosion of mild steel in corrosive medium HCl (1M), this activity was examined by gravimetric measurements, potentiodynamic polarization (PDP), and electrochemical impedance spectroscopy (EIS). These techniques show that the study of imidazo[1,2-a]pyridine derivatives in particular the two compounds IM1 and IM2 have excellent inhibitory properties and that their performance increases with increasing concentration. Higher performance was recorded by the ligand IM1 (98%) compared to IM2 (92%).

Keywords: Imidazo [1,2a] pyridines, corrosion, mild steel, SIE, PDP

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Synthesis, Spectroscopic Studies, electrochemistry and catalytic activity of Oxovanadium (IV) and Iron (III) Schiff base complexes.

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Thematic Area: ELECTROCHEMISTRY, BIOELECTROCHEMISTRY & ENVIRONMENT

Abstract

Two novel oxovanadium (IV) and iron (III) complexes of a tetradentate Schiff base ligand (H_2L) have been successfully synthesized following a reported method [1-3] and characterized by various analytical techniques including NMR analysis. Experimental data have been complemented in the light of Density Functional Theory calculation was performed using the B3LYP method concerning HOMO-LUMO energy gaps, chemical reactivity, as well as certain molecular parameters. Cyclic voltammetry in DMF revealed quasi-reversible redox processes in both complexes, suggesting possible catalytic reactivity involving electron transfer process for these complexes. The catalytic efficiency and selectivity of oxovanadium (IV) and iron (III) complexes was tested in the oxidation of cyclohexene with (H_2O_2) as an oxidant. The results show that the catalytic performance depends on the nature of metal, the most efficient catalyst in the presence of H_2O_2 being the oxovanadium complex. A plausible mechanism for catalytic oxidation by complexes is proposed and discussed.

Keywords: Schiff base, Oxovanadium, Cyclic voltammetry, Oxidation, Iron

Acknowledgements: The authors gratefully acknowledge the financial support from The Algerian Ministry of Higher Education and Scientific Research. They also acknowledge the help of Dr J. Weiss from the CLAC laboratory at the Institution of Chemistry, University of Strasbourg, France.

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Electrochemical study of inhibition performance of a pyrazole Derivative on carbon steel in 1M HCl

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Thematic Area: ELECTROCHEMISTRY, BIOELECTROCHEMISTRY & ENVIRONMENT

Abstract

The present work discusses the adsorption and inhibitory effect of a pyrazole derivative on CS corrosion in 1M hydrochloric acid environment. weight loss, electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization (PDP) were used to carry out the experimental data. The obtained results indicate that the studied product present good inhibition effectiveness against corrosion of CS. This favorable performance was due to the formation of a protective film on CS surface which is confirmed by SEM. Therefore, results conducted by PDP show that the inhibitor acts as mixed type. In addition, Langmuir isotherm is found to be the best model to describe the adoption process.

Keywords: Corrosion, Inhibitor, Carbon steel, PDP, EIS.

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Day 3 - Saturday 24 September 2022

ORAL SESSION 8:

ORAL SESSION 8: STRUCTURAL, ANALYTICAL & PHYSICAL CHEMISTRY (T4)

Chairs: Konstantinos Plakas, Ahmad ElMoll

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Biopesticides: A fundamental research towards industrial exploitation

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Thematic Area: Structural, Analytical and physical chemistry

Abstract

Awareness of the negative impact of chemical pesticides on human and environment has given rise, in recent decades, to several currents of ecologists calling for a clean environment and healthy agriculture. One of the ways of protecting the environment and the consumer is the partial or total substitution of chemicals by biopesticides. Thus, we see more and more on the market "Eco-Bio-Products" with high added value from organic farming, where pesticides are either absent or reduced.

At the Center of Biotechnology of Sfax - Tunisia, the Biopesticides Laboratory develops limitless research on products based on Bacillus sp. in order to develop Tunisian biopesticides capable of competing with marketed biopesticides. The developed research programs were focused towards: the isolation of new bacterial strains endowed with biopesticidal activities, the genetic and biochemical characterization of the molecules produced and responsible on the biopesticide activities, the study of the interaction of these molecules with their targets, the optimization of the culture conditions of the strains in order to ensure an optimal and economical production of biopesticides; through the control and optimization of fermentation technology and the use of economical culture media. These biopesticides have been produced, formulated and successfully tested in field.

Keywords: Biopesticides, *Bacillus* sp., Eco-Bio-Products

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Recent application of plasma technology for environment

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Thematic Area: Environment Protection: Environmental Monitoring, Environmental Remediation

Abstract

Microwave plasma torch has been found suitable for treatment of highly toxic gases as well as municipal solid waste, e-waste, medical waste etc. Microwave induced plasmas (MIP) are created and maintained by using an electromagnetic energy source, with frequency in the range of 300 MHz–10 GHz, in the absence of electrodes, thus limiting gas contamination. These sources have wide range of operating powers (from few watts to megawatts), required by thermal torches from very low pressures to several atmospheres. Because of these advantages, different types of atmospheric MIP sources have been developed in the last decade. Therefore, simulation and experimental investigations are made to understand gas heating and dissociation in a microwave (MW) plasma torch at atmospheric pressure. The MW induced plasma torch operates at 2.45 GHz frequency and up to 2 kW power. Three different gas mixtures are injected in the form of axial flow and swirl flow in a quartz tube plasma torch to experimentally investigate the MW plasma to gas energy transfer. Air–argon, air–air and air–nitrogen plasmas are formed and their operational ranges are determined in terms of gas flow rates and MW power. Visual observations, optical emission spectroscopy and K-type thermocouple measurements are used to characterize the plasma. The study reveals that the plasma structure is highly dependent on the carrier gas type, gas flow rate, and MW power. However, the plasma gas temperature is shown not to vary much with these parameters. Further spectral and analytical analysis show that the plasma is in thermal equilibrium and presents very good energy coupling between the microwave power and gas heating and dissociation. The MW plasma torch outlet temperature is also measured and found to be suitable for many thermal heating and chemical dissociation applications. Therefore, our study reveals that microwave plasma torch can be used for waste (toxic gases like H_2S, CH_4 etc) to energy (Hydrogen) applications efficiently.

Keywords: plasma technology, waste to energy, gasification, microwave induced plasmas, plasma chemistry

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Risk assessment and risk management of functionalized nanomaterials

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Not Presented

Thematic Area: Nanomaterials & Environment

Abstract

Nanotechnology is a multidisciplinary area and uses many areas of science and technology to make important advances. Nanoscale-sized particles have unique properties that make them interesting for numerous applications in different fields. Still, little information is available on the epidemiological effects of nanomaterials. Traditional toxicity tests, although not enough in some conditions, are still used to assess the impacts of nanoparticles on human health. New test systems have been developed to overcome these challenges. Risk assessment should be made to use nanoparticles in safely. Risk analysis is a process consisting of three components: risk assessment, risk management, and risk communication. Data are obtained from in-vitro toxicity tests, animal tests, and epidemiological studies for risk assessment. Exposure data are a key issue for risk assessment. Risk management is the process of weighing policy alternatives and selecting appropriate prevention and control options. Risk communication is the interactive exchange of information throughout the risk analysis process. In this chapter, where and how the exposure data are obtained and how these data are used for risk analysis, in short, how to make risk analysis of nanomaterials thereby evaluating safety of nanomaterials will be summarized.

Keywords: Nanoparticle, Risk assessment Hazard, Risk management, Risk communication, Toxicity, Challenge

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Monitoring of pesticide residues in tomatoes and cucumbers, and risk assessment for the Lebanese consumer during economic crisis

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Thematic Area: Agro Geoenvironment

Abstract

Since the economic crisis in Lebanon in 2019, all the sectors were affected including the agricultural one. This study aimed to analyze the pesticide residues in 2 of the most cultivated crops after potato[1], which are tomato and cucumber, assessing the effect of the economic crisis on the phytosanitary treatments, the quality of pesticides used and their residues. In addition, the risks and toxicity of approved pesticides on tomatoes and cucumbers must be compared and contrasted locally and with similar studies in other Middle East countries. Tomato and cucumber samples were collected from all the producing governorates in 2021, and the multi-residue, QuEChERS, method was used for pesticide residues extraction. Followed by analysis and determination of ressidue's concentration by liquid chromatography-tandem mass spectrometry (LC-MS/MS). Twenty-one pesticides of different chemical groups were detected in the samples, of which 62% are insecticides and 38% are fungicides, mainly metalaxyl M, thiamethoxam, acetamiprid, and carbendazim were detected. Of the 46 collected samples, 35 (76%) are contaminated, with some samples exceeding the MRL levels established by the EU database[2]. Concerning contaminated samples, 15% contain banned pesticide residues above MRL, while 4% contain approved pesticide residue above MRL. Akkar shows the highest percentage (15%) of banned pesticide residues, while South Lebanon shows the highest (50%) residue levels above MRL. In contaminated samples, risk assessment was approached through the calculation and comparison of Adequate Daily Intake (ADI) and the Estimated Daily Intake (EDI)[3] for each pesticide, which shows the highest Hazard Index (HI) for the banned procymidone (3.4%). The exposure level of the Lebanese consumer to the whole pesticides was below the level to produce health risk. But on the other hand, the authorities must regulate the usage of pesticides and have more control over the use of counterfeit and smuggled products.

Keywords: Pesticide residues, risk assessment, hazard index, cucumber, tomato

Acknowledgements: This study was conducted using data from an investigative report supported and published by Arab Reporters for Inverstigative Journalism (ARIJ).

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Removal of Rose Bengal Dye using domestic waste "Watermelon peel"

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Thematic Area: Analytical chemistry/physico-chemical chemistry

Abstract

In This study, we evaluate the efficiency of Watermelon peel as a new biosorbent to remove Rose bengal (RB) from wastewaters effluents; that is extensively used in dyeing, printing industries and also as an insecticide. It has severe toxic effects on the human health [1] especially on corneal epithelium [2]. Watermelon peel is a very abundant domestic waste especially in summer, with no evident use and with cost effective, hence their application as a biosorbent. The material was characterized by FTIR, point of zero charge measurements and potentiometric titration. In order to verify the influence of the main parameters essential for adsorption, contact time, the adsorbent dose and the initial concentration of Rose bengal (RB), initial pH were carried out. The results show that the retention process equilibrium depend on initial concentration instantaneous for concentrations equal 10mg/L, to around 80 min for higher concentrations. The kinetic data were fitted using the pseudo first; second order equations, the intra-particle diffusion and film liquid diffusion model. The results showed that the pseudo-second-order equation gave the best agreements with the experimental data, suggesting chimisorption process [3]. The isotherm model with better adjustment to the experimental data was the Langmuir (R^2 = 0,9975) and Temkin (R^2 = 0,9915) model, with a qmax of 61,75 mg/g and positive heat adsorption value (bt= 12.165) (J/mol), indicating that the adsorption process is exothermic [4]. The highest removal efficiency of 95.26% can be achieved for a dose of 2g/L only, confirming the high potential of watermelon peel as an adsorbent.

Keywords: biosorbent, wastewaters, dye, isotherm, Rose bengal

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ORAL SESSION 9:

ORAL SESSION 9: ATMOSPHERIC CHEMISTRY & ENVIRONMENTAL POLLUTION (T3)

Chairs: Konstantinos Plakas, Ahmad ElMoll

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Monitoring long-term and large-scale deposition of air pollutants in the framework of the vegetation

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Theme area: Tropospheric Aerosols and chemistry of the atmosphere-hydrosphere

Not Presented

Abstract

A brief historical review is given on the development and milestones of the moss biomonitoring technique used to study atmospheric deposition of trace elements, nitrogen, persistent organic pollutants (POPs), radionuclides of technogenic and natural origin in Europe and Asia, as well as cosmic dust. The relevance of these studies to the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP) is shown. Examples of the long-term activity of the ICP Vegetation (International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops) established in 1987 are given to illustrate the tendencies in behavior on a large scale of air pollutants such as heavy metals, nitrogen and persistent organic pollutants. In agreement with the long-term strategy of the LRTAP Convention to enhance participation and improve air quality in Eastern Europe, the Caucasus, Central Asia, and South Eastern Europe, efforts to extend the moss survey to former republics of the USSR such as Armenia, Azerbaijan, Georgia, Moldova, Kazakhstan, and Uzbekistan were successfully undertaken. Around 15 teams were formed in Russia to cover moss sampling in Northern and Central Russia, Western Siberia, and the Far East of Russia (Kamchatka and Sakhalin). To date, 42 countries, including Bulgaria, expressed their desire to participate in the 2020-2021-2022 moss survey. Analytical methods and approaches to data interpretation are reviewed. Lebanon is welcome to join our collaboration in the framework of this Program!

Keywords: moss biomonitoring, trace elements, nitrogen, POPs, radionuclides, cosmic dust

Reference

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Towards water sustainability: supporting innovative technologies for wastewater treatment and agriculture reuse

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Abstract

The sustainable and efficient use of water resources is one of the most important challenges facing the Mediterranean region, where natural resources are of great importance, especially in developing countries already suffering from a great water shortage. In addition, climate change and population growth, along with other factors, are putting increased pressure on vital resources such as fresh water, undermining water and food security, especially in developing countries living in the Mediterranean Basin. Other problems these communities face include land degradation, including low soil fertility and salinization, which affects agriculture, the main source of livelihood for poor rural communities.

However, elements seem fundamental to us among those mentioned and their current and future governance. On the one hand, the agricultural use of water, considered to be the main consumer, has developed considerably over the last thirty years under the weight of demographic pressure and thanks to technical progress which makes it possible to extract water for bulk irrigation. The overexploitation of surface water and groundwater resulting from this change can jeopardize the functioning of ecosystems and lead to water shortages with disastrous human and ecological consequences.

In particular, in the Middle East and North Africa, groundwater depletion is rapid. If the modes of exploitation of these increasingly rare resources remain unchanged, they could well no longer exist within thirty years. Populations dependent on these water reserves would suffer greatly from this situation, and their livelihoods would be severely tested. It is therefore necessary to take a broader perspective in order to develop a viable system. Indeed, a new innovative wastewater treatment plant will be needed that illustrates this interdependence between water management, energy and agriculture.

The objective is to apply a new approach by transforming public wastewater into a valuable end product through the use of wastewater in rural areas for irrigation in agriculture. In this approach, farmers are active actors in the implementation phases and will have access to a guaranteed and constant source of irrigation water, which is a huge benefit in arid regions.

Thanks to this new treatment plant, the aquifer will be able to be replenished. This facility can provide a sustainable solution to wastewater treatment where the treated wastewater is ensured in the long term and has environmental, social and economic benefits. In addition, it could satisfy the demand for water necessary for agriculture, the most "aquavore" sector.

The purpose of this paper is to present the problems of water in a general way, in order to allow the reader to put into perspective the environmental, economic and social dimensions of the problem of the management of water resources in the Mediterranean region.

Keywords : wastewater treatment, innovative technologies, sustainability, treated water, agriculture.

Reference:

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ORAL SESSION 10: SPECIAL SESSION

Special SESSION 10: AGRO GEOENVIRONMENT & AGROCHEMISTRY (T5)

Biomaterials, Waste & biomass Valorization

Chairs: Konstantinos Plakas, Ahmad ElMoll

Special session CIMEE22 Description

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The importance of reuse of treated effluent in water scarce regions.

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Description

As water is an essential component of the planetary life support system, on the other hand it is essential for agricultural production. It is the lifeblood of ecosystems, including forests and future food and nutritional security depends. Yet, our freshwater resources are dwindling at an alarming rate. Growing water scarcity is now one of the leading challenges for sustainable development. This challenge will become more pressing as the world's population continues to grow, their living standards increase, diets change and the effects of climate change intensify.

The Eastern Mediterranean region being one of the driest and water scarce regions in the world. Many countries in the region are mining groundwater, a temporary and risky expedient. The extended reuse of treated wastewater could contribute considerably to the reduction of water stress and water scarcity in the Mediterranean countries as part of an Integrated Water Resources Management approach, focusing on the component wastewater reuse for irrigation and other purposes.
This Special session discuss the progress that has been achieved on technical, institutional, financial and legislative levels as regards the development of the process of treatment and the re-use of treated wastewater.

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Reuse of Wastewater in Mediterranean Region: challenges and future opportunities

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Thematic Area: Biomaterials, Waste & biomass Valorization

Abstract

Drivers for changing the paradigm in Water Wastewater management. Water is a key issue all around the world: source of inequalities when scarce, of geopolitical conflicts when shared, of public health when polluted.
Mediterranean region is one of the 25 "hotspots" impacted by climate change in the world. By 2050, the GDP of Middle East and North Africa linked to water issues could decrease by 6-14% thus affecting agriculture, health, and incomes.
Concerning the labour market, 3 out of 4 jobs worldwide are water-dependent and 50 million jobs should be created in the next decade to absorb the growing labour supply in the Mediterranean region.
Tackling these issues is a global challenge and such a global challenge can only be met by a collective response involving public/private stakeholders: government, academia, business & civil society at local, national and regional level, to improve & consolidate water resources management systems.
New, sustainable best practices, that rely on success stories from previous and ongoing R&D projects, could pave the way for the improvement of treated wastewater reuse as a non-conventional water resource (NCWR) that can contribute to mitigating local water shortage.
Three questions have posed:
- What are the main obstacles to use NCW which prevent from their effective adoption and regulation?
- What kind of approaches, tools and methodologies can be used in order to decrease the resistance of the population and governments to the use of NCW?
- Are there enough financial instruments to support the commercialization of such adaptable sustainable strategies and technological innovation?

Keywords: Wastewater Management, Reuse, NCWR, water shortage, Mediterranean region,

ORAL SESSION 11:

ORAL SESSION 11: AGRO GEOENVIRONMENT & AGROCHEMISTRY (T5)

Chairs: Ahmad ElMoll, Kamel Ouari

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Green technology and environmental sustainability: Benefits and challenges

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Thematic Area: Agro-GeoEnvironment & Agrochemistry

Abstract

The global resource system is already stressed. In addition, the interaction between food, energy, climate, water and economic systems is becoming better understood and appropriate action is required to proactively manage future risks as well as cope with impacts already evident.
Therefore, the resource constraints and climate change represent a significant change in the environment and the increasing pressure of the long-term trend of climate change and the availability of essential natural resources will have significant impacts on economic development with a range of possible adverse effects on global society.
In parallel, climate change is having an increasingly significant impact on economic and financial activity around the globe with these impacts likely to increase over time. To examine the possible impacts, we will take a Case study: Water. A critical resource that will have significant local impacts on the well-being and possible economic growth of regions is water. Water supply is already under stress; there is not enough water availability to reliably meet the demand from current activity in several regions of the world, hence the need to promote sustainable governance of natural resources.
Indeed, to reduce the negative impact of human activity on the environment, the green technology can replace harmful materials, processes, or products with alternatives that do not disrupt or deplete natural resources and develop environmentally friendly, economically viable, and energy-efficient processes for treating and preserving the world's limited water resources.
Following an overview of water as a valuable resource, this presentation provides in-depth information on current various green technologies associated with sustainable water and wastewater management, and green materials for sustainable water remediation. In the final section, we will describe decentralized water recycling for small-scale applications and examine various aspects of green materials for sustainable water remediation/phytoremediation and restoration.

Keywords: Green technology, environment, wastewater, water sustainability, green materials

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Advanced membrane technologies for wastewater management in recycled paper processing industry

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Thematic Area: Remediation Technologies Applied in the Environment

Abstract

The recycled paper processing plants (referred to as "Recovered fiber", RCF, plants) utilize fairly large quantities of (potentially potable) water, with obvious negative environmental implications. According to the Confederation of European Paper Industries such quantities are on average ~13.5 m^3/tn of product. To address this issue, the present study is focused on developing sustainable membrane-based process(es) for treating RCF plant effluents towards maximum water reuse/recycling. Results of laboratory tests are reported herein, employing effluent samples from an operating recycled paper plant for cardboard production. Samples were used from the feed/inlet and outlet streams of the operating biological waste-water-treatment facility as well as the permeate from a special lab-scale aerobic membrane bioreactor (MBR) unit, treating RCF plant effluents.

Initially, *dead-end filtration* tests were performed with several membrane samples (microfiltration, ultrafiltration, nanofiltration and reverse osmosis) to select suitable membrane type(s), by assessing key process parameters and operating issues such as membrane permeability, species rejection, fouling propensity. These test results showed that microfiltration and ultrafiltration membranes suffered from rather severe membrane fouling, while exhibiting very low salt rejection, as expected. On the contrary, high quality permeate was obtained by reverse osmosis (RO) membranes; however, the latter exhibited quite low permeability for the treated samples, which would lead to increased energy consumption. The nanofiltration (NF) membranes performance was best overall, characterized by fair permeability and good quality permeate. Nevertheless, both RO and NF membranes suffered from significant (mostly organic) fouling. Subsequently, special *crossflow experiments* were performed under realistic (constant pressure) conditions by employing flat sheet membrane coupons (~130cm^2) to determine a narrow (near optimum) range of operating conditions as well as the efficiency of membrane cleaning procedures, both physical and chemical. NF membrane samples were used, from a Filmtech NF-90 module. These test results showed that satisfactory permeate quality (i.e. >97% salt rejection) and recovery of approx. 70% can be achieved by employing the effluent from the existing wastewater treatment plant as well as the permeate from the lab-scale aerobic MBR as feed streams. Finally, the results of membrane cleaning tests suggested that chemical cleaning leads to almost complete (>95%) restoration of membrane permeability, whereas simple flushing by water had no substantial effect on permeate flux restoration.

Keywords: membrane processes, recycle paper industry, wastewater reuse, membrane fouling.

Acknowledgements.

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ORAL SESSION 12:

ORAL SESSION 12: CLIMATE CHANGE, MARINE & COASTAL ECOSYSTEM (T6)

Chairs: Konstantinos Plakas, Ahmad ElMoll

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The pollution of the Adriatic Sea by marine litter and microplastic presence in the fish stomach

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Not Presented

Theme Area: Marine and Coastal Environment

Abstract

Maritime transport, coastal urbanization and the foreseen increase in offshore oil and gas extraction pose serious risks of pollution from hazardous substances for several coastal states in the whole Mediterranean, and in particular in the Adriatic - Ionian region. Interreg ADRION HARMONIA Project (Harmonization and Networking for contaminant assessment in the Ionian and Adriatic Seas) developed in period 2018 -2020, included 10 partners as one of them was Agricultural University of Tirana, Albania. The objective: To share best practices to support the harmonized implementation of marine environmental directives in the ADRION region. To strengthen the network of data infrastructures to facilitate access and re-use of marine data among countries bordering the Adriatic – Ionian Seas. In the end of the project: Arrived on the EU initiative EMODnet for the management and supply of fragmented marine data, HarmoNIA strengthed the existing transnational network of data infrastructures to facilitate access and re-use of marine data among countries bordering the Adriatic – Ionian Seas. The outputs consisted in a Transnational network of institutions adopting a joint data management system for contaminants in the marine environment, and in regional strategies to improve harmonization in monitoring and assessment, and to evaluate risk of contaminant dispersion in vulnerable coastal zones from different pollution sources.
HarmoNIA outputs improved the coordination among institutions involved in MSFD and UNEP/MAP protocol implementation, local, regional and national authorities in charge of environmental assessment, management, conservation, as well as research institutions, to tackle problems related to pollution dispersal and risks on the coastal areas of the ADRION region.

Keywords: Network; contamination; Adriatic and Ionian Seas; marine environment

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First Time Non-Target Screening of Emerging Organic Pollutants in Sediments and Fish from the Eastern Mediterranean Coast (Lebanon)

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Thematic Area: Marine and Analytical Chemistry

Abstract

The urbanization and the overexploitation of coastal resources along the Lebanese coast are constantly increasing. In addition, the coastal area is subjected to various anthropogenic pressures due to the presence of uncontrolled solid waste dumpsites and the discharges of domestic and industrial effluents into the sea without prior treatment. Hence, the objective of the present study was to assess the state of the Lebanese marine environment by determining the occurrence of emerging Persistent Organic Pollutants (POPs) in marine sediments collected along the Lebanese coast during November 2019. Sediments samples were sequentially extracted using a semi- pressurized solvent extraction device (EDGE from CEM), a fat clean-up was applied and then samples were pre-concentrated. Semi-volatile organic pollutants such as OCPs, BFR and their metabolites, PCDDs, PCDFs, PAHs and PCBs were screened using single quadrupole GC-EI-MS. As an extension study, preliminary tests were conducted on GC-APCI-tims-TOF HRMS since ion mobility spectrometry (IMS) offers an orthogonal separation dimension based on the ions' size, shape, and charge, known as collisional cross section (CCS). Thus, IMS enhances peak capacity and can be adapted to complex sample matrices. Meanwhile, CCS values provide a further confident identification parameter. For the first time in Lebanon, these contaminants are identified, quantified and reported on the following: extract ion, mass spectrum, and retention time for experiments run by GCMS and exact mass, true isotopic pattern, and ion mobility for the parallel appraisal run by GC-tims-TOF. PAHs concentrations in sediments ranged between 15.08 and 2132.88 ng/g dw, while PCBs levels ranged between 0.044 and 32.13 ng/g dw. Various pesticides and herbicides were also detected for the first time in the Lebanese marine environment. Sediments and fish collected near landfills and effluent discharges showed significant concentrations of various contaminants. The results of the present study highlighted the potential contribution of coastal landfills and discharges to the organic pollution. The perspectives and benefit of Non-Target Screening by GC-tims TOF are also promising on halogenated contaminants and their byproducts where more studies are being investigated to ensure the reproducibility of the method and to enrich the in-house compound library.

Keywords : Pesticide, Persistent Organic Pollutants, Marine Sediments

Acknowledgements: The authors would like to thank the E2S, University of Pau and Pays de l'Adour (UPPA), the Lebanese National Council for scientific research (L-CNRS), ELME project (Evaluation of the Lebanese Marine Environment: a multidisciplinary study (reference number: ENI/2018/398-295) and the IMAP-MAP project: Integrated Monitoring and Assessment Program-Mediterranean Marine Protected Areas.

POSTER SESSION:

Chairs: Moufida Merzougui, Konstantinos Plakas, Ahmad ElMoll

4th INTERNATIONAL SYMPOSIUM ON
MATERIALS, ELECTROCHEMISTRY & ENVIRONMENT
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Study of molecular interactions in the binary mixture containing alkan-2-ol by Density, dynamic viscosity and refractive index measurements at 298.15 K

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Thematic Area: Physical Chemistry

Abstract

Densities (ρ), viscosities (η) and refractive indices (n_D) of the binary mixture of ethyl benzoate with 2-butanol, including those of pure liquids were measured over the entire composition range at 298.15 K. From the experimental data, the excess molar volumes (V^E) and the other excess thermodynamic properties such as deviations in viscosity ($\Delta\eta$), refractive index (Δn_D) and excess free energy of activation (ΔG^{*E}) have been evaluated. The computed data V^E, $\Delta\eta$, ΔG^{*E} and Δn_D have been correlated with Redlich-Kister polynomial equation to ascertain the fitting parameters and standard deviations. A good agreement among experimental data and the values estimated by theoretical procedure was obtained. The deviations for excess properties have been explained on the basis of the intermolecular interactions [1]. The trend of excess properties varies with structural characteristics of the liquid components [1, 2]. So, they are functions of molecular interactions.

Keywords: Density, dynamic viscosity, ethyl benzoate, 2-butanol, Redlich-Kister equation.

Acknowledgements: Authors gratefully acknowledge all staff of the PTAPC (**P**lateaux **T**echnique d'**A**nalyses **P**hysico-**C**himiques) - Ouargla, Algeria, headed by the director Dr. BELKHALFA Hakim.

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[2]. Sastry S S, Babu S, Vishwam T, et al. (2014); Physica B 420: 40–48.

4th INTERNATIONAL SYMPOSIUM ON
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Efficient ultrasonic assisted adsorption of organic pollutants employing of Biomass

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Not presented

Abstract

The continuously increasing use of organic dyes in number of industries viz. textile, paper, plastics, rubber, leather treatment, etc. has led to release of these hazardous pollutants to water bodies. Most of the organic dyes do not degrade easily because of their complex aromatic structure [1]. Due to the foreseen water scarcity, wastewater treatmentis the issue to be taken up on priority. It is need of time to carry out studies on removal of dyes from industrial waste. Various techniques viz. coagulation, chemical oxidation, membrane separation process, adsorption, electrochemical, and aerobic and anaerobic microbial degradation have been developed for treatment of dye contaminated water [2,3].

One of the discussed regeneration methods is desorption by ultrasound. Ultrasound does not only promote desorption but also enhances the mass transfer of sorption processes. We discuss the arising problems and basic effects when applying ultrasound during sorption processes in order to show the potentials of this desorption process. The focus is laid in particular on the influence of ultrasound frequency and intensity.

In this study, the impact of ultrasound on the adsorption features of natural sorbent for removal of Crystal Violet.The parameters studied included effect of pH and of temperature was investigated. This study revealed that the low cost sorbent (HX) exhibit a higher sorption efficiency in the removal of textile dye from wastewater.

Keywords: ultrasound, Crystal Violet, Basic dye, wastewater.

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4th INTERNATIONAL SYMPOSIUM ON
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Arsenic (V) removal from water using magnetic nanoparticles synthetized by polyol method

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Not presented

Thematic Area: Nanotechnology & Nanobiotechnology for Environmental Remediation

Abstract

Magnetic nanoparticles (MNPs) are a group of nanoparticles that can be manipulated by the effect of magnetic field and have great potential application in a large number of environmental processes. One of the most prevalent MNPs is magnetite nanoparticles (Fe_3O_4) because they have low toxicity and good biocompatibility. Magnetite particles have proven to be a very effective adsorbent for removing metal ions from water, such as arsenic. The MNPs are most often obtained from iron salts by the method of precipitation in the base medium. However, pristine MNPs are prone to oxidation and can be dissolved in acidic media. These disadvantages can be avoided by coating the surface of MNPs with some polyol solvent (such as polyethylene glycol, acrylic polymer, polyvinyl alcohol, etc.), which can significantly improve their physical and chemical properties. Depending on the volume and quality of the solvent, the size of the particles can be affected, as well as their functionality can be significantly improved. In this work the synthesis of magnetite nanoparticles by polyol method, as well as their utilization as adsorbent for arsenic (V) removal from water was investigated.

The magnetite nanoparticles were synthetized by alkali co-precipitation method in the presence of polyethylene glycol as polyol solvent at 80°C. X-ray diffraction (XRD) analysis confirmed the presence of magnetite nanoparticles with mean crystallite size of 10 nm. Polyethylene glycol coated magnetite showed high efficiency in arsenic removal from water solution of initial concentration of 1068 µg/L. Using magnetite in concentration of 5 g/L the 99% reduction of arsenic content in water was achieved. After 2 h the concentration of arsenic in treated water was 8.4 µg/L, but after 24 h the concentration decreased to 1.7 µg/L.

Keywords: magnetic nanoparticles, arsenic removal, adsorption, polyol method

Acknowledgements: This work was supported by Ministry of Education, Science and Technological Development of Republic of Serbia (451-03-9/2021-14/200134, 451-03-9/2021-14/200125). Part of this work was supported by the COST Action CA18130 ENFORCE-TXRF.

4th INTERNATIONAL SYMPOSIUM ON
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Energy Power Plants Accidental Environmental Impact in Wartime vs. Peacetime

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Not presented

Thematic Area: STRUCTURAL, ANALYTICAL & PHYSICAL CHEMISTRY)

Abstract

A power plant can affect the environment by its construction and by its operation. A power plant and its auxiliary components (e.g. natural gas pipelines, water intakes and discharge, coal delivery and storage systems, new transmission lines and waste disposal sites) take up space on the ground and in the air, use water resources, and, in many cases, emit pollutants into the air. Fossil fuel-fired and biomass-fired plants burn fuels to make either hot air or steam needed to spin power turbines generating electricity. Nuclear power plants use the nuclear fission reaction to create steam to do the same. The burning of fuel creates exhaust gases and other by-products, including air pollutants. The use of water to make steam requires large quantities of water from nearby rivers or lakes, or from local underground water aquifers. In some cases, water must be discharged from the plant after it has been used. A variety of solid wastes can be produced, and these must be handled. The combustion of coal creates ash as a solid waste. Nuclear power plants create spent nuclear fuel rods and low-level radioactive wastes.
Such considerations can be very difference in the case the plant is involved in a war zone. The quite recent case of the Zaporizhie Nuclear Power Plant in Ukraine is just one example.
In peacetime, power reactors have a sufficiently low environmental impact: this study originates from the recent return of full-scale war in Europe, after 77 years since the end of WW2. Safety and security aspects of conventional thermoeletrical power reactors, and nuclear power reactors, if unfortunately located in a modern battlefield are addressed, with a comparison to similar scenarios for peacetime.
The most severe case is a nuclear power station heavy bombing, with failure of the primary containment and fire. Environmental impact is modelled by means of the HOTSPOT code. Less catastrophic scenarios deal with a fire of the electrical power generation and transformer systems for a conventional or nuclear reactor, with environmental release of chemical pollutants.
Finally, a scenario in which a reactor falls under control of terrorists or militia from a rouge state is considered, in terms of security and proliferation questions.
In all cases, immediate ceasefire and peace is the best solution.

Keywords: chemical pollution, radioactive pollution, energy, wartime

4th INTERNATIONAL SYMPOSIUM ON
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Application of sodium citrate for corrosion inhibition

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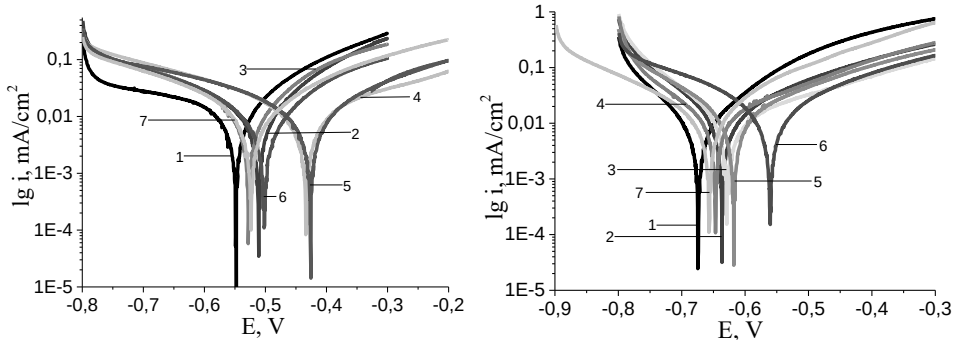
Not presented

Thematic Area: electrochemistry, environmentally friendly corrosion inhibitors

Abstract

The corrosion resistance of 09Г2С steel was investigated by the method of potentiodynamic polarization (Fig. 1), using the MTech COR – 500 potentiostat, saturated Ag / AgCl reference electrode and auxiliary platinum electrode. According to the results of polarization research, the corrosion potential and current of 09Г2С steel in 0.1% NaCl solution is -0.55 V and 7 · 10-3 mA / cm^2, respectively.

In fig. 1. polarization curves of steel 09Г2С after 3 h of exposure in 0.1% NaCl solution with different concentrations of sodium citrate, according to which the potential (Ecor) and current (caviar) of corrosion were determined. After 3 h of exposures, the electrochemical characteristics of the steel indicate an increase in its corrosion resistance. The maximum protective effect is observed at a concentration of 2.5 g / l and persists for 24 years. A further increase in concentration to 3.0 g / l does not increase the inhibitory effect of sodium citrate.



a b

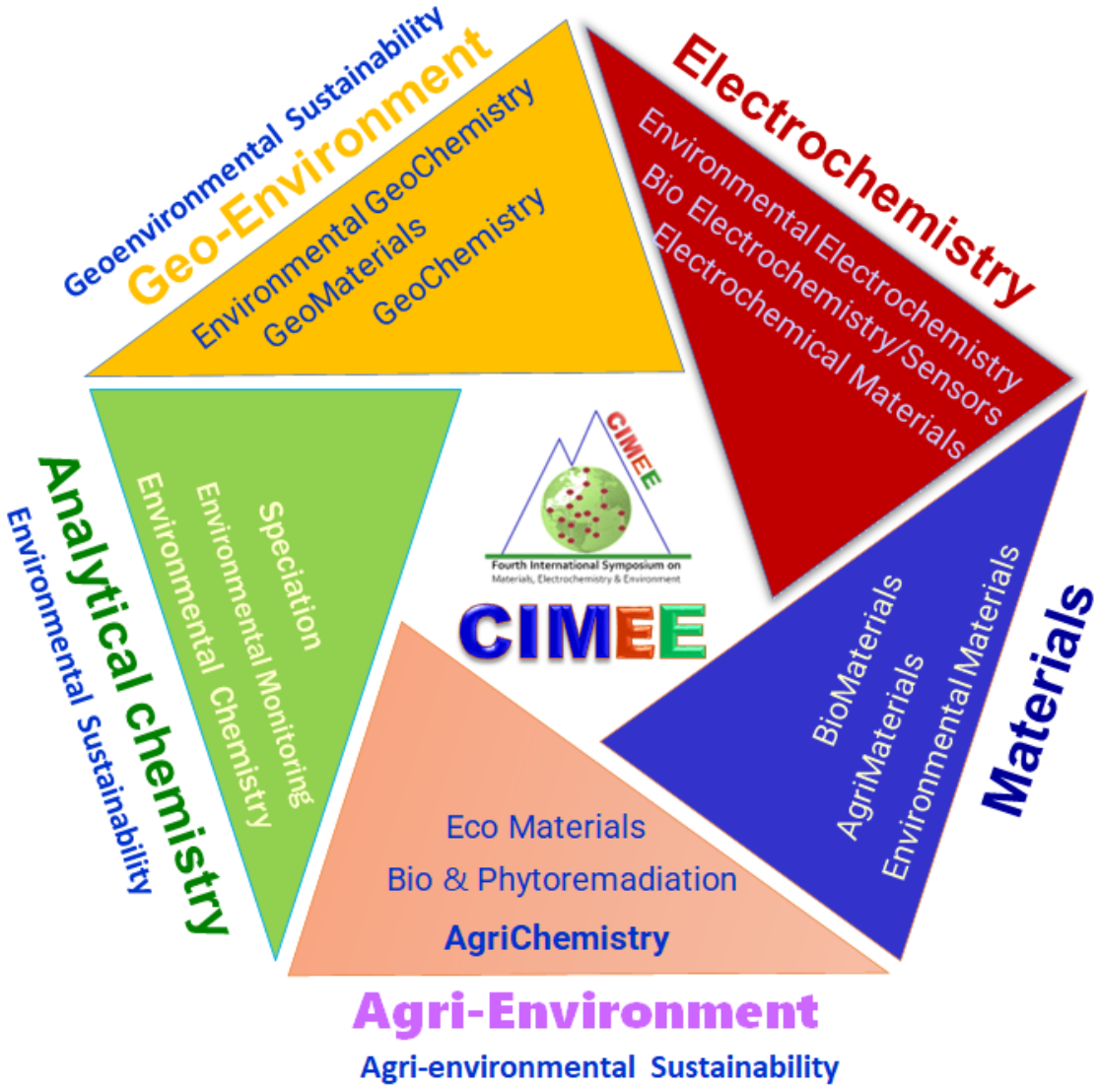
Fig. 1 - Polarization curves of steel 09Г2С after 3 h (a) and 24 h (b) exposure in 0.1% NaCl solution with a concentration of sodium citrate: 1 - 0 g / l; 2 - 0.5 g / l; 3 - 1.0 g / l; 4 - 1.5 g / l; 5 - 2.0 g / l; 6 - 2.5 g / l; 7 - 3.0 g / l

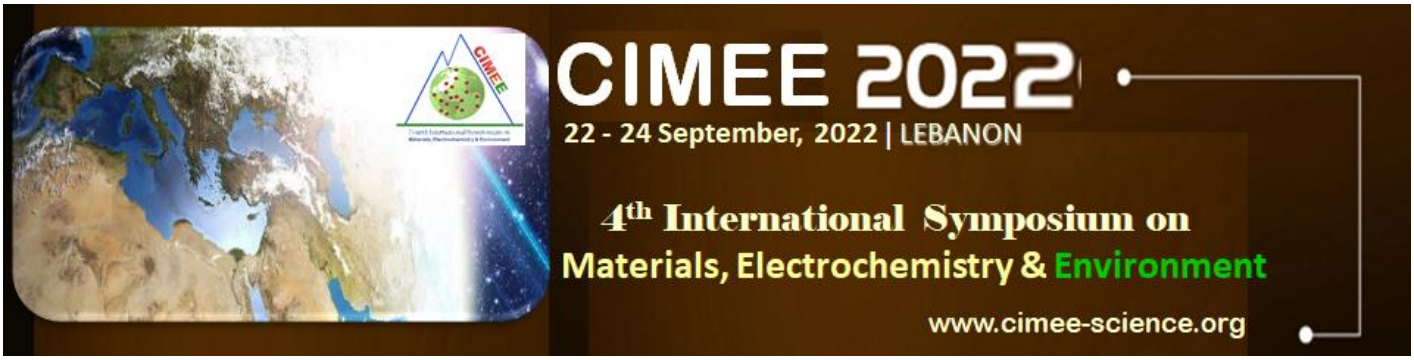
Thus, sodium citrate has an inhibitory effect to protect steel 09Г2S in 0.1% NaCl. The maximum effectiveness of sodium citrate as an anti-corrosion inhibitor is observed at a concentration of 2.5 g / l, which is apparently due to the adsorption of $Na_3C_6H_5O_7$ and the formation of a protective film on the steel surface.

Keywords: corrosion steel, environmentally friendly corrosion inhibitors, electrochemistry.

CLOSING SESSION

Ahmad ElMoll, Dalila Hammiche, Moufida Merzougui, Marta Pazos, Najla Fourati, Nalan Kabay, Konstantinos Plakas, Kamel Ouari, Tadeusz Szumiata





LAST UPDATED 29 09, 2022.

CLOSING SESSION Report

FOURTH INTERNATIONAL SYMPOSIUM ON MATERILS, ELECTROCHEMISTRY AND ENVIRONMENT

Quatrième Colloque International sur les Matériaux, l'Electrochimie et l'Environnement, CIMEE22

September 22 – 24, 2022, CNF - LEBANON

CIMEE22 The 4th International Symposium On Materials, Electrochemistry & Environment

We're pleased to announce the publication of the Book of Abstracts of the fourth edition, CIMEE22.
CIMEE is Research Group of academics and researchers focused primarily on Materials, Electrochemistry & environmental Science and other related disciplines. This conference is concentrated on the recent advances and new trends in materials chemistry, electrochemistry and environment bringing together an international community (Europe, Maghreb and Middle East) of scientists, and researchers interested in the science of materials and innovative processes in Electrochemistry and their applications in various fields of the environment. The subject of this symposium perfectly reflects, on the one hand, the importance of interdisciplinarity in chemistry to provide innovative solutions for the environment and, on the other hand, to stimulate research projects within the Lebanese University in encouraging scientific partnership with the Maghreb and Europe. It is about designing new processes in electrochemistry, inventing new and sustainable solutions for the environment based on advanced materials.
To this end, several university research laboratories from Europe, the Maghreb and the Middle East participated in the organization of this symposium. On September 22-24, 2022. The Fourth International Symposium on Materials, Electrochemistry & Environment under the theme: Advanced Green Chemistry and Sustainable Technology for Environmental Enhancement. was held in the Center Numerique Francophone, CNF de Tripoli, Lebanon.

An opening ceremony was held by Lebanon's national anthem & Lebanese University anthem and a welcome seech by the scientific Committee Chair & Chairman, Dr. ElMoll Ahmad. Next, Dr, Jihem Elleuch greated the participants on behalf of Pr. Slim Abdelkafi Director of National School Engineering of Sfax, ENIS, and Presented of the scientific and research activities of ENIS, Tunisia

With almost 60 participants from more than 24 countries across North Africa, Middle east and Europe, this edition also makes a strong case for continuing to hold an international event focusing on chemistry and environmental science. Plenary, keynote and invited speakers and more than 30 distinguished experts presented their work. We appreciate the contribution of all the speakers, who have conveyed their latest results in the conference.
The scientific program has been developed around six main scientific topics:

T 1. MATERIALS & THE ENVIRONMENT
T 2. ELECTROCHEMISTRY & ENVIRONMENT
T 3. ATMOSPHERIC CHEMISTRY & ENVIRONMENTAL POLLUTION
T 4. STRUCTURAL, ANALYTICAL & PHYSICAL CHEMISTRY
T 5. AGRO GEOENVIRONMENT & AGROCHEMISTRY
T 6. CLIMATE CHANGE, MARINE & COASTAL ECOSYSTEM

At the closing session of the Conference the Chairmen of the Area Discussion Panels attempted to bring together the more important points that emerged in the topic discussions.

Opening session Chairs: Marta Pazos, Najla Fourati,
KL1: Innovative solutions for the promotion of non-conventional water reuse and management in the Mediterranean region
Konstantinos V. Plakas, Centre for Research and Technology, Hellas CERTH, Thessaloniki, Greece
KL2: Extracellular Polymeric Substances from marine microalgae: application for water and wastewater treatment processes
Jihen Elleuch by the Director of National School of Engineers of Sfax, University of Sfax, Slim Abdel Kafi, Tunisia
KL3: Use of simple, low cost and environment friendly techniques for the growth of thin films, nanostructure layers, nanomaterials, nanocomposites and suspensions.
Emmanuel Koudoumas, Department of Electrical and Computer Engineering, Hellenic Mediterranean University, Greece.
KL4: Agroecology as new approaches to the transition towards sustainability,
El Moll Ahmad, Faculty of Public Health, faculty of Science, DSST, Lebanese university, Lebanon

OS 1: Electrochemistry & Environment (T2) Chairs: ElMoll Ahmad, Dalila Hammiche
OS 2: Agro-Geoenvironment & Agrochemistry (T5) Chairs: ElMoll Ahmad
OS 3: Materials & the Environment (T1) Chairs: Merzougui Moufida, Ahmad ElMoll
OS 4: Structural, Analytical & Physical Chemistry (T4) Chairs: Konstantinos Plakas, Ahmad ElMoll
OS 5: Agro-Geoenvironment & Agrochemistry (T5) Chairs: Ahmad ElMoll, Dalila Hammiche
OS 6: Materials & the Environment (T1) Chairs: Najla Fourati, Ahmad ElMol
OS 7: Electrochemistry & Environment (T2) Chairs: Kamel Ouari, Ahmad ElMoll
OS 8: Structural, Analytical & Physical Chemistry (T4) Chairs: Konstantinos Plakas, Ahmad ElMoll
OS 9: Atmospheric Chemistry & Environmental pollution (T3) Chairs: Moufida Merzougui, Ahmad ElMoll
SS 10: Special session, Dr. Konstantinos Plakas: Reuse of Wastewater in Mediterranean Region: challenges and future opportunities
OS 11: Agro-Geoenvironment & Agrochemistry (T5) Chairs: Dalila Hammiche, Marta Pazos
OS 12: Climate Change, Marine & Coastal Ecosystem (T6) Chairs: Konstantinos Plakas, Ahmad ElMoll
PS 13: Structural, Analytical & Physical Chemistry (T4) Konstantinos Plakas, Ahmad ElMoll

Ultimately, more than 20 plenary sessions and keynote speakers, 40 oral conferences, special sessions and several Posters were the subject of this symposium with the participation of professors, teacher-researchers and doctoral students with different nationalities (Algeria, Albania, Belgium, China, Denmark, Egypt, France, Finland, Greece, India, Italy, Ireland, Kingdom of Saudi Arabia, Lebanon, Morocco, Malta, Poland, Pakistan, Romania, Russia, Spain, Serbia, Turkey, Tunisia, Ukraine)
At the end of the colloquium a closing session was organized.

This closing session resulted in the following useful recommendations:
- Mention in the certificate of attendees if the participant attended the presentations of the other researchers present during the conference
- Submit a request to the permanent committee of the CIMEE Group to organize this conference every year and organize CIMEE23
- Publish the best papers of the conference and see the proposals received from our colleague Dalila Hammiche from Alegria for publication in the journal bioplymers and a second proposal from our colleague Rafael Luque from Spain for publication in the proposal journals

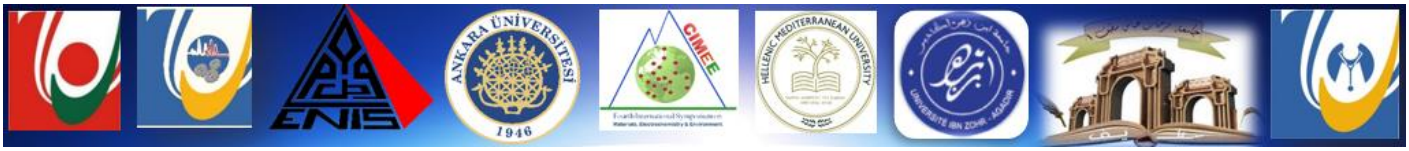
Electrochemistry of Materials and related to all areas of Electrochemistry of Materials, i.e. to both the electrochemical synthesis of novel materials and their applications to perform chemical or/and electrochemical transformations at their surface or inside the electrode.
For the upcoming event CIMEE23, we propose to contact all CIMEE partners to:
-contribute in various types of electrochemical materials such as sensor materials, energy storage materials, energy conversion materials, coatings for corrosion protection, materials with mixed conductivity, electron-conducting polymers, redox polymers, nanocomposite electrode materials, functionalized electrode surfaces.
-encourage topics and projects related to electrochemical biosensors, nanosensors and environmental sensors
-proposal new topic: pollution of the environment (air, sol): contamination level of heavy metals in road dust
At the end of the symposium, the committee agreed to extend full paper submission until October 30 for the publication of better papers in international journals.
In the meantime, if you have any questions or want to be included in the scientific committee, please do not hesitate to contact us. Cimee16@ul.edu.lb

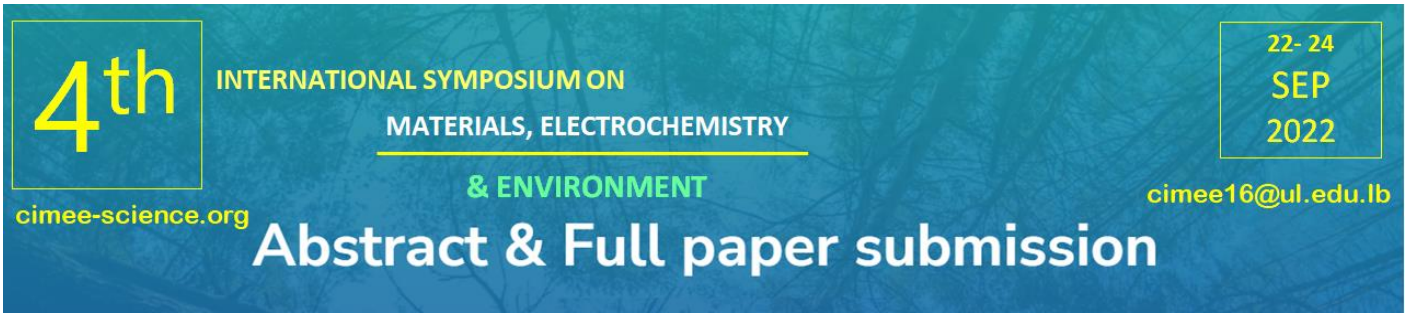
Ce rapport a été rédigé par Dr Ahmad ELMOLL, président du colloque CIMEE22

Theme of the meeting:

Advanced Green Chemistry and Sustainable Technology for Environmental Enhancement

SYMPOSIUM PARTNERS





This book composes the abstracts of the keynote, oral and poster presentations of the 4th International Symposium on Materials, Electrochemistry and Environment (CIMEE22), held in AUF, Lebanon, from 22 - 24 September 2022. The abstracts are reproduced as accepted by the Scientific Committee of the meeting.

Fourth International Symposium on Materials, Electrochemistry & Environment
FPH, DSST, Lebanese University, Lebanon

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For information on scientific issues, kindly contact Symposium Secretariat: cimee16@ul.edu.lb
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