2024
ICMSA
ABSTRACT BOOK

ALL ABOUT MATERIALS SCIENCE...

DATE :
01-03 November 2024

PLACE:
Sousse, Tunisia

ORGANIZED BY:

ATCer
Tunisian Ceramic Association
الجمعية التونسية للخزف

TAMSA
Tunisian Association of Materials Science & Applications
الجمعية التونسية لعلوم المواد وتطبيقاتها

CNRSM
Centre National de Recherches
en Sciences des Matériaux

Welcome message

On behalf of the organizing committee, I warmly welcome you to the 1st International Conference on Materials Science and Applications (ICMSA2024) which is being held from 1st to 3rd November 2024 in Sousse, Tunisia. ICMSA2024 is a unique opportunity to interact and to share scientific knowledge between researchers, industrials and Engineers in materials science.

This event is being jointly organized by the National Centre of Research in Materials Science (CNRSM), the Tunisian Association of Materials Science and Applications (TAMSA) and the Tunisian Association of Ceramics (ATCer). It is supported by the Tunisian Ministry of Higher Education and Scientific Research (MESRS).

This conference follows a program with plenary lectures, keynote speeches and parallel sessions on wide range of topics:

- Nanomaterials and Materials for Energy
- Biomaterials, Green Materials and Environmental applications
- Materials for civil Engineering
- Structural Materials and Computational Materials Science
- Polymer Science and Engineering materials
- Ceramic and composite materials
- Mineral materials and applications
- Circular economy: Recycling and reuse of waste materials
- Mechanical Engineering and Metallurgy for materials science
- Advanced Materials for Medicine, Agriculture and Food Safety
- Artificial Intelligence and Industry 4.0 for Materials Science

This year in this first edition, it is my great pleasure and honor to welcome outstanding and renowned invited speakers with large experiences in innovation. I hope that ICMSA2024 will be a valuable learning experience and it will be the best way to strengthen the relationship between participants.

A special competition will be also organized for young innovators in materials science. this side event will be a relevant opportunity for phd students and early career engineers, to present their innovative research and projects.

Last but not the least, I would like to express my gratitude to sponsors, participants and volunteers from organizing and scientific committees for making ICMSA2024 a success.

Enjoy ICMSA2024 and enjoy Tunisia.

Halim HAMMI
Chairman of the Organizing Committee of the ICMSA2024

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Hamdi HELLALI, CPG; Tunisia
Rabani ADAMOU; ABDOU MOUMOUNI Universty, Niamey; Niger

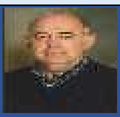
Friday 1st NOVEMBER 2024 (Morning)

07:30 – 09:30 **Welcoming participants, distribution of documents**

09:30 – 10:30 **Opening Ceremony**

10:30 – 11:00 **Welcome Reception**

11:00 – 11:40



Lecture 1 **Manuel Rendueles de la Vega**

Department of Chemical Engineering and Environmental Technology
University of Oviedo, SPAIN

New bioplastics for food packaging: from the laboratory to larger-scale design

11:40 – 12:00 **Keynote 5** **Rym dhouib**

ENIS, Founder of the start-up ISMANT Concrete Design, TUNISIA

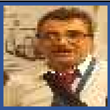
High-Performance Concrete (HPC): A Revolution for Organic Forms and Art

12:00 – 12:30 **Poster Session 1 (P1A - P 30A)**

13.00 **Lunch**

Friday 1st NOVEMBER 2024 (Afternoon)

14:30 – 15:10

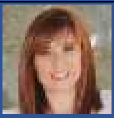


Lecture 2 **Mourad AMARA**

National Higher School of Nanoscience and Nanotechnology,
Faculty of chemistry, USTHB, ALGERIA

Improvement of membrane selectivity by chelation properties of self-adsorbed compound. The case of End-of-Life membrane recycling

15:10 – 15:40



Lecture 3 **Marta PAZOS**

CINTECX, Department of Chemical Engineering
University of Vigo, SPAIN

ADVANCING SUSTAINABLE MATERIALS
Eco-Friendly Design and Synthesis for Environmental applications

15:40 – 16:00 **Keynote 3** **Nor-Edine ABRIAK & Walid MAHERZI**

IMT Nord Europe, Institut Mine-Télécom, Centre for Materials and Process, France

Presentation of the national 'Sédimatériaux' initiative for the management and valorization of dredged sediments

Oral Communications Session 1

	Room A: Fontaine Bleue		Room B: Odéon		Room C: Panthéon 1	
16:00 – 16:15	KN1	A. GHORBAL	O1B	A. MERAD	O1C	A. DELLAGI
16:15 – 16:30	O1A	A. MAGHCHICHE	O3B	A. HADDAD	O2C	D. BAYOUDHI
16:30 – 16:45	O2A	A. KAOUKA	O4B	B. KHAOUADJI	O3C	H. KRARCHA
16:45 – 17:00	O3A	A. ANDOLSI	O5B	B. ABDOULI	O4C	M. HAJJI

17:00 – 17:30 **Poster Session 2 (P31A - P41A) & (P1B – P18B)**

Oral Communications Session 2

17:30 – 17:45	O4A	A. TABET ZATLA	O7B	F. GHANDI MANASRA	O7C	R. AYED
17:45 – 18:00	O5A	A. RHIMI	O8B	H. TLILI	O8C	S. HERMI
18:00 – 18:15	O6A	B. LOUHICHI	O10B	H. MOSBAHI	O9C	S. SHIRI
18:15 – 18:30	O7A	F. AL-RIMAWI	O12B	J. MAAMRIA	O10C	W. TAOUALI
18:30 – 18:45	O8A	I. LAIB	O13B	J. SOLI		
18:45 – 19:00	O11A	K. BEN MABROUK	O14B	M. ABIDI		

19.00 **Dinner**

Saturday 2nd NOVEMBER 2024 (Morning)

9:00 – 9:40

Lecture 4 **Karine MOUGIN**

Institut de Science des Matériaux de Mulhouse
Université de Haute Alsace, France

Toward the development of sensors and actuators by 4D printing

9:40 – 10:20

Lecture 5 **Jean-Charles Majesté**

Ingénierie des Matériaux Polymères
Université Jean Monnet, Saint-Etienne, FRANCE

RUBBER RECLAIMING: SOME ADVANCES IN THE STRUCTURE/PROCESS RELATIONSHIPS

10:20 – 11:00 **Poster Session 3 (P19B - P 40B)**

Oral Communications Session 2

	Room A: Fontaine Bleue		Room B: Odéon 1		Room C: Odéon 2		Room D: Panthéon 1	
11:00 – 11:15	O10A	J. GHOZLANI	O15B	M. DKHILI	O1D	A. GUEDRI	KN2	S. K. SHAKSHOOKI
11:15 – 11:30	O12A	K. OULD YEROU	O17B	M. BORNI	O2D	A. SDIRI	O1E	A. SALEM
11:30 – 11:45	O13A	K. YAHYA	O18B	M. NAOUS	O3D	S. MEDHIOUB	O2E	A. BEN YAHIA
11:45 – 12:00	O14A	K. FARAH	O19B	M. JAOUADI	O4D	A. BOUKHILI	O3E	H. SAWALHA
12:00 – 12:15	O15A	K. ZLAOUI	O20B	N. MITRAOUI	O5D	I. BENAOUN	O4E	M. CHEMEK
12:15 – 12:30	O16A	L. JAMMELI	O21B	N. HAMDADOU	O6D	T. KALLEL	O5E	N. E. BEN AMMAR
12:30 – 12:45	O17A	M. AL-JABARI	O22B	N. LOUKIL	O7D	N. SALEM	O6E	R. EZZEDDINE
12:45 – 13:00	O18A	M. KAHLOUL	O23B	R. BENABDERRAHMAN	O8D	R. KNANI	O7E	Y. _AFIR

13.00 🍽 **Lunch**

Saturday 2nd NOVEMBER 2024 (Afternoon)

14:30 – 15:10

Lecture 6 **Ayhan Oral**

Department of Chemistry
Çanakkale Onsekiz Mart University, TURKEY

Methods and Applications of Coaxial Nanofibers and Beads

15:10 – 15:50

Lecture 7 **Youssef El Hafiane**

ENSIL-ENSCI
Limoges University, FRANCE

Elaboration and applications of mineral materials Processes, consolidation and microstructure

Oral Communications Session 3

	Room A: Fontaine Bleue		Room B: Odéon 1		Room C: Odéon 2		Room D: Panthéon 1	
16:00 – 16:15	O19A	M. JDIDI	O24B	S. ILAHI	O9D	S. GHWAIDIA	O1F	A. ABU TAHA
16:15 – 16:30	O20A	R. ALNAJJAR	O25B	S. MAMOUN	O10D	S. GRAIRIA	O2F	F. K. FOHELY
16:30 – 16:45	O21A	H. GMATI	O26B	S. SAYEB	O11D	R. S'HABOU	O3F	M. HABIB
16:45 – 17:00	O22A	S. MAKHARZA	O27B	W. TLILI	O13D	K. MKADMINI	O4F	S. DOUIRI

17:00 – 17:30 **Poster Session 4 (P1C - P 16C) &(P1D – P8D)& (P1E – P6E)**

Oral Communications Session 4

	Room A: Fontaine Bleue		Room B: Odéon 1		Room B: Odéon 2		Room D: Panthéon 1	
17:30 – 17:45	KN4	H. MAROUF	O2B	A. MEHDAOUI	O1I	E. BEN HADDADA	O1G	A. MIDOUNI
17:45 – 18:00	O5C	M. FARJALLAH	O6B	F. BEN SLIMAN	O2I	H. BEN MOHAMED	O2G	B. KHIARI
18:00 – 18:15	O6C	M. DHIFET	O9B	H. BENGHANOUM	O3I	M. ELOUSSAIEF	O3G	H. ASKRI
18:15 – 18:30	O23A	S. BEN LATIFA	O11B	I. KHEMISSI	O4I	O. ATAWA	O4G	I. ARFAOUI
18:30 – 18:45	O24A	S. CHIBI	O16B	M. A. HAJJAJI	O5I	S. SASSI	O5G	I. KHOUNI
18:45 – 19:00	O25A	T. SEKRAFI	O28B	W. BENNANI	O6I	S. SELMI	O6G	K. LAZAAR
19:00 – 19:15							O7G	M. BOUHJAR
19:15 – 19:30							O8G	M. HAYDER

19.00 🍽 **Dinner**

Sunday 3rd NOVEMBER 2024 (Morning)

08:30 – 9:10

Lecture 8

Paulo Mourão

Department of Chemistry and Biochemistry, School of Science and Technology
University of Évora, PORTUGAL

Activated Carbon and Biochar: Synergistic Carbon Materials

09:10 – 9:50

Lecture 9

Mohamed Abdalraheem Abu-Saied

Polymeric Materials Research Department
(SRTA-CITY), New Borg El-Arab, Alexandria, EGYPT

Structure/Properties Relationship of Some Prepared Polymers - Polystyrene Blend Membranes For Fuel Cells Applications

Oral Communications Session 5

	Room A: Fontaine Bleue		Room B: Odéon 1		Room B: Odéon 2		Room D: Panthéon 1	
10:00 – 10:15	O3H	J. KAMMOUN	O29B	I. BEN KACEM	O1J	A. MEDJEDED	O1H	G. MBARKI
10:15 – 10:30	O26A	Y. FAKHFAKH	O30B	H. NAFETI	O2J	H. LAHBIB	O2H	I. HAJRI
10:30 – 10:45	O9A	I. CHERIF	O31B	H. BOUHAMED	O3J	H. MANSOUR	O4H	S. FTITI
10:45 – 11:00	O27A	R. R. SHQIER	O5F	R. ABUSAMRA	O4J	K. OUESLATI	O5H	L. AJILI

11:00 – 11:30

Poster Session 5

(P1F – P7F) & (P1G – P5G) & (P1H – P5H) & (P1I – P4I) & (P1J – P6J) & (P1K – P4K)

11:30 – 12:00

Closing Remarks, Awards Distribution

12:00 **Closing Reception, Check out and departure**

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Topic D: Oral Presentations

Topic D: Poster Presentations

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Topic E: Oral Presentations

Topic E: Poster Presentations

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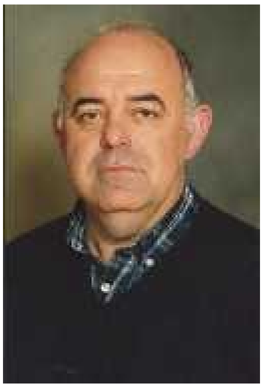
Plenary Lectures

Manuel Rendueles DE LA VEGA

Director of the Department of Chemical Engineering and Environmental Technology;
University of Oviedo, Spain



Manuel Rendueles de la Vega is a distinguished figure in the field of Chemical Engineering, currently serving as a Professor at the University of Oviedo in Spain. He earned his degree in Chemical Sciences with a specialization in Industrial Chemistry from the University of Oviedo in 1990 and later obtained his Ph.D. from the same institution in 1995.

As a dedicated academic, Dr. Rendueles coordinates the Master in Food Biotechnology program at the University of Oviedo. His significant contributions to the field are evident through his research within the TBR (Bioprocess and Reactor Technology) research group, where he focuses on separation processes and the recovery of waste generated by the food industry. His expertise particularly lies in the separation and purification of proteins from effluents, as well as the synthesis of biomaterials and fermentative processes for organic acid production.

Dr. Rendueles has enriched his academic journey with predoctoral stays at the University of Porto in Portugal and postdoctoral stays at the University of Nancy I in France. Throughout his career, he has achieved noteworthy recognition, with five six-year periods of research and one six-year period of Scientific transfer. His impact is reflected in his impressive H-35 Index and H10-100 Index.

Furthermore, Dr. Rendueles has authored 180 articles in SCI-indexed journals and presented 140 communications at both national and international conferences. As a testament to his leadership in the academic community, he has taken on the role of the main researcher in three European and National projects since 2020. Dr. Manuel Rendueles de la Vega stands out as a key figure in Chemical Engineering, contributing significantly to research, education, and scientific advancements in his field.

Lecture 1: New bioplastics for food packaging: from the laboratory to larger-scale design

M. RENDULES*, I. MARCET, M. DIAZ

Department of Chemical Engineering and Environmental Technology, University of Oviedo, C/Julián Clavería s/n, 33071 Oviedo, Spain

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Approximately 300 million metric tons of fossil fuel-based plastic are produced worldwide, which has triggered a global problem, as this material is non-biodegradable and produces toxic gases during incineration. In this regard, the fourth United Nations Environment Assembly has achieved a global agreement among over 200 countries to significantly reduce single-use plastic products by 2030. Additionally, in line with this objective, the European Union promotes, through its Bioeconomy Strategy, the replacement of petroleum-derived plastic materials with biodegradable alternatives sourced from renewable natural sources.

In this sense, there are currently a variety of natural biopolymers sourced from renewable materials that are completely biodegradable, which can serve as an ecological alternative to petrol-based plastic. These biopolymers can be extracted directly from the biomass, such as proteins, polysaccharides and lipids, or produced directly by microorganisms, such as polyhydroxyalkanoates (PHAs), bacterial cellulose and xanthan gum, or even sythesized in a reactor using bio-derived monomers, such as polylactic acid (PLA). The performance of all these polymers to produce bioplastics has been widely studied under laboratory scale, and for this purpose, biopolymers have to be solubilised in an appropriate medium and then mixed with some plasticiser, usually glycerol, and finally casted in a plain surface and dried. The resultant bioplastic can be finally recovered dettaching it manually from the bottom of the container. This procedure, called "solvent casting", is energy intensive and difficult to be scalated to pilot plant, and almost impossible to scale up to industrial scale, at least from the economic point of view. In this regards, the most valuable biopolymers are those that can be extruded with the machinery already available in traditional plastic packaging plants, but in this case only few of them have the thermoplastic properties necessary to be processed. This communication is focussed around the topic of substituting conventional plastics with fully biodegradable plastics, commonly known as bioplastics. It will emphasize the obstacles encountered by the industry in connecting the advancements achieved at the laboratory level in the production and characterization of bioplastics with their large-scale industrial production.

Key words: bioplastic, industrial production, natural biopolimers, bioeconomy

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Mourad AMARA

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Full-time professor since 2010, doctor in materials chemistry since 2003 and author of several scientific publications and educational works on chemistry. He is reviewer in about 15 scientific journals including (Science Journal of Analytical Chemistry; Desalination; Fresenius Environmental Bulletin; Journal of Hazardous Materials; Journal of Membrane Science; Journal of Hazardous Materials; Chemosphere, etc.). Speaker, expert consultant in chemistry, mineral recovery and water treatment. His article published in 2003 in the Talanta journal was ranked first in the top 10 most consulted articles in analytical chemistry during the first 2 years of its publication. Professor Amara is the President of the Algerian Society of Chemistry, former Dean of the Faculty of Chemistry and former Director of the Hydrometallurgy Laboratory of the USTHB of Algiers and team leader of Ion Exchange Membrane Materials. He has also led numerous research projects and doctoral theses related to membranes and water treatment.

Lecture 2: Improvement of membrane selectivity by chelation properties of self-adsorbed compound. The case of End-of-Life membrane recycling

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Membrane materials are not utilized only as porous materials; they also play a significant part in the transport and separation of species due to their surface charge, hydrophilic/hydrophobic balance, texture, and many other physical and chemical properties that depend on the medium matrix. The development of selective membranes implies the adoption of a novel concept of separation, which is based on the complexes that form within the membrane material during the chelation process of transport. This gives the membrane a highly selective characteristic regarding to specific species that exist in a highly heterogeneous environment. Using this phenomenon of chelation and transport by complexation-decomplexation between feed-and-receive surfaces in the direction of transference flow became possible by polymer inclusion membranes, or PIMs. This type of membrane has been synthetized using polyethyleneneimine (PEI), which has the ability to chelate metals in aqueous environments. This polymer exhibits polyelectrolyte behavior in aqueous solution; the pH and ionic strength of the water determine its viscosity, protonation rate, and conformation. A structure with both amine and ammonium groups is produced when the pH is kept at or near pKa=8.8, which polarizes the membrane surface. Alcaline medium leads to the predominance of amine groups, non-binding nitrogen doublets, and complexation mechanisms as opposed to ion exchange mechanisms. Negatively-charged metal-ligand complexes are transported at higher pH levels by ion pair mechanism into the membrane bulk. Since more than 20 years, we have concentrated our efforts on the investigation of several facets of PEI's acid-base and complexing behavior in aqueous solutions, as well as inside membranes or ion exchange resins as a surface modification and ion transport facilitator through complexation. Copper is a highly studied metal that absorbs light at 630 nm in the visible spectrum and 280 nm in the ultraviolet spectrum when linked to PEI. In addition, additional molecules like polyvinylpyrrolidone (PVP) for cobalt, thiourea for copper and silver separation, D2EHPA for chromium transport, and other complexing agents have been utilized to complement PEI or work as substitutes.

Marta PAZOS CURRÁS

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Marta Mª Pazos Currás is an Full Professor of the Department of Chemical Engineering at the University of Vigo and belonging to the Bioengineering and Sustainable Processes Group (http://biosuv.webs.uvigo.es). Her research career has focused on the area of Environmental Technology and Biotechnology. The concession of different projects as PI in national and regional calls has allowed the development of the different lines of research that Dr. Pazos has carried out in recent years. Presently, she is developing Advanced Oxidation Processes for industrial and environmental applications. In addition, these projects have allowed her the support of the 13 Doctoral Theses that Dr. Pazos has directed. She has an H index of 48 by her authorship of more than 190 articles that have been published in prestigious international journals. In addition, her research has been divulgated in more than 300 communications to national and international conferences.

Lecture 3: ADVANCING SUSTAINABLE MATERIALS:

Eco-Friendly Design and Synthesis for Environmental applications

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The advancement of innovative technologies for environmental protection and restoration has led to the need for new advanced materials. This communication presents the experience in the development of synthesized materials for environmental applications. In recent years, the production of biochar and hydrochar from agro-industrial waste through thermal and hydrothermal treatments has emerged as a promising technology for enhancing the circular economy by reducing waste accumulation. Through these thermal treatments, valuable adsorbents have been generated from lignocellulosic materials, such as olive pomace and banana, and their effectiveness in the remediation of wastewater containing emerging contaminants, such as pharmaceuticals, has been validated [1]. Additionally, the modification of materials through nitrogen or metal doping in a one-pot synthesis process has proven to be an effective strategy for altering properties and enhancing catalytic characteristics. These functionalized carbonaceous materials exhibit notable properties for electrochemical hydrogen production and their application in Advanced Oxidation Processes (AOPs), such as Fenton-based processes. Simultaneously, research has focused on the development of nanostructured materials, such as Metal-Organic Frameworks (MOFs), which are novel porous materials formed by the linkage of transition metal ions with organic ligands. The ingenious synthesis of mono- and bimetallic MOFs has provided exciting properties comparable to those of carbonaceous materials, and their viability as adsorbents and catalysts in various AOPs, including Fenton-based processes, photocatalysis, and sulfate radical-mediated oxidation, has been demonstrated [2].

Key words: Metal-organic Frameworks, hydrochar, biochar, Advanced oxidation process, Hydrogen production.

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Karine MOUGIN

Institut de Science des Matériaux de Mulhouse, Université de Haute Alsace, France

Expert for the European Commission (Marie-Curie Fellowship) and for L'Oréal Fellowships; Institute of Materials Science of Mulhouse, France

Dr. Karine MOUGIN from the Institute of Materials Science of Mulhouse (IS2M) is a researcher and teacher specializing in the field of nanomaterial synthesis, particularly metallic nanoparticles, their surface functionalization, and associated self-assembly phenomena. Her research focuses on studying interface phenomena where surface-induced self-organization processes and related scale effects play a crucial role. Controlling the mobility and organization of nanoparticles through surface structure and chemistry allows for the intentional creation of functional surfaces/interfaces with adjustable and stimulable physico-chemical properties.

Her body of work has enabled her to publish around 70 articles in high-impact scientific journals, contribute to the writing of three chapters in books, file a Soleau envelope, and hold 13 patents, with the last nine extended globally. She has also presented her work at 36 invited conferences worldwide (Europe, USA, Asia - Japan, Thailand, etc.). The international recognition of her expertise and dynamism is evident in the numerous requests she receives, such as serving as an expert for the European Commission (Marie-Curie Fellowship), an expert for L'Oréal Fellowships, and actively participating in the organization of scientific events (organizing member of the TMS conference in 2021 in Orlando, Florida, organizing committee member of the CNRS's first national thematic school on 4D printing, etc.).

Lastly, Dr. Karine MOUGIN is also the vice-president of the SCF Alsace regional section and was invited to represent women in the sciences on the "International Women's Rights Day" by the prefect of the Grand Est region.

Lecture 4: Toward the development of sensors and actuators by 4D printing

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The "polymer" 3D printing was invented in the 1980s, we see that today, there is a very limited choice of resins or polymers compatible with this process, greatly limiting the range of final properties or functionality of the 3D objects obtained. Hence, this project deals with the implementation of 3D printing processes to manufacture complex three-dimensional objects that are able to react or adapt to their environment, process so called 4D printing. To achieve this goal, new resins for additive manufacture by photopolymerization are developped. In order to obtain a 4D effect, colloidal metallic nanoparticles with different shapes (spherical, rod, etc.) have been synthesized and then introduced into the photosensitive resins [1][2][3]. Different objects of controlled geometry have then been realized by photopolymerization according to the desired effects. Several stimuli (light, temperature, stress mechanical, etc.) have been explored. For example, on a macroscopic scale, one can imagine producing a colour change induced by light (photochromic) or mechanical stress (mechanochromic) [4]. At the microscopic scale, the aim will be to propose miniaturized actuators controllable by light or temperature. These programmable materials will be able to find application in several fields such as sensors, robotics or the microfluidics.

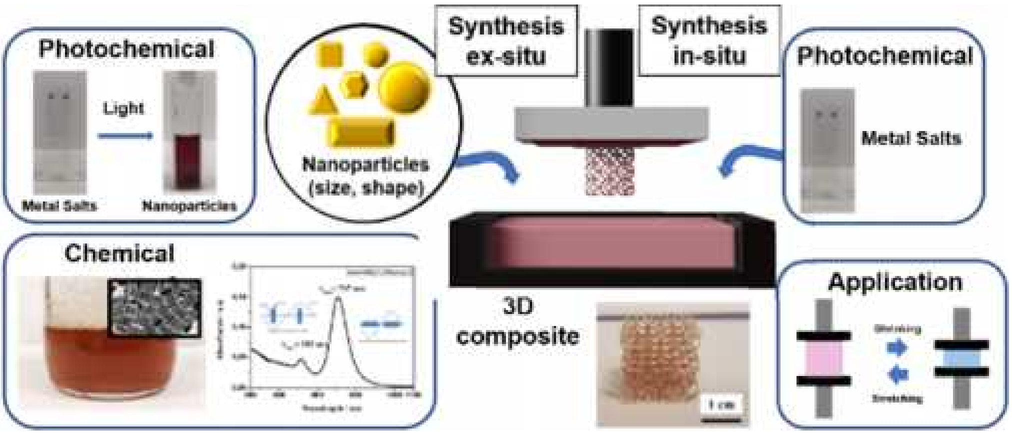

Fig. 1. Global outline of the subject.

Keywords: nanoparticles, 3D printing, nanomaterials, color change materials

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Pr. Jean-Charles Majesté studied polymer science at the University of Pau and Bordeaux (France). He received his PhD in polymer physics in 1998 on the subject of molecular dynamics of polymers with very broad molar mass distributions. Then, he joined the EXXON Chemical Europe group for one year post-doctoral position to work on branched polyolefins. In 1999, he joined the IMP laboratory (Ingénierie des Matériaux Polymères, UMR CNRS 5223) where he is currently a full professor, head of the laboratory in Saint-Etienne and leads the team "Structure and Rheology of polymers: processes and modeling". His research activities, in close collaboration with the polymer industry, focus on the relationships between the structure, morphology and rheological properties of polymer systems in the melt state, elastomers and colloïdal systems. He is particularly interested in modeling viscoelastic behavior for applications in polymer processing and in understanding the flow of complex materials. He is a member of the French Rheology Group.

Lecture 5: RUBBER RECLAIMING: SOME ADVANCES IN THE STRUCTURE/PROCESS RELATIONSHIPS

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The major socio-economic challenges of the rubber and polymer industry involve transitioning from a linear economic model, which consists of "extracting, manufacturing, consuming, and discarding," and which faces resource depletion, to a circular economic model. To meet this challenge, the main proposed development pathways currently rely on recycling. Two predominant solutions are: pyrolysis, which allows for the recycling of rubber waste into oil and carbon black, and grinding, which through mechanical transformation results in obtaining rubber powder or pellets that can be used as is in the field of civil engineering for instance. In recent years, the reclaiming of cross-linked elastomers through chemical or physical processes into thermoplastic materials has emerged as an alternative solution that is garnering increasing interest and showing significant industrial potential. The challenge of this approach is to control the conditions that lead, by breaking selectively the chemical links of the elastomer network, to a new material capable of being integrated with equivalent performance into elastomer formulations or even substituting for a virgin elastomer. Physical reclaiming remains the most compatible with an industrial context. It is based on thermo-mechanical treatment, which can be done either in batches using HSM (High Shear Mixing) technology or continuously through twin-screw extrusion.

In this talk, we will discuss a series of studies on the reclaiming of elastomers via twin-screw extrusion from the perspective of the structure/properties/process relationships. We will highlight the various stages and chemical or physical mechanisms involved, as well as their consequences on the structures formed at different scales. We will then show that reclaimed elastomer can be incorporated into a blend with another polymer to create materials with new or modified properties, such as thermoplastic elastomers (TPE) and we will detail the parameters that control the properties of the TPE through the relationships between morphology, composition, and thermo-mechanical history.

This work demonstrates the major influence of the process (positive or negative) on the properties of reclaimed elastomers and their usability. Moreover, a thorough understanding of all the steps requires taking into account the competition between the chemical aspects and the underlying physics.

Keywords : Rubber reclaiming, twin-screw extrusion, structure properties relationships, polymer blends

Ayhan ORAL

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Ayhan Oral is working as full-time professor at the Department of Chemistry at Çanakkale Onsekiz Mart University. He obtained his BSc and MSc in Chemistry at the İnönü University, Çanakkale Onsekiz Mart University. In 2007 he earned his Ph.D. at The Ege University, in chemistry. During his doctorate studies he worked on developing and preparation of nanocomposite. He served as the chairman of the audit committee of the Chemists Society of Türkiye and is currently the deputy president of the same association. He is founder and chairman of International Joint Congress of Materials and Polymers. The main research fields of prof. A. Oral are polymer chemistry, nanochemistry, different materials in chemistry with the expertise in nanofibers, nanocomposite, biopolymer materials for different applications such as drug release, wound healing, and bio-scaffolds. Dr Oral's h-index is: 13, has 38 published articles and 585 citations.

Lecture 6: Methods and Applications of Coaxial Nanofibers and Beads

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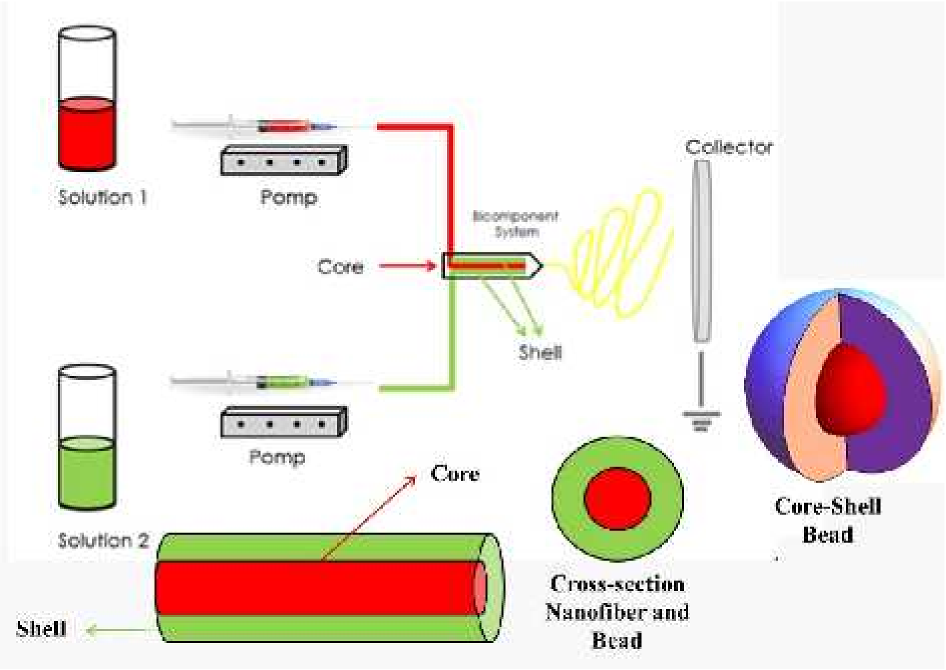
Electrospinning is the most widely used technique in nanofiber and bead production. With this method, the structures of nanofibers and beads can be changed and produced for use in different applications. Electrospinning conditions must be optimum to obtain bead-free, smooth, and homogeneous nanofibers. In addition, to produce beads, the flow rate must be higher and the viscosity of the polymer solution must be lower. The electrospinning device generally consists of a needle, pump, and collector. Coaxial nanofibers and beads can be obtained by using needles with multiple hollows. Coaxial systems can spin two different polymer solutions at the same time, thus intertwining nanofibers and beads with different properties as core-shell structures can be obtained. Coaxial nanofiber or bead can be obtained by changing electrospinning conductions such as flow rate, polymer solution viscosity, and applied voltage. Coaxial systems with a hydrophobic core and hydrophilic shell layer have been frequently used in many medical applications such as drug delivery systems. Thus, hydrophobic and hydrophilic drugs can be released simultaneously with controlled long-term release. Additionally, it is available in the literature that coaxial systems release the active ingredients of drugs more efficiently than monoaxial systems. Coaxial systems can be used for both healing and infection prevention by placing antibacterial agents loaded in the shell and special drugs loaded in the core part. Additionally, the release profiles of different drugs in two different polymer matrices can be changed by an external effect, such as radio frequency or radiation. Due to the mentioned properties, Coaxial nanofiber and bead systems are expected to be used in tissue engineering applications such as wound covering, topical drug release, tissue regeneration, etc., and will become more common in the future.

Keywords: Coaxial nanofiber, coaxial bead, electrospinning, core-shell



Graphical Abstract

Youssef EL HAFIANE

ENSIL-ENSCI, Limoges University, FRANCE

Youssef EL HAFIANE is a physical chemist specializing in eco-materials. Most of his research work is devoted to mineral materials (glass, clays, cement). He obtained his Advanced Studies Diploma and his PhD in ceramic materials and processes from the University of Limoges (France). His thesis focused on the development of the tape casting process for the production of thick films based on calcium aluminates. He then led an incubation project and the creation of a startup, from 2002 to 2009, to promote the patents filed as part of the research work. Between 2010 and 2016, during his role as a associate professor at ENSA in Safi, he worked to promote Moroccan mineral materials. Since 2016, associate professor at the ENSIL-ENSCI engineering school (University of Limoges), doing his research work at the Institute for Research on Ceramics (IRCER), UMR CNRS-University of Limoges, on low-carbon mineral binders. He is the author of five patents, about sixty articles and book chapters. He has also held numerous positions of responsibility, at the industrial, teaching and research levels. Currently, he is:

- Deputy Director of the ENSIL-ENSCI engineering school (University of Limoges)
- Head of the cross-disciplinary research axis "Ceramic materials and processes and sustainable development", within IRCER
- ustainable Development Officer within IRCER
- Sustainable Development and Social Responsibility Officer (SD&RS) within the Industrial Ceramics specialty - ENSIL-ENSCI

He has received numerous distinctions:

- Winner of the Innovation Trophies (2nd national prize), INNOVACT, Reims (2003)
- Winner of Business Creation - Master of Business Creation, Entrepreneur Week at the Senate, Paris (2004)
- Special Jury Prize of the 7th European Competition for Innovative Business (C2EI), Young Economic Chambers (JCE) France, Limoges (2008)

Lecture 7: Elaboration and applications of mineral materials: processes, consolidation and microstructure

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This work concerns the microstructure and its role in different systems, namely: (i) monitoring the microstructure during the synthesis of pure and doped cementitious phases; (ii) modulation of the microstructure of natural raw materials, with a view to developing particular usage properties; (iii) control of the microstructure by optimizing the dispersion of particles in suspensions and its impact on the consolidation of a calcium aluminate-based cement shaped by different processes. In the first example, the objective is to work on new so-called low-carbon cements (sulfo-aluminous cements (SAC)). The approach consists in studying model cementitious systems (pure or doped) through different aspects: (i) the synthesis of particular phase powder (ye'elimite, Ca4Al6O16S) and the fundamental understanding of the formation mechanisms of these phases through the monitoring of their evolution during heat treatments; (ii) the study of the impact of additions as dopants on the polymorphism and microstructure of the phases studied.

In the second example, the problem addressed concerns the microstructure of different materials, developed from natural raw materials. These materials were developed for specific uses such as filtration, enameling or refractory materials. In one case, a modulated porous microstructure was studied for ceramics developed from two clays, a clay rich in stevensite, and a kaolinitic clay. In the other case, the opacification of an enamel was developed by inclusions, crystallized or amorphous, in an amorphous matrix. In both cases, the correlation between the microstructure of the materials and the usage properties was explored.

In the third example, the challenge is the control of the microstructure by optimizing the dispersion of particles in the suspensions of a calcium aluminate cement. This better dispersion leads to a greater densification and consequently to an improvement in the mechanical properties of the hardened material, although the hydration rate is not very high, or even in some cases the absence of formation of classic alumino-calcium hydrates. It has been shown that the control of the microstructure can play a role as important or even more important than that of the hydration rate in the consolidation and development of the mechanical properties of cementitious materials. In this respect, the continuity of the bonds can have a more important role than the strength of the bond. The suspensions developed have been used for the development of thick films by tape casting and for surface treatments on objects made by a 3D printing process.

Keywords: synthesis, cementitious phases, low carbon, silicate ceramics, consolidation, sintering, hydration, microstructure, processes, usage properties.

Paulo MOURÃO

University of Évora, Portugal

P.A.M. Mourão is a Researcher (permanent position) from University of Évora, Portugal. He has a Physics and Chemistry graduation, a master in Physics, and a PhD in Chemistry, in the Materials and Surface area. In the last years, he has consolidated his research in the fields of preparation, characterization, development and application of porous materials, with the focus on the recovery and valorization of different raw materials and waste, from natural and/or synthetic sources, by its transformation into adsorbents with potential application in the liquid (e.g. dyes, pesticides, pharmaceuticals, metals) and gas phases (e.g. CO2), guided by a circular economy perspective.

Lecture 8: “Activated Carbon and Biochar: Synergistic Carbon Materials”

P.A.M. Mourão

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Carbon-based materials have emerged as a key area of interest for both academic research and industrial applications. This surge in attention reflects the growing collaboration and knowledge exchange between these sectors, driven by the vast potential of these materials across various industries, including energy, chemicals, pharmaceuticals, food, healthcare, automotive, railways, aerospace, and particularly in water treatment for human consumption and wastewater management. A notable advantage of carbon materials is their ability to be produced from lignocellulosic and synthetic waste, which are often problematic due to their volume and composition. As a result, there is also significant potential to valorise waste, especially natural and renewable sources, by transforming it into high-value products like carbon-based adsorbents.

Among carbon materials, activated carbon and biochar stand out due to their versatile structural and chemical properties. Key features such as their porous structure (including factors like pore volume, average pore size, pore size distribution, and external surface area) and surface chemistry (e.g., specific functional groups, point of zero charge) make them highly suitable for water treatment applications.

This communication explores the potential of activated carbon and biochar as effective adsorbents. It discusses the various precursors used in their production, the processes involved in their preparation, and their application in both liquid and gas phases, illustrated with case studies developed on the Chemistry and Biochemistry Department of the University of Évora.

Mohamed Abd Al-Raheem Abd Al-Gayed ABU SAIED

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Dr. Mohamed A. Abu-Saied received his bachelor's, master's and doctorate degrees from Al-Azhar University, Faculty of Science, Cairo, Egypt in 2002, 2006 and 2010, respectively and he received postdoctoral fellowship in Arizona State University, AZ, USA, University of Akron, Akron, OH, USA and Vanderbilt University, Nashville, TN, USA. He is currently an Associate Professor at the Polymer Materials and Advanced Technology Research Department and Director of Central Laboratory, New Materials Research Institute (ATNMRI), the City of Scientific Research and Technological Applications, New Borg El Arab City, Alexandria, Egypt. His research interests are in the areas of engineering, materials science, medical applications (drug delivery, wound dressing and tissue engineering), environmental science, nanotechnology, nanotechnology, polymerization, Dyes, Coloring materials and water Desalination.

Lecture 9: Structure/Properties Relationship Of Some Prepared Polymers - Polystyrene Blend Membranes For Fuel Cells Applications

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Global energy demand is rapidly increasing, driven by population growth and economic development, particularly in emerging markets. However, this growth comes with significant environmental challenges, including greenhouse gas emissions, pollution, and resource contamination. Renewable energy presents an opportunity for sustainable development, with Direct Ethanol Fuel Cells (DEFCs) emerging as a potential alternative energy source. DEFCs use ethanol as fuel and have advantages such as high energy density, low operating temperature, and safer ethanol storage and transport, making them suitable for portable devices. However, DEFCs face challenges such as lower efficiency compared to other fuel cells, constant ethanol supply needs, catalyst poisoning, and ethanol crossover from the anode to the cathode, which leads to efficiency losses.

Our research sought to address these issues by developing polyelectrolytic membranes using sulfonated polystyrene (SPS), modified from Styrofoam, blended with either Chitosan (CS) or Xanthan Gum (XG). These biopolymers were chosen to improve the membrane's thermal and mechanical stability and enhance proton conductivity, crucial for fuel cell performance. The sulfonation process introduced conductive groups into the membrane, enhancing its ion exchange capacity. The prepared membranes were evaluated using various techniques such as scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FT-IR), and proton conductivity (PC) tests. Results showed that adding CS or XG to the SPS polymer matrix increased water uptake, improved thermal stability, and enhanced proton conductivity, while reducing ethanol crossover. The SPS/CS and SPS/XG membranes demonstrated good electrochemical and mechanical performance, making them promising candidates for low-cost DEFC applications.

In conclusion, our research suggests that SPS/CS and SPS/XG membranes can significantly improve DEFC performance, offering a viable, cost-effective solution for renewable energy technologies.

Keynotes

Achraf GHORBAL

Research unit Advanced materials, applied mechanics, innovative processes, and environment, UR22ES04, Higher Institute of Applied Sciences and Technology of Gabes, University of Gabes, Tunisia

Professor Achraf Ghorbal stands at the forefront of cutting-edge research as the Director of the Advanced Materials, Applied Mechanics, Innovative Processes, and Environment Research Unit (UR22ES04). With a distinguished academic career, he served as the Vice-Director of the Higher Institute of Applied Sciences and Technology of Gabes—University of Gabes—Tunisia, demonstrating leadership and expertise over a seven-year period from 2013 to 2020.

Achraf Ghorbal's academic journey began with the successful completion of his M.Sc. in Processes and Materials Engineering in 2003, followed by a Ph.D. in Chemistry of Materials in 2006 from the University of Haute Alsace–Mulhouse–France. In 2007, he embarked on a pivotal postdoctoral fellowship at the French Atomic Energy Commission (Commissariat à l'énergie atomique) in Saclay—France, laying the foundation for his future contributions to the field.

Recognized for his outstanding capabilities, Achraf Ghorbal assumed the role of Assistant Professor in 2008 at the University of Gabes—Tunisia. Over the years, his dedication and scholarly achievements led to successive promotions, reaching the positions of Associate Professor in 2015 and Full Professor in Materials Sciences in 2022. In these roles, he has significantly advanced the academic and research landscape, contributing to the University of Gabes and beyond (https://sites.google.com/view/achraf-ghorbal).

Professor Ghorbal's research is at the forefront of addressing pressing environmental challenges. His focus spans wastewater treatment, bio-based polymers, eco-materials, and bio-based composites, showcasing a commitment to sustainable solutions. He has played a pivotal role in various major research initiatives, serving as a co-investigator and notably as the Principal Investigator (PI) for significant projects such as the Indo-Tunisian joint project (2017-2000), the Federated Research Projects of the Tunisian Ministry of Higher Education and Scientific Research (2019-2023), and the PRIMA – Partnership for Research and Innovation in the Mediterranean Area – project (2023-2026).

KN1: Characterization of Pentaethylenehexamine-Modified Reed Beads for Congo Red and Cr(VI) Removal: Insights from AFM PeakForce QNM, ATR-FTIR and SEM

Hana Boubaker [a], Rim Ben Arfi [a], Karine Mougin [b], Achraf Ghorbal [a]

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Marine ecosystems face numerous environmental stressors, from plastic pollution to light intrusion. Despite these challenges, significant efforts have been directed toward developing eco-friendly technologies with a low carbon footprint. This study focused on creating an innovative, environmentally friendly sorbent for wastewater treatment. Reed-based balls (RB) were produced by dissolving reed powder in BMIMCl, followed by functionalization with epichlorohydrin and grafting with pentaethylenehexamine (PEHA), leading to the formation of a biosorbent named "GRB." This material was designed for the simultaneous adsorption of Congo Red (CR) and hexavalent chromium [Cr(VI)] in aqueous solutions.

A Central Composite Design for Response Surface Methodology (CCD-RSM) was employed to optimize biosorption parameters. Optimal conditions were found to be a pH of 4.5, Cr(VI) concentration of 30 mg L^{-1}, CR concentration of 40 mg L^{-1}, a contact time of 120 minutes, and an adsorbent mass of approximately 1 g L^{-1} at 25°C. Under these conditions, adsorption percentages reached 98% for CR and 84% for Cr(VI), with maximum adsorption capacities of 130.34 mg g^{-1} and 87.45 mg g^{-1}, respectively. FTIR analysis revealed characteristic peaks of pentaethylenehexamine, suggesting interactions between the epichlorohydrin-modified reed beads and the grafted PEHA molecules. AFM analysis showed increased surface roughness, likely due to the accumulation of CR and Cr(VI) on the GRB surface. Additionally, SEM/EDX analysis demonstrated significant morphological changes in the biomaterial, attributed to surface coverage by PEHA molecules.

Isotherm studies indicated that the Sips model best fit the concurrent adsorption of CR and Cr(VI). Furthermore, the GRB material exhibited excellent reusability and regeneration for up to ten cycles, highlighting its potential as a sustainable solution for wastewater treatment.

Key words: Biomass-based beads, PEHA Grafting, Simultaneous adsorption, anionic pollutants, Response Surface Methodology, Reuse and Regeneration.

Sadek Khalifa Mohamed SHAKSHOOKI

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Prof. Dr Sadek Khalifa Mohamed Shakshooki received BSc (Chemistry - Grade Excellent) from Libyan University on June 1962. MSc in Chemistry from Rochester Institute of Technology (New York (RIT) USA. On March 1967., Since then appointed as staff member in Department of Chemistry, Faculty of Science University of Tripoli, Libya. completed PhD from Bristol University, UK. (Inorganic Chemistry) on April 1971. Head Department of Chemistry (1973-1975). Dean College of Pharmacy (1975-1978) 1st Dean (have initiate the College of Pharmacy). Vice Director of the University (1978-1979). Dean College of Pharmacy (1987-1988) for 2nd time. has received nomination for membership of New York Academy of Sciences November 1994, Nominated on April 1974 as organizer (supervisor) of chemistry education for levels 7-9 and secondary schools) by Prof. Foeck head of chemistry education in UNESCO, Paris (I have apologize).

14 Awards, nationally and internationally. including Nomination for MAARQUIS WHO, s WHO in the world, USA. Edition (2018, 2021) , (Chosen for impressive distinction for less than 3% of world-wide in his scientific field). International Scientist Award- 2021, Excellence Service Award 2021.and lifetime Achievement Award 2022. have been asked on September 2023 for nomination, among others, for Scientist of year 2023 by Arabic Chemists Organization, Editor in Chief of Academic Journal of Chemistry, since July 2016. serving as an editorial board member of repute 4 international journals in USA. and local journal, Published many papers in national and international conferences and journals. 3Patents, (4th and 5th ready for registration by June2024, and one as registered mark).

KN2: Developments on The Synthesis and Characterization of Metal(iv) Oxides, Phosphates, Tellurates, Vanadyl Phosphate / Conducting Polymers and Copolymers Nano Composites

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Most characteristic of metal(iv) oxides, phosphates, tellurates and vanadyl phosphates, are insolubility in strong mineral acids and alkali, good thermal stability, resistance toward ionizing radiation and strong acidity of their hydrogen phases. Their layered phases are known to possess rich intercalation chemistry.

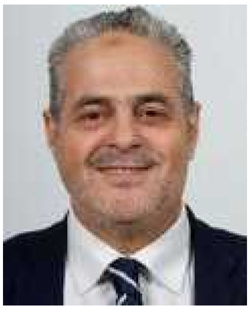
Conjugated conductive polymers, such as polyaniline, polypyrrole, polyindole and polytiophene tetravalent metal materials composites, have exhibited promising properties as composites semiconductors. On doping these conjugated polymers show very high conductivity similar to metal (known as synthetic metals, known also materials of 21st century), have generated tremendous interest due to their potential applications in various fields such as rechargeable batteries, electrochromic display devices, separation membranes, sensors and anticorrosive coating,

Polymerization of the monomers of the conjugated conducting polymers can occur via a variety of reaction mechanisms that vary in complexity due to the functional groups present in the reactants and their inherent steric effects. Various in-situ synthesis methods have been developed for the polymerization of organic conjugated monomers. The final products were conducting polymers, meeting industrial requirements.

For that reason, providing novel methods for the synthesis of tetravalent metal materials conjugated conducting polymers composites offer huge scope for better understanding and usage of such products. This perspective talk will present typical and progress of methods for preparation and characterization of novel conducting polymers, copolymers nanocomposites of tetravalent metal oxides, phosphates. tellurates and vanadyl phosphates.

Nor-Edine ABRIAK & Walid MAHERZI

IMT Nord Europe, Institut Mine-Télécom, Centre for Materials and Process, Lille, France



Nor-Edine Abriak, professor at IMT Lille Douai for thirty-four years, Director of the Laboratory of Soil Mechanics and Materials and also the deputy Director of LGCE, which is the largest civil engineering laboratory in France. Our activities go from the environmental valorisation of co-products to engineering models (for example valorisation of sediment and understanding) and modelling of the mechanism chemo-medicinal alteration of civil engineering model.

Walid Maherzi holds a PhD in Materials Chemistry obtained in 2013 from the University of Caen-Basse Normandie; He also holds an engineering degree in Public Works from the Ecole Nationale des Travaux Publics in Algiers (Algeria). Since 2017, MAHERZI Walid has held the position of Associate professor in Civil Engineering at the Materials and Processes Teaching, Research and Innovation Centre at IMT Nord Europe.

KN3: Presentation of the national ‘Sédimatériaux’ initiative for the management and valorization of dredged sediments

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The onshore management of dredged sediments is the responsibility of various project owners, who operate in isolation on a case-by-case basis in the absence of specific regulations governing the onshore disposal of sediments (and in particular their physico-chemical quality), methodological guidelines or reference operations on which to draw. This is a highly complex recent technical and environmental issue, which goes far beyond the areas of competence of the various project owners who are confronted with it. To remedy this situation, project owners generally call on the services of private engineering firms, each with a highly specific approach to the problem, but without the necessary scientific expertise. In addition to the resulting national heterogeneity of approaches, the environmental consequences of poor management of these products can be dramatic, given the volumes involved and the pollutants present. The National SEDIMATERIAUX program to be presented at this conference therefore aims to implement significant reference operations. These operations will involve dredging, followed by more or less advanced treatment and operational implementation in the various civil engineering destination sectors. The “Sédimatériaux” project aims to acquire knowledge demonstrating the technical, environmental, economic and societal feasibility of creating one or more sediment recovery process.

Hafida MAROUF

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MAROUF Hafida was born in Algeria, Doctor in civil engineering, Specialising in Sustainable Materials. Head of Department in Civil Engineering and Publics Works at Ain Temouchent University, Algeria. She is a Researcher at the Smart Structure Laboratory SSL, Energy System and Sustainable Development Team at Ain Temouchent University. Her Research Themes are focused on the Valorization of Dam Dredging Sediments in Construction Materials Cement and Brick. Currently the Leader of a National Research Project (PNR) Entitled "Promotion of Bio-Source Materials with High Thermal Potential for the Energy Efficiency of the Building Sector in Algeria.

KN4: Exploitation of Eco Materials Sustainable Development in the Building Sector

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We are currently witnessing the use of waste of all kinds. In order to overcome the scarcity of natural resources, particularly those used in the design of construction materials, followed by a strong demand from public authorities and operators for materials with better thermal insulation.

Our study enters into this approach particularly the design of Eco materials the design of Eco brick and Eco concrete based on sediments dredged from Algerian dams.

Keywords: Waste recovery, Dredged sediment, Algerian dams, Eco concrete, Eco brick.

A. Biomaterials, green materials, and environmental applications

ORAL-A

O1-A : Synthesis and Optimization of Nano Silica for Advanced Biomedical Applications

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Nanostructured materials have garnered significant attention in the field of biomedicine due to their distinct properties and wide-ranging applications. Among these materials, nano silica has emerged as a promising contender for diverse biomedical uses, including drug delivery, bioimaging, tissue engineering, and biosensing. This study aims to focus specifically on the chemical preparation of nano silica tailored for biomedical applications. The objective is to devise a cost-effective and scalable approach for synthesizing nano-sized silica particles with enhanced biocompatibility and precise control over their physicochemical properties. To achieve this, we employed chemical methods to extract silica from sand and generate nanoscale particles. Through thorough analysis, we successfully produced silica material primarily composed of $SiO2$, as verified by infrared spectroscopy (FTIR). X-ray diffraction (XRD) analysis further confirmed the amorphous nature of the metallic $SiO2$ in the synthesized material. Examination under a scanning electron microscope (SEM) confirmed the presence of agglomerates consisting of silica particles in the nanometer size range. Collectively, these results offer compelling evidence for the formation of exceptionally pure silica material.

Overall, this study presents a successful and efficient method for preparing nanoscale silica material using sand as the starting material. The findings highlight the production of highly pure silica particles, opening up exciting possibilities for their utilization in diverse applications within the realm of nanotechnology.

Keywords: sand, nano silica, biomedical applications, drug delivery, bio imaging, tissue engineering, bio sensing.

O2-A : Mechanical and Biological Assessment of Spark Plasma-Sintered Ti6Al4V Alloy Modified with Niobium

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The purpose of this work is to assess the mechanical and biological characteristics of a Ti6Al4V alloy that has been spark plasma-sintered (SPS) and modified with 5 and 10 weight percent niobium (Nb). Sintered using SPS for five minutes at 1400 °C, five batches of Ti6Al4V, Ti6Al4V-5 Nb, Ti6Al4V-10 Nb, and Ti6Al4V-10 were produced. Phase identification of the specimens was accomplished by X-ray diffraction (XRD) examination. X-ray mapping studies, energy dispersive X-ray spectroscopy (EDS), and scanning electron microscopy (SEM) were also used to examine the materials' broken surfaces, microstructure, and powder morphology. After conducting Vickers microhardness and three-point flexural strength tests, the fracture toughness (K1 C) was computed.

Keywords: Biomaterials, Titanium alloys, Implants, Mechanical properties

O3-A : Synthesis and characterization of magnetite/silica nanocomposite for the adsorption of Crystal Violet dye

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This work focuses on the synthesis and characterization of a magnetite/silica nanocomposite for the adsorption of Crystal Violet (CV) dye. The aim is to produce an eco-friendly and economically viable nano-adsorbent for the removal of cationic dyes from polluted water, with potential industrial applications. The synthesis involves three main steps : the preparation of magnetite (Fe3O4) nanoparticles via the co-precipitation method, the production of silica using sodium silicate derived from silica sand, and finally, the coating of silica with magnetite to form the Fe3O4/SiO2 nanocomposite. The nanocomposites were characterized using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FT-IR), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and Brunauer–Emmett–Teller (BET) analysis. To optimize the variables affecting CV dye removal, factors such as solution pH, adsorbent dose, and contact time were evaluated. Kinetic studies indicated that the pseudo-second-order model best described the adsorption process, while isotherm analysis showed that the Langmuir model was the most appropriate, with a maximum adsorption capacity (qmax) of 200 mg/g. Thermodynamic studies revealed that the adsorption process was favorable, spontaneous, and exothermic.

Keywords: Siliceous sand; Magnetite/silica nanaocomposite; Characterization; Adsorption

O4-A : Evaluation of the synergistic effects of antioxidant activity of essential oils from two species of Asteraceae

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Natural antioxidants are attracting increasing interest both for their potential as food preservatives and for their role in the treatment of various diseases. As part of a prospective study aimed at identifying promising sources of natural antioxidants, we chose to investigate two medicinal plants belonging to the Asteraceae family. The interest in natural compounds, especially essential oils (EOs), continues to grow due to their well-documented therapeutic efficacy. An interesting approach to optimize this efficacy is to combine several essential oils, a strategy comparable to that used in combination therapy. Therefore, the aim of this study was to evaluate the antioxidant activity of EOs from two species of the Asteraceae family: Anacyclus valentinus and Chrysanthemum coronarium, as well as the potential synergistic effects of their combinations.The essential oils were extracted by hydrodistillation using a Clevenger apparatus. The antioxidant activity was measured by two methods: the Fe3+ reduction test, where the conversion of Fe3+ to Fe2+ increases the absorbance at 700 nm, and the DPPH test, which determines the ability to absorb the DPPH radical at 517 nm by comparing the extracts with the standard BHT.The results show that the EOs of A. valentinus and C. coronarium have a dose-dependent ability to reduce Fe3+, with both essential oils having almost the same reducing power. The 1:1 mixture of these two oils increases the absorbance and thus the reducing power.In terms of DPPH activity, both essential oils showed strong activity, whether used individually (with IC50 values of 7.8 mL/L and 4.6 mL/L, respectively) or in combination (IC50 of 1.90 mL/L). This combination showed activity approximately six times greater than that of the synthetic antioxidant BHT used as a reference (IC50 of 16.4 mL/L), suggesting a synergistic effect.In conclusion, the essential oils of A. valentinus and C. coronarium showed promising antioxidant activities in both the Fe3+ reduction method and the DPPH test. Moreover, their synergistic effects enhance their potential as natural antioxidant sources or dietary supplements. However, further studies on their toxicity and cytotoxicity are needed to confirm their safety for use.

Keywords: Anacyclus valentinus, Chrysanthemum coronarium, Synergistic antioxidant activity, Essential oils.

O5-A : Comparative study on the effect of poly (vinyl pyrrolidone) and polyethylene glycol as additives on polysulfone synthesized ultrafiltration membranes

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Polysulfone ultrafiltration membranes were prepared by phase inversion technique with 1-methyl-2-pyrrolidinone as solvent, poly (vinyl pyrrolidone) (2 wt% and 3 wt%), and polyethylene glycol (6 wt%) as additives.

Water contact angle measurements, scanning electron microscopy and Fourier transform infrared spectroscopy were used to characterize the synthesized membranes. The membrane permeation has been evaluated in terms of ultrapure water, bovine serum albumin, and cobalt and copper retention.

This study compared the effect of the amount and different additives on the performance and structure of synthesized membranes to enhance the hydrophilicity of polysulfone membranes.

It was found that 2 wt% poly (vinyl pyrrolidone) gives the best potential retention and permeation. When applied in ultrafiltration, the membrane had an improved retention of bovine serum albumin and copper (99.1% and 46.7%, respectively).

In the polyelectrolyte enhanced ultrafiltration process, the addition of a complexing agent, such as sodium alginate, enhanced the retention of copper to reach 97%, respectively. These optimal performances based on the result of copper retention have been obtained at 2 bar and pH 4.

Keywords: Ultrafiltration, synthesis, removal, membranes, heavy metals.

O6-A : Tertiary treatment of wastewater by coupling anodic oxidation processes and the coagulation-flocculation processes

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Tunisia has been forced to use treated wastewater in irrigation due to the constant increase in demand. Since 1999, the Edissa perimeter (Gabes-Tunisia) has been irrigated by treated wastewater (TWW) from Gabes sewage treatment plant. However, it is imperative to study the quality of this water category. The present work aimed at the tertiary treatment of TWW of Gabes sewage treatment plant using alternative processes by coupling anodic oxidation processes using solar energy and coagulation-flocculation. Treatment with optimal conditions reveals that coupling two processes made it possible to achieve abatement of pollutants with satisfactory yields in terms of elimination of the chemical oxygen demand (COD) 100%, total organic carbon (TOC) 100%, biochemical oxygen demand (BOD5) 86 %, Cl-, NH4, NO3-, and PO43- with abatement rates of 100%, the heavy metals (Cd, Cr, Fe, Zn Pb, Al, Cu, Ni) concentrations abatement varies from 45% for Fe to 95% for Ni and complete elimination of germs.

Keyswords: Irrigation; treated wastewater; soil; Anodic oxidation, coagulation-flocculation.

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O7-A : Chitosan from fish scales: Extraction, Characterization, and application (enviromental for chromium removal, and bio-based polymers)

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Fishery by-products, such as fish scales, bones, and skin, represent a significant portion of the total catch weight. These materials can be properly managed **by** converting fishery waste into valuable products like chitosan. The study concentrated on chitosan's extraction and characterization and antibacterial activity and its use for chromium removal from wastewater. Chitosan was extracted from fish scales using a three-step method that included demineralization, deproteinization, and deacetylation. The successful extraction and purity of the chitosan were further confirmed by Fourier Transform Infrared (FTIR) spectroscopy. The antibacterial activity of the extracted chitosan was tested against three pathogenic bacteria: Staphylococcus aureus, Klebsiella pneumoniae, and Escherichia coli. In terms of environmental applications, the effectiveness of chitosan in removing hexavalent chromium in wastewater was thoroughly investigated by atomic absorption and UV – spectrophotometer. Fish scales wer found to be a suitable source for chitosan manufacturing, as demonstrated by % yield of 10.8%. A high level of deacetylation, averaging 79.3%, was found during characterization of the extracted chitosan,. The results showed significant antibacterial properties against Staphylococcus aureus, with the highest inhibition zone observed at a concentration of 0.0075 g/100ml. However, no significant antibacterial activity was observed against Klebsiella pneumoniae and Escherichia coli. In terms of environmental applications, the effectiveness of chitosan in treating hexavalent chromium (Cr(VI)) in wastewater was thoroughly investigated. The study found that chitosan was highly effective in removing hexavalent chromium, with the optimal pH for removal of 4. At this pH, the remaining Cr(VI) was reduced to zero, achieving a 100% removal rate. and the best time for removal was at the 90th minute, as it recorded the highest chromium removal rate. The highest removal observed at a dose of 0.5 g for a chromium concentration of 20 ppm. The adsorption behavior of chitosan was analyzed using adsorption isotherms, with the data fitting well to the freundlich isotherm model that indicated multilayar adsorption of chromium ions onto the chitosan surface. The kinetic model analysis showed good agreement with the pseudo-first-order kinetics. Chitosan was also used for production of biopolymers (chitosan-based biopolymers). Such biopolymers can be used as innovative "bioplastics" for industrial exploitation e.g. packaging materials for food products. Chitosan-based bio film was consisted of chitosan, glycerol as plasticizer, water as a solvent, and plant extracts as bioactive compound.

In conclusion, this work highlights the potential of utilizing chitosan derived from fish scales as a multifunctional biopolymer, contributing to waste valorization and offering practical solutions for environmental remediation. Additionally biopolymers can be prepared from chitosan. This work not only emphasizes the benefits of sustainable resource utilization but also sets the stage for future innovations in biopolymer applications.

O8-A : Therapeutic Potential of Silver Nanoparticles from Helianthemum lippii Extract for Mitigating Cadmium-Induced Hepatotoxicity and Nephrotoxicity in Wistar Rats

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This groundbreaking study delves into the remarkable therapeutic potential of silver nanoparticles (Ag NPs) synthesized from Helianthemum lippii extract to counteract cadmium-induced hepatotoxicity and nephrotoxicity in Wistar rats. Through meticulous characterization using X-ray diffraction, UV-Vis spectrometry, and energy-dispersive X-ray spectroscopy, we confirmed the successful synthesis of Ag NPs with a distinct cubic crystal structure and particle sizes ranging from 4.81 to 12.84 nm. Our sub-acute toxicity assessments at doses of 2 mg/kg and 10 mg/kg revealed no significant adverse effects compared to untreated controls. The experimental protocol involved exposing Wistar rats to 50 mg/kg $CdCl2$ for 35 days, leading to significant liver and kidney damage, characterized by reduced body weight, elevated liver enzymes, impaired renal function, oxidative stress, and severe tissue alterations. Remarkably, the subsequent administration of Ag NPs (0.1 mg/kg/day) led to substantial recovery, ameliorating hepatic and renal dysfunction, restoring body weight, and significantly reducing oxidative stress. This study not only highlights the profound therapeutic efficacy of Ag NPs but also champions the eco-friendly synthesis of nanoparticles, aligning with sustainable practices in medical research and therapeutic development. The findings underscore a novel, green approach to mitigating heavy metal toxicity, offering promising avenues for future research and therapeutic applications.

Keywords: Silver Nanoparticles, Green Synthesis, Cadmium Toxicity, Hepatoprotective, Nephroprotective, Oxidative Stress, Wistar Rats.

O9-A : Synthesis of Co_3O_4 from a new hybrid organic-inorganic salt, bis(3-aminopyridinium)tetrachlorocobaltate(II), for hexavalent chromium removal

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The design of novel hybrid organic-inorganic compounds as precursors for the synthesis of metal oxides has been explored in recent years and has shown promising results [1, 2]. To further expand on this synthetic approach, a new hybrid compound, bis(3-aminopyridinium)tetrachlorocobaltate(II) $(C_5H_7N_2)_2[CoCl_4]$, was synthesized . Structural analysis using single crystal X-ray diffraction revealed that it crystallizes in the triclinic system, space group P-1, with the following unit cell parameters: a = 6.945(1) Å, b = 8.503(2) Å, c = 13.862(3) Å, α = 81.36(2)°, β = 89.40(2)°, γ = 80.17(2)°, V = 797.3(3) $Å^3$ and Z = 2. Upon thermal treatment at 450°C in air atmosphere, $(C_5H_7N_2)_2[CoCl_4]$ leads to Co_3O_4, which was subsequently used for the removal of hexavalent chromium ions by adsorption. The kinetic study of the adsorption process, described by the pseudo-second-order model, showed that the adsorption capacity reached 15 $mg.g^{-1}$ after an equilibrium time of 50 min. A comparative study with other adsorbents highlights the potential of the synthesized Co_3O_4 for treating hexavalent chromium-contaminated solutions.

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O10-A : Enhancement of Tribological Properties of Ag-Decorated TiO2 Nanotubes via SILAR for Biomedical Applications

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TiO2 nanotubes were synthesized using the anodization method on Ti foils and decorated with Ag nanoparticles with SILAR method each at different cycles. These samples were characterized using SEM, TEM and XRD. Morphologically, the Ag nanoparticles were evently dispersed on TiO2 nanotubes in the shape of small spheres. With an increase in the number of cycles the size and shape of the nanoparticles increased. This also effected the structure and crystallinity of the Ag-NPs as the crystallite size of Ag increased. The conducted in-depth analysis of the tribological characteristics of the coatings using the scratch test allowed us to evaluate the adhesion of the coatings, a crucial aspect in determining their effectiveness and durability. Furthermore, we found that the wear resistance of the coatings increased with the number of Ag cycles up to 8 cycles. However, for the samples with higher size distribution and crystallite size, such as those with more than 8 cycles the microhardness continued to decrease. This indicates that the addition of PbS can improve the durability of TiO2 coatings, making them a potential candidate for biomedical implants.

Keywords: TiO2, nanotubes, Ag, SILAR, mechanical , tribological properties, biomedical implants.

O11-A : Electrodeposition of BiVO4 nanostructures on TiO2 nanotubes: Characterization and Synergetic photocatalytic degradation activity of Amido Black Dye

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Titanium dioxide (TiO2) is one of the most exploited photocatalysts with its excellent properties and its band edge positioned in an adequate potential for radical generation [1,2]. The variation in morphology of TiO2 expressed different results for the photodegradation of organic pollutants. Here, in order to enhance the photocatalytic performance of TiO2 nanotubes (NTs) for the degradation of the organic pollutant Amido Black, the electrodeposition of bismuth vanadate (BiVO4) nanostructures was successfully applied. The effect of electrodeposited BiVO4 (25s, 50s, 150s, 250s) followed by thermal treatment on TiO2 NTs was investigated. The BiVO4/TiO2 NTs sample with a deposition time of 50s showed the highest photocatalytic performance for the degradation of Amido Black, 99.4% after 150min under UV light. This result was achieved due to the structure and optical properties of the sample. The hetero-junction of both catalysts showed the synergetic effect on the photo-catalytic performance, where they remained stable after five cycles. Furthermore, quenching tests were carried out and showed that superoxide radicals (O2°) are the main active species during the photodegradation process.

Keywords: nanotubes, BiVO4 nanoparticles, heterojunction, photocatalysis, Amido Black

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O12-A : Oued Taht (Ain Ferrah) (western of Algeria)and its characterization

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Water is a natural element that is essential to life. It is a necessary wealth for all human activity, and constitutes the heritage of a nation. So it has to comply with quality standards. Thus, it must not contain any microorganisms, parasites or substances that pose a potential danger to human health . Our study aims to contribute to the evaluation of the physico-chemical and microbiological quality of the raw water of the Oued . At the end of this study, we found that the physico-chemical properties are in line with Algerian standards and those of the World Health Organization guidelines. However, the bacteriological results of the raw water from this dam revealed the presence of bacteria (Escherichia Coli and Streptococcus Faecal), and Berucella sp. Therefore, it is concluded that the raw water of the Oued Taht dam is not suitable for direct human consumation of the dam, and requires prior treatment in the dam's treatment plants.

Keywords: Dam , Raw Water ,physical-chemical analyses , microbiological analyses.

O13-A : Phosphate and fluoride uptake by raw and modified clay in batch and continuous adsorbers

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The development of effective adsorbents is essential for eliminating harmful elements from wastewater. In this study, a smectitic clay mineral sourced from Jebel Haidoudi in Gabes was evaluated for its capacity to remove phosphate and fluoride ions from aqueous solutions. The clay samples underwent purification and modification using a cationic surfactant, hexadecylpyridinium (Organoclay), at concentrations equivalent to 3.0 times the cation exchange capacity (CEC) of the clay. These samples were subsequently characterized using X-ray diffraction and Fourier-transform infrared spectroscopy. A series of batch and dynamic adsorption experiments were conducted. In the batch experiments, three parameters were examined: the effects of pH, contact time, and the initial concentrations of fluoride and phosphate ions. For the dynamic experiments, two parameters were analyzed: feeding flow rates and the number of reactors used. The results from the batch static adsorption process indicated that most of the adsorption occurred within the first 5 hours, with the optimal pH range identified as 3 to 4. Kinetic and isotherm studies revealed that the best fit for the data was achieved using the pseudo-second-order kinetic model and the Langmuir isotherm, respectively. Furthermore, continuous dynamic adsorption studies demonstrated that utilizing two reactors in series at a flow rate of approximately 20 mL/min resulted in high removal efficiencies of phosphate (82%) and fluoride (83%) when using the organoclay.

Keywords: Organoclay, Static/dynamic, adsorption, phosphate/fluoride

O14-A : Electron paramagnetic resonance study of the effect of γ and electron beam irradiation on a silicate glasses: Potential application as high dose dosimeter.

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The use of large cobalt-60 gamma ray facilities and electron beam accelerators for radiation processing technology continues to increase. Quality Control is vital for the success of this technology; and can often be achieved by full knowledge of the irradiation parameters and by periodic analysis product. We are interested to colour centres induced by γ and electron beam irradiation in silicate glasses in order to study their sensitivities to radiation for possible use as detectors of high doses using electron paramagnetic resonance spectrometry (EPR). The preliminary characterization of the samples before irradiation confirmed the presence of iron as Fe3+ ions. The reduction of iron and the formation of colour centres were studied as a function of the dose and post-irradiation time. Several doses were used in the range from 0.1 to 6000 kGy. After irradiation, three defects are observed: E' centre, NBOHC centres (Non-Bridging Oxygen Hole centres) and TE centre (Trapped Electron). The relative intensity of the EPR signal depends on the dose. A study of post-irradiation annealing was also carried out and showed that E' centre is much more stable than the NBOHC centres. Isochronal annealing showed that E' centre is converted into Proxy Radical (PR) by trapping a dissolved oxygen molecule. Since only two point defects are observed, the material formulation is relatively simple. In addition, we observed an increase in the concentration of these defects as a function of dose. In conclusion, this commercial glass appears to be a possible candidate for use as a dosimeter in large dose range.

O15-A : Study of cadmium retention by ultrafiltration using experimental design

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The environmental protection remains a major concern for our society because the problem of pollution is constantly worsening, due to anthropogenic activity, mostly industrial. In response, governments are advocating for the development of innovative processes to enhance pollution control.

Polyelectrolyte Enhanced Ultrafiltration (PEUF) has proven to be a highthly effective technique in the decontamination of water polluted by Cadmium ions.

The PEUF studies were carried out using an ultrafiltration tangential cell system equipped with 5.000 MWCO (PVDF) membrane. A water-soluble polymer: the polyethylene glycol (PEG) was used as complexant agent for PEUF experiments.

In order to determine the optimum conditions for the retention of cadmium ions on a PVDF membrane, the experiments methodology design was used. Several parameters were successfully optimized such as transmembrane pressure, PEG concentration and the pH to improve the retention of Cadmium ions. This methodology enabled us to evaluate the effect of all the independent factors and their interactions on the quality of Cd ion retention.

Keywords: Ultrafiltration, Experiments methodology design, Environment, Cadmium retention.

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O16-A : Effectiveness of an ecological and innovative treatment of soap industry wastewater using a green plant-based coagulant for a safe and sustainable reuse

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The soap manufacturing industry, known for its high-water consumption, generates waste that contains organic and inorganic pollutants often accompanied with high toxicity. Coagulation/Flocculation (CF) is a physico-chemical water treatment process grounded in the use of chemical reagents, which have many negative impacts. In response to these concerns, there is a growing emphasis on developing low-cost, environmentally friendly, and safe materials for wastewater treatment [1].

Within this framework, the present study focuses on improving the CF process for treating soap industry wastewater using innovative green natural coagulant from plant-based material. Response Surface Methodology (RSM) were used optimizing (i) coagulant concentration (X1), (ii) flocculant dosage (X2), and (iii) initial pH (X3). Optimal conditions achieved complete turbidity removal (100%) and 40% of COD reduction, with R² values of 0.957 and 0.939, respectively, demonstrating the effectiveness of plant-based coagulants as a sustainable alternative to conventional methods.

Keywords: Soap industry wastewater, Coagulation/Flocculation, plant-based coagulant, Box–Behnken design, innovative green coagulant.

FUNDING: The authors are grateful for the financial support of the Tunisian-Algerian research and development project COPERER (Design and Optimization of an Eco-friendly Process based on Membrane Technology for the Treatment of Soap Manufacturing Wastewater for Sustainable Reuse), provided by the Ministry of Higher Education and Scientific Research of Tunisia.

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O17-A : Comparing Methods of Green Hydrogen Productions and Proposing a Feasible Technology for Palestine

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Hydrogen can be used a source of clean and renewable energy; thus it is receiving great worldwide and regional interests for reducing the level of emissions. In Palestine, as in other Arab countries, there are motivations for studying the options of hydrogen production methods. There are some knowledge gaps in the availability of local and regional studies on this issue that can guide policy makers. This paper provides a descriptive study that reviews most of the technologies used worldwide for producing hydrogen. Then, it concludes by proposing a feasible technology for considering for local implementation. Polymer Electrolyte Membrane (PEM) is found to be a suitable method of application in Palestine and it is recommended for the Environmental Quality Authority (EQA) in Palestine.

O18-A : A new ecofriendly heterogeneous catalyst for efficient dye removal by Advanced Oxidation Process

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This study investigates the efficiency of a new synthesized ecofriendly heterogeneous catalyst, for the removal of Methylene Blue (MB) dye from wastewater via a catalytic-oxidation process. The X-Ray Diffraction and Fourier Transformed InfraRed have been used to characterize the synthesized material. The optimal conditions of Advanced Oxidation Process (AOP) has been determined by using Response Surface Methodology (RSM) based on a Box–Behnken Design (BBD) to enhance dye removal efficiency. The effect of four operating parameters, including contact time, [H2O2]/[catalyst] wt% ratio, initial MB concentration and pH value have been optimized. The obtained results have been examined and modeled quadratically with the analysis of variance (ANOVA) as a function of input parameters. The experimental and the predicted data agree fairly well with a significant regression coefficient (R2 = 0.99). In addition, the catalyst has exhibited excellent recyclability with conservation of its oxidizing efficiency after multiple reuses.

Keywords: Advanced oxidation process, Polyoxometalates, Methylene Blue,degradation rate, Box-BehenkenDesign

O19-A : Kinetic study of the adsorption of dye from wastewater on Algerian activated clay

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Pollution refers to the introduction of harmful contaminates into the environment; which can cause adverse effects on ecosystems, human health and well-being [1]. Indeed, dyes have polluted waterways from rapidly growing industrial activities [2]. the polluted water becomes then a danger to the public since the dyes can inflict life-threatening diseases and also devalue the aesthetic nature of the water bodies, leading to abnormal variations in the aquatic environment [3].

This work focuses on the removal of dyes from rainwater using Algerian activated clay [4]. Batch adsorption experiments are carried out by adding a known amount of adsorbent namely Algerian Maghnite-H+ to a liquid solution at a known initial concentration and following the evolution in time of the concentration of the adsorbate. The effects of solution pH, temperature, initial concentration and contact time were investigated.

Results showed that the maximum adsorption capacity was 350 mg/g. Furthermore, the adsorption kinetics illustrated the suitability of employing the pseudo-second-order kinetic model. The equilibrium adsorption data fitted the Langmuir isotherm well.

Keywords: Batch adsorption, Langmuir Kinetics, Algerian clay, dyes, adsorbents.

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O20-A : Overcoming the Resistance in Breast Cancer by Targeting the Allosteric Sites of HER2T798I Kinase Utilizing In silico Approaches

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Cancer is categorized as a multifaceted clinical, financial, and social world problem. Breast cancer is the most common cancer globally (BC) and has become a risk to women's health, with nearly 500,000 people worldwide dying from metastatic breast cancer every year. The HER2 kinase is an essential target in treating breast cancer. Although lapatinib was approved for treating metastatic BC in 2007, drug resistance developed rapidly due to a mutation in the gatekeeper residue in HER2T798I. Herein, we attempted to identify new treatments with a novel mechanism of action to overcome the resistance in HER2T798I kinase domine using in sillico approaches. Four possible allosteric sites were identified within the HER2 protein surface and cavities, and a database of 26,000 possible allosteric kinase inhibitors was HTVS, followed by docking at both standard and extra precision against the newly identified allosteric sites. The top three compounds for each allosteric site were subject to molecular dynamic simulation for 1000 ns. The effect of these new compounds inside the suggested allosteric site on the conformation of the orthosteric site was investigated. These outcomes are promising in finding a new treatment for BC with a novel mechanism of action.

Keywords: Breast cancer, lapatinib, HER2, XP docking, MoA

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O21-A : Cuttlefish bone: A Natural Resource with Environmental Benefits

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Organic dye pollution is a significant environmental issue, particularly due to the toxicity, mutagenicity, carcinogenicity, and oxygen-depleting properties of these compounds, even at low concentrations. Methylene blue (MB) is a synthetic organic dye extensively used in diverse industries such as textiles, pharmaceuticals, and healthcare. Due to its widespread industrial application, substantial amounts of MB are released into wastewater streams, posing a significant environmental concern [1]. However, there is an urgent need for an alternative adsorption technique that is inexpensive, nontoxic, and locally available for successful wastewater treatment application.

The main objective of this research is to characterize and evaluate the removal capacity of methylene blue from an aqueous solution using: cuttlefish bone and clay as a bio-adsorbent. Activation of cuttlefish bone by chemical treatment led to an increase in size and a change in surface charge (negative for raw bone and positive for activated bone). The adsorption capacity of raw bone is close to that of activated bone. Adding clay to raw or activated cuttlefish bone enabled us to obtain new composites. Indeed, a clear reduction in particle size was observed following the addition of clay to activated bone and the transition from a positive surface charge (activated bone) to a negative charge (clay, activated bone). It should also be noted that characterization techniques (X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM)) highlighted a structural change. Although bio-composites have a fairly high adsorption capacity, the best adsorbents obtained in this work are those based on clay. In conclusion, this project demonstrates the potential of cuttlebone and clay-based adsorbents for the treatment of water contaminated by methylene blue. These economical and environmentally friendly materials could be used in pollution control processes.

Keywords: Cuttlebone, ZnCl2 activation, Clay, Adsorption, Methylene Blue

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O22-A : Highly Adsorptive Removal of Chromium (VI) Metal Using graphene Oxide Nanoparticles

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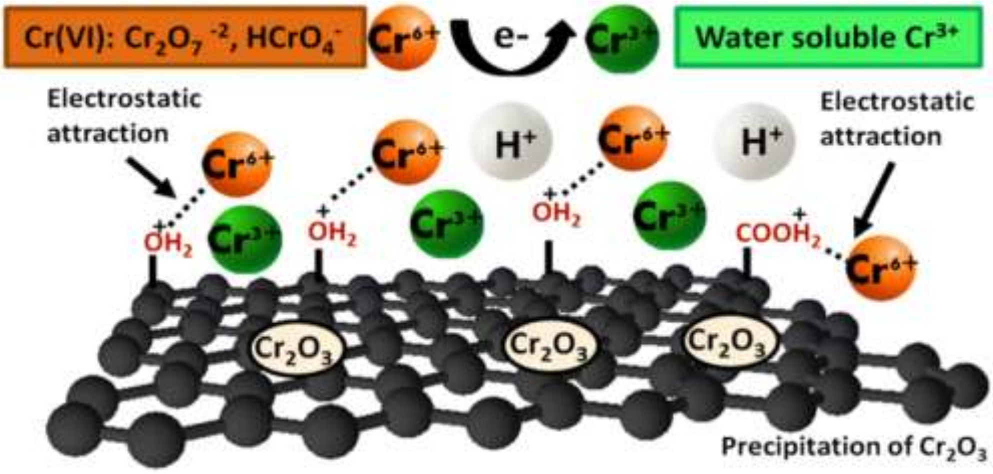
In this study, graphene oxide (GO) was prepared by hummers method of graphite material. The adsorption potential of GO with 200 nm average lateral size distribution for removal of Cr(VI) ions has been investigated. The study follows the batch experiments to understand the effect of pH, temperature, initial concentration, adsorption dose, agitation speed and contact time in solution.

The size distribution of GO nanoparticles was elucidated via scanning electron microscopy (SEM). The Fourier transform infrared (FTIR) spectroscopy was used to analyze Cr(VI) before and after adsorption. The adsorption isotherm was fitted by Langmuir model, the maximum adsorption capacity of the GO was 41.27 mg/g at 25 0C.

The thermodynamic parameter including free energy (ΔG^o), enthalpy change (ΔH^o), and entropy change (ΔS^o) were calculated and exhibited as +2.63 KJ/mol.k, +4.30 KJ/mol.k, and +5.56 KJ/mol.k at 30 mg/L of Cr(VI) solution respectively.



Proposed mechanism for Cr(vi) removal by GO in an acidic environment.

O23-A : Study and effect of an anti-scale process for hard water

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Scaling in natural hard water is a major concern in various industrial processes and domestic installations. For this reason, this issue needs to be studied very carefully, in order to identify an appropriate treatment that has no harmful effect on water quality.

The aim of this work was to study and evaluate the effectiveness of magnetic field treatment on scale precipitation. The first part is devoted in particular to the inhibiting effect of this treatment against scaling, in synthetic water with a hardness of 25°F. Investigations are carried out using a non-electrochemical method, the Fast Controlled Precipitation (FCP).

The results indicate that the magnetic treatment considerably slows down the kinetics of homogeneous $CaCO_3$ precipitation. The memory effect of magnetic treatment is also verified through this technique.

The second part is focused on the study of heterogeneous scale precipitation in the presence of magnetic treatment. To achieve this, an original method using a Quartz Crystal Microbalance with a pre-calcified Surface (SQCM) is used in this study. The comparison of the results obtained showed that the SQCM is sufficiently sensitive to study the scaling phenomenon and its inhibition and to evaluate the scaling power of given water.

After each method, the morphology of crystals formed in solution or on a surface was analyzed and characterized by Scanning Electron Microscopy (SEM) and X-ray Diffraction (XRD).

Keywords: Fast controlled precipitation, Inhibition, Magnetic treatment, Memory effect, Scaling, Scaling Quartz Crystal Microbalance.

O24-A : Comparative Study of Methyl Esters Purification Methods from Vegetable Oils: Process Optimization to Improve Final Product Quality

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The transesterification of vegetable oils into methyl esters (biodiesel) is a promising pathway to replace fossil fuels. However, the purification of methyl esters is crucial to ensure the quality and performance of biodiesel as a fuel. This comparative study evaluates different purification methods, including water washing, vacuum drying, the use of adsorbents, and vacuum distillation. The main objective is to identify the most effective methods for removing impurities such as glycerol, catalyst residues, and soaps, while optimizing energy and operational costs. The performance of the various purification techniques is assessed based on biodiesel quality parameters, such as viscosity, water content, acid value, and oxidative stability. The results indicate that vacuum distillation, although more energy-intensive, offers superior quality biodiesel with very low impurity levels. In contrast, water washing methods, though more economical and simpler, pose challenges in terms of wastewater management and may not achieve the same purity levels. This study highlights the importance of optimizing purification processes to improve biodiesel quality and its industrial acceptance. Recommendations include adopting combined techniques to balance costs and performance. Continuous improvement of purification methods is essential to encourage broader adoption of biodiesel as a sustainable alternative to fossil fuels.

Keywords: purification, methyl esters, biodiesel, vegetable oils, transesterification, process optimization.

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O25-A : Detection of low concentration volatile organic compounds using a zinc oxide nanoparticles biosynthesized based sensors

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The detection of gases is nowadays play very important roles in many fields such as industrial applications and public security. However, volatile organic compounds (VOCs) such as formaldehyde is a toxic liquid and a high volatile which is harmful to human health and can cause headaches, acidosis, and blindness [1]. Metal oxide based gas sensors have gained considerable attention due to their attractive characteristics like easy to use and highly sensitive to various gases [2]. In present work, the structural, morphological, and optical properties of ZnO nanoparticles (NPs) prepared by ecofriendly, simple and green method was investigated. The sensor was prepared by spraying the suspension of ZnO NPs on alumina substrates with pre-deposited gold interdigitated electrodes. The developed ZnO NPs bio-synthesized based sensor exhibits a good response towards ethanol, isopropanol, acetone and formaldehyde vapors at low concentrations ranging from 0.5 ppm to 5 ppm at 50 RH.

Keywords: VOCs, ZnO NPs, Biosynthesized, low concentrations

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O26-A : Atmospheric-Pressure Synthesis of Na-LTA zeolite: Optimization using Taguchi Orthogonal Array

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Conventionally, zeolites are produced through high-pressure hydrothermal synthesis in an autoclave. However, this technique presents challenges in terms of environmental issues, safety, and efficiency. Here, we proposed a new technique called the ‘‘Atmospheric-Pressure Synthesis (APS)’’to prepare Na-LTA zeolite. The reaction setup involved using a simple glass tube as the reactor and a low-density liquid as a sealant to create a physical barrier between the reactor contents and the atmosphere (figure 1). Therefore, the aim of this investigation is to optimize the synthesis parameters of Na-LTA zeolite starting from the following gel composition 3.741 Na2O: Al2O3: 1.45 SiO2: 175.52 H2O. Silicon and aluminum sources used for the gel preparation are industrial metasilicate (Na2SiO3.5H2O, PQ corp, purity 96%) and aluminum scraps (Al (wt. %) = 99.77; Fe (wt. %) = 0.207; Cu (wt. %) = 0.008), respectively. A combination of Taguchi orthogonal array design followed by a central composite design is employed to identify influential factors during the hydrothermal synthesis of Na-LTA zeolite. In the first stage, a Taguchi orthogonal array design with 8 trials is used to optimize the following parameters: crystallization temperature, crystallization time, maturation time and the nature and the quantity of sealant agent (PEG 400, Ethylene glycol, Silicone oil, Dodecanol) on the crystallinity of Na-LTA zeolite. The 8 trials were characterized using XRD, FTIR techniques and some selected trials were further characterized with SEM, EDX, and N2 adsorption- desorption technique *(BET).* According to the results of the Taguchi design, the maturation times of 14 and 28 hours, as well as the amount of separation agent (1 g or 4 g), have no significant effect on the crystallinity of Na-LTA zeolite. The variables influencing the crystallinity of zeolite Na-LTA are the type of separation agent, the crystallization temperature, and the crystallization time. Na-LTA zeolites with a relative crystallinity of 107.16% at 80 °C and 100% at 120 °C were obtained when using dodecanol, compared to silicone oil, which yields 100.29% at 80 °C and 100.05% at 120°C. However, with other sealing agents such as ethylene glycol and PEG 400, the Na-LTA zeolite is contaminated with HS zeolite when the crystallization temperature is about 120°C and yielding amorphous phase at 80 °C.

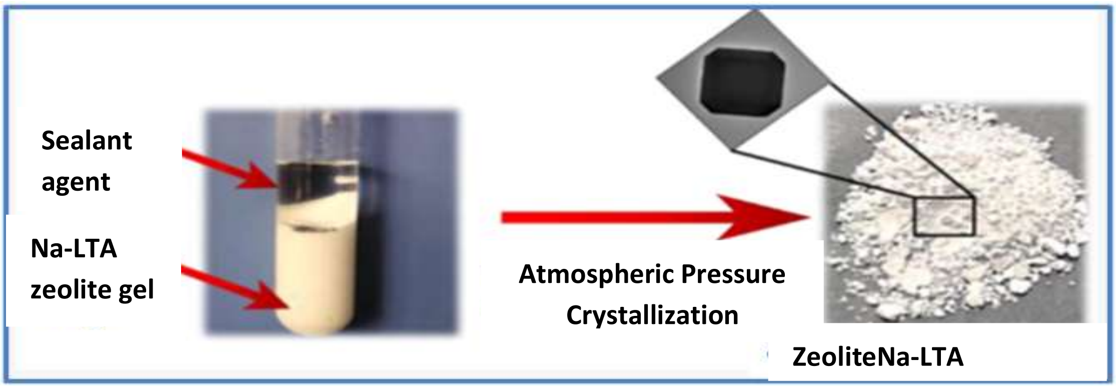

Figure 1: Atmospheric-Pressure Synthesis of Na-LTA zeolites.

Keywords: Na-LTA zeolite, Atmospheric-Pressure Synthesis, Taguchi orthogonal array design, Sealant agent

O27-A : Assessment of TiO2 as photo catalyst for complete mineralization of aqueous bacteria and their organic

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Phtodegradation is one of the most useful water purification means as itinvolves at a later stage the mineralization of chemical or pollutant contaminants within the water. Photo catalytic activity using titanium dioxide TiO2 utilizes the longest wavelength located at the end of ultraviolet. In this work water was purified from negative and positivebacteria by complete mineralization using TiO2 of both types (Rutile and Anatase) using UV tail in solar simulated radiation. The results obtained revealed the high efficiency of TiO2 (Anatase) in the destruction of bacteria and mineralization. This catalyst was able to destroy the bacteria G +ve S. aureus and baptized after exposure to 4 hours of light. The catalyst also proved its ability to inhibit bacteria in the dark but to a lesser extent than under radiation. It is therefore recommended to expand the present study and include other types of biological pollutants. Study of other factors that might optimize the photo mineralization reaction

POSTER-A

P1-A: Biological Evaluation of Iron Oxide Nanoparticles Synthesized from Pomegranate Peels and Their Efficacy Against Multidrug-Resistant Bacterial Strains

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This study investigates the synthesis and biological activity of iron oxide nanoparticles (Fe3O4 NPs) derived from pomegranate (Punica granatum L.) peels, with a focus on their potential antibacterial effects against resistant bacterial strains. Pomegranate peels, rich in bioactive compounds, were utilized as a natural reducing agent in the green synthesis of Fe3O4 NPs. The synthesized nanoparticles were characterized using Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), and Scanning Electron Microscopy (SEM) to determine their structural and morphological properties. The antibacterial activity of the Fe3O4 NPs was evaluated against clinically relevant resistant bacterial strains, including *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*. The results demonstrated that the nanoparticles exhibited significant antibacterial properties, with enhanced efficacy against Gram-positive bacteria. These findings highlight the potential of utilizing pomegranate peels in the environmentally friendly synthesis of iron oxide nanoparticles, offering a promising alternative for the treatment of infections caused by multidrug-resistant bacteria. Further studies on the mechanisms of action and in vivo applications of these nanoparticles are recommended.

Keywords: Iron oxide nanoparticles, Pomegranate peels, Green synthesis, Antibacterial activity

P2-A: Eco-Friendly Synthesis of Ag and Zn Nanoparticles for Water Pollutant Remediation

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The synthesis of metal oxide nanoparticles (MONPs) from plants presents an eco-friendly and cost-efficient alternative to traditional methods in bioremediation. In this study, a green synthesis approach was employed using the extract of Phoenix dactylifera L. (date palm) leaf to fabricate silver (Ag) and zinc (Zn) nanoparticles. The synthesized nanoparticles underwent characterization via UV-Vis spectrophotometer, XRD, and FT-IR analyses to examine their morphological, crystalline, and structural properties. Remarkably, the Ag and Zn nanoparticles exhibited strong antibacterial effects against various waterborne pathogens, such as Escherichia coli, Pseudomonas aeruginosa, and Staphylococcus aureus. The results highlighted the significant antibacterial activity of the synthesized nanoparticles against all tested pathogens. Furthermore, the catalytic efficiency of the nanoparticles in removing methyl red dye was evaluated, demonstrating that the synthesized nanoparticles achieved approximately 90% decolorization of the dye. This study not only provided environmentally friendly Nano catalysts, but also demonstrated the efficacy of green biosynthesis in producing metallic nanoparticles and showcased their potential in the treatment of pollutants.

Keywords: ZnO, AgO, nanoparticles, green synthesis, antibacterial, dye removal, water pollution.

P3-A: Removal of methyl orange Dye from Aqueous Solutions using Kaolin-Supported zinc Nanoparticles as an Effective Catalyst

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In this study, inexpensive, locally available kaolin (KT)-supported zinc nanoparticle (Zn-NPs) composite was synthesized via a facile wet impregnation method. The composite was employed for the photocatalytic degradation of methyl orange (MO) dye. In order to identify the optimal conditions for decolorization, the variables, including the catalyst dose and the initial concentration of MO in the reaction system, were investigated. The structure of the synthesized material was analyzed using Fourier transform infrared spectroscopy. The characterization results demonstrate the successful growth of Zn-NPs on the kaolin surface. To evaluate the catalyst's efficacy in photocatalytic degradation, batch experiments were conducted using MO as a model dye. In order to ascertain the optimal decolorization conditions, a systematic investigation was conducted, whereby a number of variables, including the dosage of the catalyst, and the initial concentration of MO in the reaction system, were subjected to rigorous examination. The results demonstrated that increasing the Zn-NPs content on the kaolin surface effectively enhanced the removal of MO dye from aqueous solution. The removal efficiency was 89.1%, indicating that the material exhibited outstanding activity. In conclusion, the Zn-NPs/KT has demonstrated remarkable activity.

Keywords: kaolin, dye, catalyst, impregnation

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P4-A: Advanced materials, Applied mechanics, Innovative processes and Environment: Basic science for real world challenges

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The research in our group is organized around two main projects:

1) INNOVATIVE MATERIALS AND PROCESSES FOR REMOVAL OF ENVIRONMENTAL POLLUTANTS –

This Research Topic aims to elaborate innovative materials and design new processes that contribute to the development and application of potential sorbents, coagulants, membrane materials, heterogeneous catalysts, ion exchange, and photocatalytic materials for decreasing environmental pollution.

and

2) GREEN MATERIALS FOR SUSTAINABLE DEVELOPMENT –

Green materials offer a unique characteristic and properties including abundant in nature, less toxic, economically affordable and versatility in term of physical and chemical properties. Green materials can be applied for a numerous field in science and technology applications including for energy, building, construction and infrastructures, materials science and engineering applications and pollution management and technology.

Keywords: UR22ES04, Materials Science, Green Materials, Sustainable development.

P5-A: Evaluation of an electrodeionization cell's performance with different Inter-membrane spacing and operating conditions.

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This research focuses on electrodeionization (EDI), a hybrid separation process that integrates electrodialysis (ED) and ion exchange. A key advantage of EDI is its continuous regeneration through the application of an electric current. Although its range of applications has significantly expanded, the mechanisms of transport phenomena and water dissociation remain subjects of debate.

The study aims to determine how resin bed thickness affects EDI performance by testing three thicknesses—2 mm, 4 mm, and 6 mm—under varying operating conditions. Key performance indicators, including mass transfer flux (J), current efficiency (Ce), removal efficiency (R), power consumption (P), and I–V curve analysis, were used to assess the process.

Results indicate that the optimal resin bed thickness depends on specific electrical and hydrodynamic conditions. Furthermore, the study presents an empirical equation linking EDI efficiency to flow rate and cell thickness, offering a predictive tool for optimizing system parameters.

Keywords: Electrodeionization; Electrodialysis; Ion-exchange; Bed thickness; Efficiency

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P6-A: HEAVY METAL EXTRACTION METHODS IN THE SOIL

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Soils, which are the most important part of the terrestrial ecosystem, constitute the largest receiving environment for heavy metals. The primary source of heavy metals in soil is the parent material on which it is formed. However, heavy metals reach the soil from many sources such as atmospheric deposition, industrialisation, mining, agrochemical use, urbanisation. Heavy metals have attracted the attention of the whole world due to their persistence, toxicity and bioaccumulation as well as the damage they cause to the environment and human health. Therefore, it is important to determine the heavy metal content of soils. Many extraction methods have been developed for the determination of heavy metals in soil samples. These methods are considered in terms of 'total', 'pseudo-total' and 'extractable' contents depending on the purpose. Determination of the total and pseude-total content of heavy metals generally provides information about heavy metal accumulation. The extraction methods that have been developed and modified to extract heavy metals from soils over the past years are evaluated under two groups. These are 'single step' and 'sequential' extraction methods. In single-step extraction methods (e.g. salt extractions, acid extractions, chelate extractions), one solvent is applied to the sample, while in sequential extraction methods (e.g. Tessier, Community Bureau of Reference-BCR, Maiz sequential extractions), multiple solvents are applied sequentially on the same sample and separate extracts are obtained at each step. In soil science, single-step extraction methods are generally developed for the relationship between the amount of metals extracted from the soil and the amount taken up by the plant. Sequential extraction methods, on the other hand, provide information on the identification of binding patterns of heavy metals, determination of bioavailability and potential mobility. In this review, commonly used single-step and sequential extraction methods are presented and discussed.

Keywords: Soil, Heavy metals, Extraction methods

P7-A: Green and Facile Synthesis of SmFeO3 Perovskite Nanoparticules using Lemon Juice for optical and environmental applications

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Oxides with a perovskite structure have been the subject of recent research because of their interesting electronic, magnetic and optical properties. SmFeO3 is one of the most promising materials that has been the subject of numerous studies, as well as being used in nanotechnology. All these properties depend essentially on the method used to prepare the oxide and the conditions under which it is synthesized. In this study, we report the preparation of SmFeO3 through a simple, cost-effective, and eco-friendly method using lemon juice as a natural reagent. The synthesized sample was characterized using various techniques, including X-ray diffraction (XRD), infrared (IR) spectroscopy, and Raman spectroscopy, all of which confirmed the formation of pure samarium ferrite at 800°C. In addition, particle size distribution analyses were conducted using laser granulometry. The optical properties of the green synthesized samarium ferrite were investigated. Promising results were obtained, suggesting its potential use in optical and environmental applications.

P8-A: Larvicidal activity of Lavandula angustifolia essential oil against Tuta absoluta, the devastating pest of tomato.

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Tuta absoluta is the most serious pest of tomato crops. Its control relies mainly on the intensive use of insecticides, which leads to the development of resistance and increases production costs. Therefore, there is an urgent need to develop more environmentally friendly control methods. Essential oils (EOs) have several advantages that make them valuable alternatives for pest control. In this study, essential oils of Lavandula angustifolia from western Algeria were evaluated for their insecticidal activity against Tuta absoluta for all larval stages and for adults

Chemical analysis revealed that the major compounds of L. angustifolia essential oil include 1,8-cineole, β-pinene, trans-pinocarveol, and cryptone. These volatile compounds exhibited toxic effects against all larval stages and adults of Tuta absoluta after 12 hours of exposure at a concentration of 15 mL/L air for the essential oil of L. angustifolia.

Based on the positive results obtained, this study concludes that these essential oils are promising alternatives for the control of Tuta absoluta. It also suggests several avenues for future research to promote their commercialization as effective and environmentally friendly insecticides.

Key words: Essential oils, Lavandula angustifolia, Larvicidal activity, Tuta absoluta.

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P9-A: Structural, mechanical and biological properties of Al2O3-Fap composites as a promising material for bone implants

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This study purported to design compact and porous bioinert-bioactive (Al2O3-Fap) composite ceramic for bone implants. Alumina was used, as inert material, for its mechanical and thermal performances and its good biocompatibility. Whereas, Fluorapatite was chosen, as a bioactive material, due to its stability and good mechanical properties compared to those of β-TCP and Hap. Brazilian test was performed on the obtained composites to evaluate their mechanical properties. The ceramic structure and the characteristics of the bone/implant interface were investigated with scanning electron microscopy. The biocompatibility and the bioactivity of composites were evaluated by in-vitro/in-vivo tests. The obtained results show that the combination of Al2O3 and Fap can provide a biocomposite with some mechanical characteristics that would make of it a better choice in bone implants. Moreover, Al2O3/Fap composite showed excellent behavior in vitro and in vivo tests revealing that the Fap is quite effective in improving biocompatibility.

Keywords: Alumina, Fluorapatite, bioactivity, mechanical properties

P10-A: Inhibitory Properties and Theoretical Analysis of Substituted Azines against Acetylcholinesterase and Butyrylcholinesterase: A Combined Docking and DFT Study

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Azines are promising inhibitors of cholinesterase, making them valuable in the context of neurodegenerative diseases. This study investigates the impact of various substituents on azine derivatives (AZ1, AZ2, AZ3, and AZ4) for the inhibition in vitro of acetylcholinesterase (AChE) and butyrylcholinesterase (BChE). Results indicate that AZ4 (3-Cl) is the most effective against AChE, while AZ1 (2,4-diMe) shows notable activity against BChE. Molecular docking studies and DFT calculations were employed to characterize the molecular interactions and electronic properties of these ligands, supporting their inhibitory potential.

Keywords: Azines, Acetylcholinesterase, Docking, DFT

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P11-A: Optimization of dye removal from wastewater by adsorption onto raw and activated carbon obtained as a co-product from fast pyrolysis of sawdust

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The excessive release of dye waste poses significant environmental, social, and ecological challenges. Using biomass-derived activated carbon as an adsorbent offers a sustainable solution, gaining attention for its potential to produce value-added products with minimal environmental impact. This study explores the use of raw sawdust (SD) and activated sawdust (ASD) for the removal of tartrazine dye. Both adsorbents were characterized using various techniques, including elemental analysis, BET surface area, thermogravimetric analysis, pH of zero charge, Boehm titration, Fourier transform infrared spectroscopy, and scanning electron microscopy. The influence of parameters such as pH, contact time, agitation speed, adsorbent dosage, initial dye concentration, and temperature on dye removal efficiency was examined. The highest removal efficiencies were 47.88% for SD and 99.52% for ASD. Langmuir adsorption capacities were determined to be 0.8 mg/g for SD and 127 mg/g for ASD at 298 K. While SD is less efficient in tartrazine removal, it can be used without an activation process, making it a convenient and low-cost alternative. Overall, SD and ASD are promising, biodegradable, eco-friendly, and cost-effective adsorbents for the efficient removal of tartrazine from wastewater.

Keywords: Activated sawdust, Biosorption, Tartrazine, Isotherm

P12-A: Extraction and characterization of new biocompatible gelatin from camel slaughter by-products: Biochemical, sensory, interfacial, and textural properties

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The study investigated the impact of pepsin pretreatment and extraction temperature (70 and 90 °C) on the biochemical, interfacial and textural properties of gelatin extracted from camel skin. The highest concentration of low molecular mass peptides (<5 kDa) was observed in gelatins extracted with pepsin pretreatment. Moreover, the total free amino acids content showed a direct correlation with the concentration of low molecular mass peptides, ranging from 6 to 15 mg/g of gelatin. Proline was identified as the predominant free amino acid (from 2.39 to 4.92 mg/g) in gelatin samples, with levels significantly increased after pepsin treatment. Regarding textural properties, gel hardness was found to be the highest in gelatin extracted at 70 °C (380.12 g), while it was observed that the combination of pepsin pretreatment with higher temperatures led to decrease the gel strength (301.89 g). However, despite this lower gel strength, this gelatin showed the highest emulsifying activity index (34.76-37.82 m2/g). These findings highlighted the importance of pepsin pretreatment and extraction temperature in modulating the biochemical and textural characteristics of camel skin gelatin, thereby providing insights for optimizing gelatin extraction processes as a function of the target application.

Keywords: New biocompatible gelatin; Texture and Biochemical properties; Sensory and interfacial properties.

P13-A: Physico-chemical characterization of an Algerian biomass, application in the adsorption of an organic pollutant

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The objective of this work is to study the retention of methylene blue (MB) by biomass. The Biomass is characterized by X-ray diffraction (XRD), infrared absorption (IRTF). Results show that the biomass contains organic and mineral substances. The effect of certain physico-chemical parameters on the adsorption of MB is studied (effect of the pH). This study shows that the increase in the initial concentration of MB leads to an increase in the adsorbed quantity. The adsorption efficiency of MB decreases with increasing biomass mass. The adsorption kinetics shows that the adsorption is rapid and the maximum amount is reached after 120 min of contact time. It is noted that the pH has no great influence on the adsorption. The isotherms are best modeled by the Langmuir model. The adsorption kinetics follows the pseudo-second order model. The thermodynamic study of adsorption shows that the adsorption is spontaneous and exothermic.

Keywords: dyes, adsorption, biomass, methylene blue, Langmuir.

P14-A: New Biomaterial Microspheres for Preventing Fungal Mycoses

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This project presents an experimental study aimed at developing a paramedical textile to prevent foot fungal infections through the use of bio-based functional microcapsules. The study first reviews the impact of fungal infections on feet and the antifungal treatments available, while also examining microencapsulation techniques and their application to textiles. Next, a microsphere, using essential oil encapsulated in alginate-chitosan, were developed and tested, with an analysis of how various physical and chemical parameters affect particle size distribution. The microspheres ranged in size from 0.05 to 4.9 µm. Finally, the fixation of these microspheres onto cotton fabric was studied using two methods, with the best results achieved through a coating technique involving pH adjustment to 4.5. Infrared analysis confirmed the presence of the thin film of microsphere on the textile surface, even after washing tests.

Keywords: mycoses fungal, Alginate, chitosan, microspheres

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P15-A: The effect of a copper complex on the degradation of textile dyes

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Environmental pollution caused by organic compounds is a significant problem that damages flora and fauna [1].

Among these pollutants we cite synthetic dyes used in the textile industry which are difficult to degrade due to their stable molecular structure. In order to contribute to their elimination from contaminated water, several methods are used, including catalytic degradation called photocatalysis in the presence of a light source [2]. This method of depollution has several advantages such as: low cost, low energy consumption, diversity of degradable pollutants and very good pollutant degradation efficiency. For this purpose, the catalyst that we used is a copper Schiff-based complex formed of a central metal ion and a Schiff-based ligand which has been characterized by different analytical methods, and whose structure has been confirmed by X-ray diffraction (XRD).

The results of photocatalysis are very encouraging and show that the degradation rate exceeds 90% after 90 min.

Keywords: Photocatalysis, Organic dyes, Mononuclear copper complexes, X-ray molecular structure.

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P16-A: Photophysical Properties of Heterobimetallic 3d4fSchiff Base Complexes

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Three new heterobimetallic Schiff base complexes of formula $[(LZnCl)_2Gd(H_2O)](ZnCl_4)_{0.5}$. , $[(LZn(OH))(LZnCl)Sm(H_2O)](ZnCl_4)_{0.5}$, and $[(LZnCl_{0.5}(OH)_{0.5})(LZnCl)Dy(H_2O)](ZnCl_4)_{0.5}$ were designed from the reaction of the metallo-ligand ZnL (H_2L= N,N′-bis(3-methoxysalicylaldiimine)-1,3-propylene-2-ol) and lanthanide salt in a ratio 1 to 1. The crystallographic structures of Zn-Ln-Zn complexes were resolved by single crystal X-ray diffraction. Light irradiation allowed the observation of a broad emission centered on the organic ligand which is exalted upon Zn(II) coordination.

The crystallographic structures of the three heterometallic compounds revealed the formation of Zn2Ln trinuclear Schiff base complexes in which the two Zn(II) have a pyramidal geometry with a square base linked by a lanthanide ion surrounded by nine oxygen atoms. The coordination of the Zn(II) ion enhanced the broad emission of the L^{2-} ligand. A mononuclear Zn compound is able to act as a metallo-organic chromophore for the sensitization of the Sm(III) luminescence while an efficient back energy transfer led to a poor sensitization in case of the Dy(III) ion.

Keywords: Trinuclear complexes, metallo-ligand, photophysical properties, X-ray molecular structure**.**

P17-A: The sintering and the mechanical characterization of Tricalcium phosphate - Magnesium fluoride composites

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The sintering of the tricalcium phosphate with different percentages of magnesium fluoride was investigated. The samples were examined by using the mechanical properties such as rupture strength, Young's and shear modulus and Vickers hardness. The mechanical properties were characterized by using Brazilian test and ultrasonic technique. The performances of the composites increase with both the sintering temperature and the magnesium fluoride addition. At 1300°C, the highest mechanical properties values of the composites were obtained after the sintering process for one hour with 7.5wt% magnesium fluoride. In fact, those properties reached 8.73 MPa, 214.4 Hv, 41.05 GPa and 22.65 GPa as rupture strength, Vickers hardness Young's modulus and shear modulus, respectively. The amelioration of these performances is due to the formation of the liquid-phase, which helps to fill the pores in the microstructure. Beyond 7.5 wt% MgF2, the mechanical performances of the composites are hindered by the exaggerated grain growth.

Keywords : Tricalcium phosphate, magnesium fluoride, composites, sintering, rupture strength, Young's modulus.

P18-A: Characterization of biomaterial based on the tricalcium phosphate and the calcium silicate

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The study examined the impact of incorporating calcium silicate {CaSiO3} into tricalcium phosphate {Ca3(PO4)2} matrice on the sintering and the mechanical properties. The mechanical properties were characterized through infrared spectroscopy and scanning electron microscopy. The tricalcium phosphate - calcium silicate composites samples were sintered at various temperatures (1200°C, 1300°C and 1400°C) with different levels of calcium silicate (25 wt%, 50 wt%, and 75 wt%). The sintering process of tricalcium phosphate-calcium silicate composites revealed improvements in microstructure, densification and mechanical performance. Enhanced composite performance was observed with increased the sintering temperature and the calcium silicate content. At 1400°C, the tricalcium phosphate - 25 wt% calcium silicate composites achieved impressive maximum rupture strength of 13 MPa and a Vickers hardness of 211 Hv, approaching the mechanical properties of the enamel. This performance enhancement is attributed to the formation of a liquid phase, which aids in filling microstructural pores.

Keywords : Tricalcium phosphate, Calcium silicate, Ruptures strength, Vickers hardness

P19-A: Impact of Carbon Nanotube Loading on the Photocatalytic Activity of $MTiO_2$/CNT Nanocomposites for Methylene Blue Degradation

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The aim of this study was to examine the effect of carbon nanotube (CNT) concentration on the photocatalytic activity of $MTiO_2$/xCNT (x = 1, 2, 5, 10) nanocomposites for the degradation of methylene blue (MB). The nanocomposites were successfully synthesized using the sol-gel method, followed by characterization via X-ray diffraction (XRD) and X-ray fluorescence (XRF). The XRD and XRF analyses confirmed the successful synthesis and the formation of the anatase phase of TiO_2 and MnO in the composite.The study of photocatalytic performance as a function of CNT concentration revealed that the $MTiO_2$/CNT nanocomposite with 5% CNT exhibited the highest efficiency, achieving an MB degradation rate exceeding 79% and a rate constant of 2.31×10^{-2} min^{-1}. However, it was observed that an excessive concentration of CNTs (notably at 10%) reduced photocatalytic activity, likely due to the shielding effect of CNTs, which limits TiO_2's exposure to UV light. This study provides new insights into the fabrication of MTiO2/CNT as an efficient photocatalyst and facilitates its application in the photocatalytic degradation of organic compounds.

Keywords: TiO2, Manganese, carbon nanotubes, nanocomposite, photocatalytic degradation, methylene blue

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P20-A: Poster Full Name: Production different types of Biochar from Organic Wastes with Thermal Conversion for Environmental Purposes.

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The land located near the factories absorbs all the substances with which it comes into contact, and this porosity creates problems of toxicity, sterility and water contamination. Deposits and burials of waste, whether domestic, industrial or radioactive, remain largely the cause of soil pollution. Intensive agriculture contributes to this through the use of fertilizers and pesticides resulting in significant chemical fallout.

In the present study, we report the production of different types of activated Biochar (activated carbon) from biomass by thermic activation (pyrolysis).

The activated Biochar product has been characterized in order to determine the attractive physicochemical properties using various protocols, and have shown very interesting properties which have opened up a wide field of application especially wastewater and soil treatment .

Keywords: Biomass; Activated Biochar; Pyrolysis; Environmental treatment; Soil treatment.

P21-A: Mechanosynthesis, Characterization, and Adsorptive Properties of Mg–Al–LDH and Zn-Al-LDH for Olive Mill Wastewater Treatment

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Industrial olive oil production is of fundamental economic importance for many Mediterranean countries. However, this industry generates huge amounts of toxic olive mill wastewater (OMW), which could represent a serious threat to human health and environmental biodiversity. In the current study, calcined layered double hydroxides (LDHs) were synthesized through a mechanochemical process involving the manual grinding of magnesium or zinc- and aluminum-nitrate salts in an agate mortar, followed or not by a peptization process. The experimental results showed that non-peptized LDHs have a layered structure with relatively low crystallinity. However, the peptization process resulted in LDHs with regular particles exhibiting high crystallinity and thermal stability. These LDHs achieved a significant improvement in the quality of OMW. Indeed, after 44 h of contact time, the removed amounts of chemical oxygen demand (COD) and biological oxygen demand (BOD) were assessed at approximately 300 and 100 mg g^{-1}, respectively. Moreover, the discoloration rate of this effluent was more than 90%. Overall, the results demonstrate the convenience of the mechanosynthesis of hydrotalcite and the high efficiency of OMW treatment, which is promising for the potential applications of calcined LDH in environmental clean-up and remediation of contaminated water.

Keywords: Layered double hydroxides; Mechanochemistry, Peptization; Olive mill wastewater treatment.

P22-A: Green formulation of Water Based drilling Mud (WBM) with low cost: substitution of polymers by agricultural wastes Locust Bean Gum LBG

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Currently in the field of oil well drilling, research tends to use new technologies including alternative components for drilling fluids. Among the compounds that can be used in drilling fluids, carob nuts. The aspect of this project has been inserted into a section for the recovery of agricultural waste in order to minimize the degradation of the natural environment. This part of the work focused on the development of a biopolymer derived from carob nuts because of its techno-functional properties (stabilizer, thickener, binder and gelatinizer). In order to enhance the carob grains, preliminary treatments were carried out: Acid shelling (maceration), washing, soaking, drying and grinding operations. During this work, we wanted to check the conformity and study the performance of locust bean gum, which is a biodegradable biopolymer of plant origin derived from biomass, obtained locally, that we are substituting for other conventional products in the field of water-based Muds drilling fluids.

In particular we have studied the effect of carob gum as a filtrate reduction instead of polyanionic cellulose (PAC LV), and as a viscosifying instead of Xanthane gum which are imported biopolymers. These polymers often increase the cost price of a drilling operation.

Finally a water-based drilling mud formulated using environmentally friendly and low-cost locust bean gum has been developed by substituting total and partial biopolymer of Xanthan Gum (PAC LV) giving better rheological properties and flow control. Fluid loss requirements necessary for proper oil well drilling operation.

Key words: Drilling, Drilling fluid, Biopolymers, Rheological

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P23-A: Development of Functional Bio-Based Materials from Chitosan

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The increasing need for sustainable and eco-friendly materials has driven research into bio-based polymers derived from natural resources. Chitosan, a polysaccharide obtained from chitin, has gained significant attention due to its unique properties, including biodegradability, biocompatibility, and antimicrobial activity. These characteristics make chitosan an ideal candidate for a wide range of applications, particularly in the biomedical field. However, limitations such as poor solubility and weak mechanical strength necessitate further enhancement through chemical and physical modifications.

This research focuses on the development of bio-based materials using chitosan as the primary biopolymer. By employing chemical and physical modifications, we aim to improve the mechanical properties, bioactivity, and processability of chitosan for advanced applications. This study also explores the incorporation of natural extracts to enhance the antimicrobial and antioxidant properties of the modified chitosan.

Our work demonstrates the potential of chitosan-based materials for use in medical applications such as wound healing, tissue engineering, and drug delivery. This research contributes to the advancement of sustainable biomaterials that offer a promising alternative to conventional synthetic polymers.

Keywords: Chitosan, natural extract, biomaterial, chemical and physical modifications

P24-A: Interaction bentonite-colorant : Application wastewater treatment and application environmental adsorption

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Dye is a type of prevalent contaminant which is extensively used in many industries such as food, textile, cosmetics, printing and paper.
This study addresses the last developments in physical, chemical eco-fiendly biological and advanced strategies for the efficient removal of dye pollution in the environment [1].
Algerian clay that is called Bentonite has been used environmentally friendly adsorbent in this research as adsorbents for dyes due to their availability, structural properties, ion-exchange capacity, excellent surface, relatively low cost, abundance, non-toxicity, and high adsorption properties. At the beginning, surfaces of bentonite clays were activated by an acid solution of selected concentration [2]. Then, activated bentonite was modified using intercalation of surfactants cationic HTAB by an exchange reaction. The next step, the intercalation of PVA [3]. Adsorbent was characterized through DRX, IR and CES. Finally, the results indicate that the synthesize composite could be employed as low-cost material for the removal of dye from wastewater: excellent adsorbent for cationic dyes [4].

Keywords : Algerian bentonite, acid activation, adsorption, Surfactant, wastewater.

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P25-A: ACTIVATED BIOCHAR FOR ANIONIC DYE REMOVAL

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In recent years, numerous studies have investigated the use of biochar to remove organic and inorganic pollutants. Biochar is a carbonaceous material produced primarily from waste biomass through a thermochemical conversion process. This material has been used as a biosorbent in various pollutants removal processes including dyes.

Biochar, as adsorbent, offer a more cost-effective adsorption solution compared to most conventional adsorbents. Adsorption processes provide a cost-effective, easy-to-control and high-quality treatment processes.

The present work investigates the preparation of promising activated Biochar derived from biomass via a pyrolysis process. Our adsorbent was characterized and then used to remove the Azorubine (E112) from wastewater using adsorption technique. The effects of impregnation ratio, amount of adsorbent, pH and contact time on the adsorption activity of biochar on AZ were evaluated.

The obtained products were characterized using different techniques, such as: XRD, FTIR,RAMAN and FESEM in order to determine more precisely their their surface chemistry basing on the functional group.

The maximum MB removal efficiency of our biosorbent reached 80 % at 20 ◦C at acide pH and this is due to the the activation process efficiency, which has allowed to have a nanoporous structure.

Keywords: Biochar; Pyrolysis; AZ adsorption; Depollution; Wastewater treatment.

P26-A: Contribution to the study of the hemolytic effect of hydro-alcoholic extracts of some natural green materials

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Our work focused on the phytochemical and biological study of three extracts and the essential oil from the aerial parts of an Algerian medicinal plant, Rhamnus alaternus. The phytochemical study, carried out on the three extracts using solvents of different polarities (aqueous, ethanolic, and hydroalcoholic) prepared under reflux, highlighted the richness of this plant in secondary metabolites, particularly tannins, flavonoids, saponins, alkaloids, and heterosides. Based on these findings, we were interested in the biological study and evaluation of two biological activities of this plant. Firstly, we studied the antioxidant activity of Rhamnus alaternus using two methods, namely the DPPH free radical scavenging assay and the FRAP iron-reducing capacity assay, which showed that all the plant extracts and its essential oil have antioxidant activity and iron-reducing capacity. Secondly, we studied the cytotoxicity of this plant by evaluating the hemolytic activity of the extracts in vitro against human red blood cells. The results showed that this plant has low toxic effects on human erythrocytes. The maximum hemolytic effect was obtained with the aqueous extract (6.38%) and the essential oil (10.52%).

Key words: Rhamnus alaternus, antioxidant activity, DPPH, FRAP, secondary metabolites, hemolytic activity

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P27-A: Evaluation of the hemolytic effect of Sonchus oleraceus

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This study was carried out within the laboratory of natural and bioactive substances (LASNABIO-TLEMCEN) with the aim of analyzing extracts from the aerial part of the plant Sonchus oleraceus L., an annual plant belonging to the Asteraceae family and widely used in traditional medicine. The main objective of this study is the evaluation of the cytotoxicity of the extracts on human red blood cells. The aqueous, ethanolic, and hydroethanolic extracts were prepared from hot extraction, and the polyphenolic extract is obtained using a polyphenol extraction protocol. Precipitation and color change reactions were used to determine secondary metabolites, such as tannins, saponosides, glycosides, alkaloids, and flavonoids. Antioxidant activity was carried out using the DPPH and FRAP tests, and showed that the aqueous extract has relatively low antioxidant activity compared to the reference (vitamin C), although it was better according to both tests. The hemolytic power of the extracts on human red blood cells was determined, and the results showed a very low toxic effect of the aerial part of the plant, even at high doses.

Keywords: Sonchus oleraceus, antioxidant activity, DPPH, FRAP, red blood cells, hemolytic activity

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P28-A: Green Chemistry Approach to 3,4-Dihydropyrimidin-2(1H)-one Synthesis via Biginelli Reaction Using CoCuZnO and $CoCuZrO_2$ Catalysts

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The Biginelli reaction is one of the most extensively studied multicomponent reactions. It enables the synthesis of a single complex product with biological, therapeutic and pharmaceutical properties, such as antiviral, antibacterial, anti-inflammatory and antitumour activities [1-2]. These reactions are particularly interesting for their economic and ecological advantages, known as 'green chemistry'. Under homogeneous conditions, this reaction can be limited by several factors such as the use of toxic or flammable solvents, which may be considered inappropriate for green chemistry principles. This is why the use of heterogeneous phase catalysts has been proposed as an alternative approach. In this context, we have studied the biginelli Reaction for the synthesis of 3,4-dihydropyrimidine-2-(1H)-one (DHPM), using benzaldehyde, ethyl acetoacetate and urea as reagents, in the presence of $CoCuZnO$ and $CoCuZrO_2$ catalysts prepared by the sol-gel method and calcined at 800°C. The structural and textural properties of the synthesised solids were studied by X-ray diffraction (XRD), scanning electron microscopy (SEM), Brunauer-Emmett-Teller (BET) nitrogen adsorption.

The prepared sample $CoCuZrO_2$ showed the highest yield of DHPM (85%), in free solvent with a reaction time of 3h.

Keywords: Heterogeneous catalysis, Biginelli reaction, Green chemistry, ZrO_2,

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P29-A: Contribution to the microwave-assisted green synthesis of 2-phenyl-1,3-dioxolane catalyzed by Tunisian acid-activated clay

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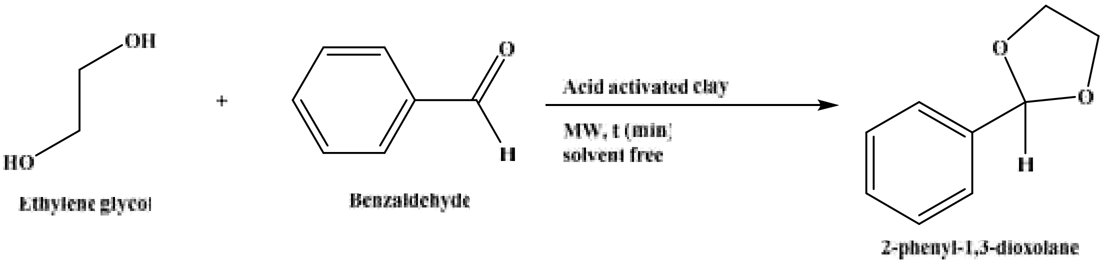
This work highlights the potential of Tunisian acid-activated clay as a green and sustainable catalyst for the efficient synthesis of heterocyclic compounds [1-6].
Thus, we have synthesized 2-phenyl-1,3-dioxolane which a versatile compound with applications in various industries. A solvent-free, microwave-assisted condensation of benzaldehyde and ethylene glycol was carried out using Tunisian acid-activated clay AH2 as heterogeneous catalyst. Reaction conditions were optimized to maximize both yield and environmental sustainability. The synthesized compound was characterized by ^{1}H and ^{13}C NMR spectroscopic analysis, confirming the formation of 2-phenyl-1,3-dioxolane in good yields. The catalytic efficiency of clay AH2 was validated, and a mechanistic pathway for the reaction was also investigated.



Scheme. Acetalization of ethylene glycol with benzaldehyde in the presence of acid-activated clay AH2.

Keywords: green acetalization, Heterogeneous catalyst, Tunisian acid-activated clay.

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P30-A: Valorization of Recycled Tire Rubber Powder as a Filler in Thermosetting Polymer Composites: Influence of Particle Size on Mechanical Properties

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This study forms part of a broader initiative to valorize rubber gum powder, derived from recycled end-of-life tires, by incorporating it as a filler in polymer matrix composites. Our work marks the initial phase of a detailed characterization process aimed at understanding the material's potential in composite formulations. A range of physicochemical techniques, including laser particle sizing, were employed to assess the particle size distribution of the rubber powder.

The size of the reinforcement particles plays a pivotal role in determining the mechanical properties of the composite. Increasing the specific surface area of the fillers, whether through smaller particle sizes or enhanced surface roughness, is hypothesized to improve interfacial bonding, thereby optimizing load transfer and energy dissipation under mechanical stress. Moreover, finer particles facilitate the production of complex geometries and improve handling characteristics, particularly in powder-based delivery systems.

In this study, particle size analysis was performed on waste tire powder produced through mechanical grinding, with the goal of optimizing its incorporation into a thermosetting matrix composite formulation.

Key words: Keywords: Waste valorization; Reinforcing particles; Mechanical properties; Interfacial area; Composite; Particle size analysis.

P31-A: Removal Of Malachite Green From Water Using Natural And Thermally Activated Bentonite

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One challenging issue that needs to be addressed right now is water contamination. In this study, we looked into different methods of purifying water by using green clay, also known as bentonite, which is native to the algerian province of batna. Because of its benefits, Bentonite is a type of clay that is commonly used in wastewater treatment and traditional ceramics.The ability of bentonite to adsorb the cationic dye malachite green was investigated using experimental methods. To improve its adsorption capacity, bentonite was thermally activated at two different temperatures (300°C and 500°C). After that, it was examined with a number of techniques, including X-ray diffraction. The results showed that, as compared to natural bentonite, activated bentonite had a greater degree of malachite green adsorption effectiveness. Moreover, the adsorption mechanism of malachite green exchanged bentonite was examined using UV-visible visible adsorption spectroscopy. These findings suggest that thermally activated bentonite has potential as an adsorbent for eliminating malachite green from wastewater.

Keywords: adsorption, X-ray diffraction, water pollution, bentonite, malachite green.

P32-A: Green synthesis of zinc oxide nanoparticles integrated into oral-dental pharmaceutical form

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For many years, zinc oxide (ZnO) has been widely used in the chemical and pharmaceutical industry due to its unique properties. It presents a series of characteristics that make it suitable for various applications. This study focuses on the green synthesis of zinc oxide nanoparticles from aqueous extracts of laurus and thym leaves. The optical and chemical properties of the nanoparticles were studied using various characterization techniques, including UV-visible spectroscopy and infrared spectroscopy. After characterizing the product obtained in powder form, tests were carried out to evaluate their antibacterial activity. These tests were carried out by evaluating samples at different concentrations of ZnOPNs on bacterial strains such as E. fecalis and S. aureus and a Gram-positive fungal strain C. albican. The evaluation of the antibacterial activity was based on the observation and measurement of the inhibition zone around the bacterial colonies. The results demonstrated a significant bactericidal activity of ZnO nanoparticles which offers the possibility of incorporating it into the composition of medicinal and pharmaceutical products such as mouthwash.

Keywords: NPsZnO, laurus nobilis. L, Thym Fontanesii, antimicrobial activity, UV-visible, infrared spectroscopy.

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P33-A: Isolation and characterization of novel cellulose nanofiber (CNF) from Lygeum Spartum using chemo-mechanical method

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Nowadays, the attention has shifted to environmentally friendly materials and bioproducts, cellulose the most abundant polymers provide a sustainable source of nanocellulose, also nanosized cellulose have sparked widespread interest due to their numerous applications, including cosmetic, medicinal, filers, nanocomposite, due to their versatile properties such as biodegradability, stiffness, high surface area, higher mechanical properties, thermal properties, porosity, flexibility. The latest advancements in green synthesis and technology encourage the maximum use of green methods of nanocellulose extraction. The aims of the study was the extraction of CNF from Lygeum spartum (Sparte) by a chemo-mechanical method. First the fibers were subjected to different chemical treatment to eliminate non-cellulosic compounds, the chemically treated fibers were mechanically separated into nanofibers using ultrasound and homogenization. The obtained CNF were characterized by FTIR, XRD, TGA, SEM. The FTIR results show the removal of hemicellulose and lignin, while XRD confirm the presence of cellulose I, the Thermal analysis reveals that the thermal stability increases for the isolated nanofibers. The outcome of the study implies the possibility of nanofiber extraction from new source using green methodologies, these nanofibers present a prominent alternative of synthetic fibers in large application, especially in manufacturing green composites.

P34-A: The response of thermal properties with hydrostatic pressure of zinc-blende ZnSxSe1-x alloys

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The theoretical study of thermal properties for the ternary alloys ZnSxSe1-x in zinc-blende phase, has been affected by using the pseudopotential method (EPM) coupled with virtual crystal approximation (VCA). In first, we have calculated the elastic constants at normal pressure (zero pressure) employing different formula in the goal to determinate Debye temperature how make possible the calculation of conductivity and specific heat with taking on consideration the compositional disorder effect. Then we give a several attentions to the hydrostatic pressure effect on the thermal properties for the entire range of the alloy composition x (from 0 to 1) of the ternary alloy ZnSxSe1-x. The obtained results are found to be in good agreement with the available experimental and published data..

Keywords: ZnSxSe1-x, hydrostatic pressure, thermal properties, conductivity, Debye temperature, specific heat, pseudopotential method.

P35-A: DFT Analysis of the Interaction between GLDA Chelator and Competing Alkali Metal Ions

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Alkali metals such as lithium (Li), sodium (Na), potassium (K), and rubidium (Rb) play a key role in numerous chemical and biological processes due to their unique reactivity and ionic properties. However, their effective manipulation and utilization in various applications largely depend on the ability to selectively and strongly bind them to suitable ligands. Among potential ligands, chelating agents stand out for their ability to form stable complexes with metal cations. In this context, GLDA (tetrasodium glutamate diacetate) has drawn attention as a versatile ligand, potentially capable of selectively complexing alkali metals.

GLDA is particularly promising for its environmentally friendly properties and its efficiency as a chelator in various industrial and environmental applications. Indeed, optimizing the complexation of these metal cations by GLDA could offer innovative solutions in fields ranging from water treatment to catalysis and rechargeable batteries.

This study is dedicated to an in-depth study of alkali metal complexation by GLDA, using a theoretical approach based on quantum calculations, particularly density functional theory (DFT). By conducting a comparative study of Li , Na , K , and Rb complexes, we aim to understand the selectivity of GLDA and the binding strength of the complexes formed, both in the gas phase and in solution, using the COSMO implicit solvation method.

This study seeks to provide new and valuable insights for the development of selective and effective chelating agents by optimizing the complexation of alkali cations in various environments.

Keywords: DFT, GLDA, Alkali metals,

References.

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P36-A: Valorization of local resources for the preparation of a new biopolymer materials

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The exploitation of the plant and food resources produced by the Algerian soil provides a highly interesting alternative to the environmental problems and the probable depletion of fossil resources. This study explores the development of new materials by utilizing abundant and often underexploited local resources. The main objective is to create high-density polyethylene (HDPE) matrix composites reinforced with acorn pericarp fibers (APF) and eggshells (EH). This study also aims to propose ecological alternatives to traditional composites, reducing dependence on fossil resources and meeting environmental requirements. In this context, different formulations based on HDPE/APF/EH were prepared with different loading rates ranging from 10 to 40% of APF using twin-screw extruder. The materials developed have been characterized by various analytical techniques, namely: mechanical, physical and structural tests. The recorded results indicate good mechanical properties, which are increased by the increase in the charge rate.

Keywords: acorn pericarp fibers, eggshells, biomaterial, properties.

P37-A: Removal of Zinc and Nickel from wastewater using ultrasound-treated orange and lemon peel powders: Adsorption mechanism, kinetic and isotherm studies

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In the present study, orange and lemon peels known as Citrus peel, treated or not with ultrasound (US) sensor, were used as bio-sorbents to remove heavy metals (Co, Ni and Zn) from the wastewater. The tested bio-sorbents were named CO, USO, CL, and USL for control (C) and US-treated orange and lemon peel powders, respectively. The impacts of several factors such as metal concentration, time sorption, and weight of sorbent were investigated to determine the sorption capacity as well as the metal removal percentage using the raw and US-treated samples. The results showed that the US-treated lemon peel powder had an excellent Ni sorption capacity (5.45 mg/g) as well as a good removal efficiency (54%) compared to that of raw lemon (3.95 mg/g and 39%). The sorption capacity and the removal efficiency of Zn were recorded at about 14.64 mg/g and 73%, respectively, with the use of USO and about 14.31 mg/g and 71%, respectively, with the use of USL. To note these values were significantly higher than those of the CO and CL peel powders. Structural modifications have been observed in the Infrared (FTIR) spectra after the sorption of each metal (Zn or Ni) using USO and USL. The study of kinetic models revealed that Ni and Zn uptake followed the pseudo-second-order model onto the treated orange (USO) and lemon (USL) peel powder suggesting chemical bonds between sorbent and sorbate. For the isotherm models, the Ni uptake onto the lemon peel powder tended to fit the Langmuir model revealing a monolayer sorption process, while for Zn, it is almost the Freundlich model revealing a multilayer sorption process. The results showed that, the US-treated orange and lemon peel powder might be relevant bio-sorbents for the elimination of heavy metals from wastewater thanks to their efficient sorption capacity, along with their abundance, low cost and biodegradability.

P38-A: SYNTHESIS AND EVALUATION OF ANTIMICROBIAL ACTIVITY OF NEW COMPLEXES OF COPPER (II)

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Among organic compounds, which can serve as ligands, 2-pyrone ring and its derivatives have received much interest because of their many interesting features [1].The different complexes with different types of drugs heterocyclic such as imines, amines, imidazole groups and ligands containing 2-pyrone ring play an important role in biology and medicine areas [2]. The prepared 2-[aryl (hydroxy) methyl]-6-methyl-2H-furo[3,2-c]pyran-3,4-diones were fully characterized by 2D NMR spectroscopy and supported by single crystal X-ray analysis to prove the furan-3-one five-membered ring-closure [3].On the basis of previous works and more particularly coordination complexes [4], a total of two new metal complex derivatives of two new ligands 2-(hydroxy(phenyl)-6-methyl-2H-furo[3,2-c]pyran-3,4-dione (L1) and 2-(hydroxyl (2-hydroxyphenyl) -6-methyl-2H-furo[3,2-c]pyran-3,4-dione (L2) with the metal ions Cu(II) have been successfully prepared in alcoholic medium. The complexes obtained are investigated by spectral studies with the use of FT-IR and UV-vis techniques, ESR and magnetic measurements. Elemental analysis revealed the geometry of these complexes whose general formula is [M (L) 2 (H2O)2] .nH2O. The calculated geometric parameters confirmed the distorted octahedral geometry of the studied complexes.Compared with the standards data, the tests reveal that the newly prepared ligands and their metal complexes showed an interesting effect against most microorganisms. However, the results show that L1 and L2 ligands are more active against Gram-positive bacteria than Gram-negative bacteria.

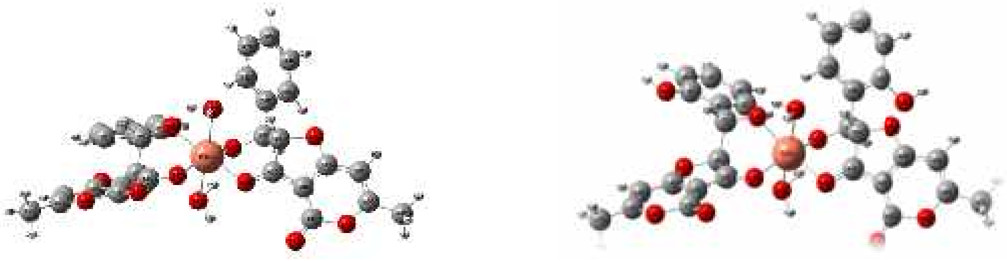

Fig. Structures of the complexes [Cu(L1)2. (H2O)2].H2O ; [CuL2)2(H2O)2].H2O optimized with the DFT method.

Keywords: Heterocyclic ligands; ligand derived from the furopyran-3,4-dione; Metal complexes; ESR; DFT

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P39-A: Synthesis, modifications, performance and regeneration of activated biochar from Washingtonia robusta seeds heavy metals removal from wastewater

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Scientists and experts are hitched to develop processes to save our environment from the huge quantity of daily released pollutants such as heavy metals that represent a potential risk to nature figure. In this context, low cost activated biochar was produced from Washingtonia robusta seeds. The investigation of the preparation conditions showed that an impregnation ratio (precursor /acid) about 3/1 (w/w) and a pyrolysis temperature of about 650°C revealed the most effective adsorbent considering its high methylene blue index and low ash content [1]. The removal of some heavy metals such as copper ions and zinc ions in contaminated water by prepared activated biochar were explored. The experimental results showed that the removal of copper ion and zinc ions in solution was reached during the first 90 and pH equal to 6 and 7 respectively. The batch adsorption study showed that Langmuir adsorption isotherm and pseudo-second order models well described adsorption of the tested metallic ions. Results verified that the synthesized biochar can be an efficacious alternative to commercially available adsorbents for the removal of cationic ions from wastewater at large scale using the Washingtonia robusta seeds.

Keywords: .Waste valorization, Adsorbent, Heavy metals, Wastewater.

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P40-A: Pollution of groundwater by the intrusion of olive mill waste water: case of Wadi Laya Central-Eastern Tunisia

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The production of olive oils is often accompanied by an important quantity of olive mill waste water (OMWW) rejections. In Tunisia, the OMWW is considered to be a fatal problem. Spreading is random and generally without paying attention to already established protocols. The Sahel region is the target of tons of OMWW. The problem for which we should find an ambulatory solution is how to stop the communication between the OMWW and the contiguous water tables. Around ten sampling sites water samples were collected in the Kalaa Kebira region. The carried out analyzes are pH, electrical conductivity and phenol content, COD, BOD and nitrate content. The results obtained showed that there is a strong intrusion between the water discharge basins and the water tables. Traces of phenols are present in the majority of samples. Mapping by interpolation of the results proves that all drilling is not exempt from this phenomenon. The discharge of water in the Sahel region should have more control to better protect water resources and their qualities. This is done through more awareness, more education and communication.

Keywords*:* Olive mill waste water, pollution, groundwater, intrusion.

P41-A: Highly Efficient MSPE of Naproxen Using Lignocellulosic Biomass -Derived Magnetic Biochar

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Biochar, a porous carbon material derived from biomass pyrolysis under oxygen-limited conditions, has emerged as a promising and sustainable adsorbent. Its affordability, environmental friendliness, and large surface area make it well-suited for various applications, including water and air purification [1]. By magnetizing biochar with iron oxide, its adsorption capabilities can be significantly enhanced [2].

This study investigated the use of magnetic biochars derived from almond, walnut, and peanut shells for the magnetic solid-phase extraction (MSPE) of naproxen from human saliva. The bioadsorbent were characterized using IR, XRD, SEM, and EDX, and their extraction efficiency was evaluated through experimental design. Results demonstrated that almond shell-based magnetic biochar exhibited superior performance in naproxen extraction, achieving a 100.2% yield under optimized conditions. This exceptional performance can be attributed to the abundant lignocellulosic content in almond shells. Coupled with LC-MS analysis, the magnetic extraction method using almond shell biochar displayed excellent linearity ($R^2 = 0.9987$) and low detection and quantification limits (LOD = 0.013 µg/L, LOQ = 0.047 µg/L).

Keywords: Magnetic Solid Phase Extraction (MSPE), Lignocellulosic biomass, Saliva, NSAID, LC-MS.

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P42-A: Synthesis of Ultralong, Well-aligned $LaAlO_3$ Fibers Through Electrospinning Technique

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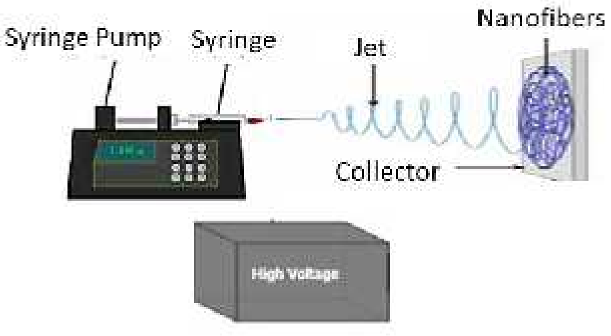
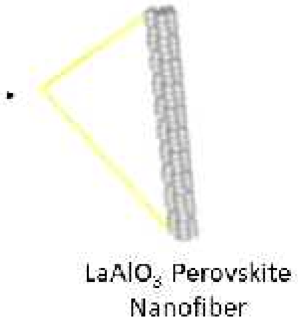
Electrospinning is a versatile technique that has obtained significant interest in materials science for producing nanofibers with tailored properties. In this study, we applied this method to synthesize lanthanum aluminate $LaAlO_3$, a perovskite material with promising applications in environmental and sensor technologies.

The synthesis involved electrospinning a polymer-metal salt solution, followed by calcination at 800°C, resulting in well-crystallized perovskite fibers with uniform fibrous morphology. Infrared spectroscopy revealed two absorption bands at 658 cm^{-1} and 419 cm^{-1}, corresponding to La–O and Al–O stretching vibrations, confirming the formation of the perovskite phase.

We have proposed a mechanism of fiber formation where the polymer aids in the uniform distribution of metal ions, facilitating the controlled crystallization of the perovskite phase during calcination. The resulting fiber morphology shows great potential for applications in gas sensing and catalytic processes.

Key words: $LaAlO_3$, nanofibers, electrospinning, nanostructured perovskite.





B. Nanomaterials & Materials for Energy

ORAL-B

O1-B : Design and numerical investigation of highly photovoltaic efficiency of novel non-toxic double perovskite solar cell with MoSe2 as hole transport layer

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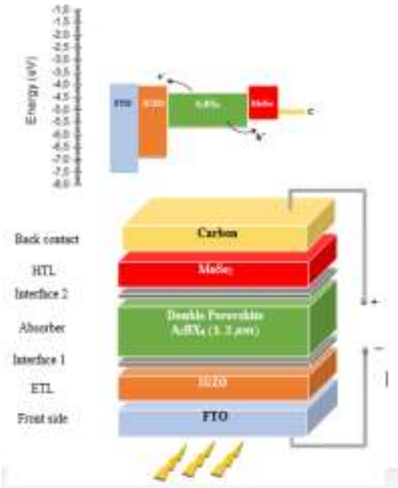

The development of lead-free perovskite solar cells, is indeed a promising solution to the toxicity issue associated with traditional lead-based perovskites. These lead-free alternatives aim to maintain high efficiency while being environmentally friendly. In this context, we aim to propose a novel lead-free double perovskite solar cell with MoSe2 as hole transport layer (HTL). It has been demonstrated recently that this inorganic halide double perovskite with the structure A2BX6 is more stable compared to the lead-free perovskite with the structure ABX3.

We design our solar cell with the planar architecture where the perovskite layer is sandwiched between the hole transport layer MoSe2 and an electron transport layer IGZO This contributes to efficient charge separation and collection, which is crucial for the performance of the solar cell. Our work focuses on the optimization and analysis of various key parameters governing perovskite solar cell performance in different values of working temperature. Our final optimal results, gives an impressive Power Conversion Efficiency (PCE) up to 25%. These findings represent a significant advancement and proposes the perovskite as a potential photoactive material in the renewable energy technology.

Keywords: Lead-free halide double perovskite solar cell, SCAPS simulation, MoSe2 as HTL, Working Temperature.

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O2-B : Characterization of Pd-TiO2 nanotubes and study of LSPR effect for photocatalytic degradation of organic pollutants.

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Titanium dioxide TiO2 nanotubes were synthesized with a simple anodization method to form highly ordered and organized nanotubes, this morphology is preferred for its advantages in electron transfer and high specific surface area for more active sites related to photocatalytic activity. We used the electrodeposition method to deposit palladium Pd nanoparticles onto the TiO2 nanotube, the surface modification with noble metal will help enhance light absorption and electron/hole pair recombination. To study the LSPR effect on TiO2 nanotubes photoactivity, a morphological, structural and optical characterization were conducted with scanning electron microscopy, x-ray diffraction and PL and UV-Vis spectroscopy. The obtained results showed, The presence of nanotubes with a length of 15 micrometers and a diameter of 100 nm. An agglomeration of palladium nanoparticles was observed, along with their dispersion within the TiO2 nanotubes. The estimated size of the Pd nanoparticles is 0.26 nm. Optical analyses, such as photoluminescence and diffuse reflectance spectroscopy, have confirmed the charge transfer between metallic nanoparticles and the semiconductor. The successful incorporation of Pd onto TiO2 nanotubes (TiO2-NTs) enhanced photocatalytic activity beyond that of the unmodified sample. The Pd/TiO2-NT sample with a Pd deposition time of 300 seconds exhibited optimal photocatalytic performance, demonstrating efficient degradation under UV light. This enhancement in photocatalytic activity is attributed to the plasmonic effect of the Pd nanoparticles. Kinetic studies revealed that the photocatalytic reaction followed first-order kinetics, thus positioning Pd/TiO2 NTs among the most efficient photocatalysts for dye removal. Furthermore, quenching experiments indicated that hydroxyl radicals (OH°) and superoxide radicals (O2°-) were the primary and secondary reactive species involved in the photodegradation process.

Keywords: titanium dioxide TiO2, Palladium nanoparticles, Pd/TiO2 nanotube, Electrochemical deposition,Local Surface Plasmonic Resonance LSPR, Photocatalysis.

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O3-B :Green synthesis of Ag and NiO nanoparticles using Pelargonium graveolens plant extract

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An environmentally friendly green approach for the synthesis of silver (Ag) and nickel (NiO) nanoparticles was developed using Pelargonium graveolens leaf extract. The XRD revealed the formation of pure cubic crystalline structure of AgNps and NiONps. Plant extract acts as both a reducing agent and a capping agent, providing a rapid and simple method for the synthesis of nickel oxide and silver. Results confirmed that this protocol as simple, rapid, one step, eco-friendly, nontoxic and an alternative conventional physical/chemical method. Just a few times is enough to convert ions into nanoparticles without the use of hazardous chemical.

Keywords: Ag, NiO, Pelargonium graveolens, nanoparticles, coprecipitation, environmentally friendly green method

O4-B : Flexible and Luminescent Polymer Nanocomposite Films (YPO4:Pr3+/ polystyrene): Investigation of Structural, Morphological and Photoluminescence Properties for Solid-State Lighting Applications

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Luminescent polymer films are promising for future optoelectronic devices owing to their ease of synthesis, tunable properties and flexibility. The present work reports on the fabrication of YPO4:Pr3+/polystyrene based flexible and luminescent nanocomposite (NC) films followed by an investigation of their structural, morphological and photoluminescence properties for their potential applications in optical devices. NC films were successfully prepared by direct solution mixing of YPO4: Pr3+ (0.1, 2 at. %) luminescent nanoparticles (NPs) and polystyrene (PS). X-ray diffraction (XRD) analysis of pure and PS NC films revealed an improvement in crystallinity upon YPO4: Pr3 NPs doping into PS films, particularly for Pr3+ (2 at. %). The emission spectra of the pure and YPO4:Pr3+/PS NC films under UV excitation at 223 nm showed the same features with a broad emission band in the 280-400 nm region. However, an increase in emission intensity, and absence of interconfigurational emission characteristic of the YPO4: Pr3+ NPs were observed in UV region, due to the strong absorption band of PS in this region. Upon doping, YPO4:Pr3+ NPs were found to reduce their intrinsic luminescence emission from (4f2—4f2) interconfigurational transitions of Pr3+ ions. However, it was dominated by an orange-red luminescence of 1D2→3H4 transition, while, no emission was observed for the PS film owing to its transparency in the visible region. The fluorescence decay times of 1D2→3H4 in the NC films were shorter those of the original nanopowders. Chromatic coordinates and correlated colour temperature indicated that the YPO4:Pr3+/PS NC films are promising polymer-phosphors for lighting applications.

Keywords: YPO4:Pr3+ nanoparticles, polystyrene, nanocomposite films, photoluminescence, direct solution mixing method.

O5-B : Fabrication and characterization of flexible and transparent composite thin films based on Polyvinyl Alcohol (PVA)/rGO for optoelectronics devices applications

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In this present paper, we describe the synthesis of graphene oxide (GO) and hydrazine-reduced graphene oxide (rGO) fillers using respectively modified hummer's technique and hydrazine monohydrate reactive chemical agent. We are concerned in the investigation the impact of varying weight % fraction of hydrazine-reduced grapheme oxide (rGO) on the crystal structure of polyvinyl alcohol (PVA). These provided samples were deposited on tin-doped indium oxide (ITO) transparent conductive plastic films on polyethylene terephthalate (PET) using spin-coating process and analyzed by structural and optical spectroscopy. A significant reduce in the crystallinity of PVA thin film composites due to rGO doping was esteemed. At a high concentration or weight % of rGO, the intermolecular hydrogen cohesion resulted in a characteristic new feature of the host polymer PVA Thin film. The band gap energy of samples is determined via Tauc method. Energy gap is decreased by adding rGO filler in the PVA matrix. The prepared thin film composites have ameliorated structural and optical properties, making them optimistic materials for optical storage and opto-electronic devices applications.

Keywords: Polyvinyl alcohol, hydrazine-reduced graphene oxide, Modified Hummer's Process, Thin film Composites PVA/rGO, Structural and Optical characteristics, Band gap analysis.

O6-B : Synthesis of coatings of metallic nanoparticles on TiO2 nanotubes : physico-chemical and tribological characterisation

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Self-organized TiO2 nanotubes were fabricated by anodization on a titanium substrate and loaded with platinum nanoparticles dispersed using the photoreduction method (1h, 2h, 3h, and 4h) to shift the absorption range of TiO2 from UV to visible light by decorating it with Pt NPs to improve photocatalytic activity. Scanning electron microscopy characterization showed a self-organized nanotubular TiO2 structure with NTs of 72.99 nm length vertically aligned on the titanium substrate. The average diameter of the NTs is around 33.10 nm, and the wall thickness is about 11.73 nm, as determined by transmission electron microscopy. XRD characterization revealed that all samples crystallized in the anatase phase after annealing at 400°C for 3 h. The presence of the Pt NPs was confirmed by XRD characterization. Mechanical characterization through scratch tests showed that the coatings exhibited good intrinsic properties after being deposited with different Pt deposition times, with the 2-hour deposition showing superior wear resistance. An energy wear evaluation performed for the first time on these coatings showed that the energy wear coefficient of pure TiO2 NTs was higher than that of the films after being subjected to different deposition times. This result confirms the good wear resistance of the 2-hour coatings. The adhesion of the coating to the substrate was measured using a delamination test. We demonstrate that the coating exhibits better cohesion and adhesion.

Keywords : Anodisation, nanotubes, TiO2, Photo-réduction, tribological properties, scratch test.

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O7-B : Threshold Voltage Rectifier Cancellers for RF and Piezoelectric Energy harvesting prototype

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Energy harvesting gives a promising future to supply energy from different ambient sources. This can be accomplished by catching minute amounts of energy from one or more of normally getting energy sources, accumulating and storing them for some time in the future. Such sources may include; Light or sun oriented Energy (SE), mechanical energy (ME), Thermal Energy (TE), Ambient Energy (AE) and Other Energy - from chemical and organic sources, Electromagnetic or radio frequency RF Energy (RFE). ME is the primary one, which can be gotten from vibration, mechanical anxiety. Electromagnetic energy in the millimeter (mm) is changed over to micron-wavelength scope of the electromagnetic spectrum to electrical energy. AE can be generated from the environment such as wind, water stream, sea ebbs and flows, and solar, human body - a mix of mechanical and thermal energy normally produced from bio-organisms or through activities such as strolling and sitting. Energy harvesting is the change of environment energy to electrical energy to be utilized in fueling electronic gadgets or circuits.

In this work study, we concentrate on energy harvesting from the RF and Piezoelectric Energy where we focused on the problems of using rectifier circuit represented by: Threshold Voltage (TV) higher than input voltage. As it is the case of reverse current from the storage devices damages the current rectifier, here, we propose a new rectifier circuit that reduce the drop voltage, and protection the reverse current with hybrid energy harvesting from RF and piezoelectric and thus provide DC voltage and improve the system. The simulation results showed an increase efficiency of rectifier circuit to 41.7% compared to the efficiency reached by researchers previously and the voltage reaches stability in a brief period of time, which is estimated to be nanoseconds. Those two points were an obstacle in the path of researchers previously, those problems are solved, and then energy from many sources could be collected to power any smart system.

Keywords: Energy harvesting , Electromagnetic Radio Frequency RFE, Piezoelectric Energy, Threshold voltage TV

O8-B : Innovative Enhancements in Magnetic Nanofibers for Efficient Dye Adsorption

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Water pollution is a critical global issue, and while various chemical, physical, and mechanical purification methods exist; nanotechnologies, particularly electrospun nanofibers, have emerged as a promising solution. These nanofibers are highly efficient in filtering contaminants, especially organic pollutants such as dyes, and offer the additional advantage of being reusable [1-3].

This study explores the synthesis of magnetite nanofibers via electrospinning and their potential application in water purification. The nanofibers were characterized using techniques such as BET, FTIR, TGA, and SEM to determine their structural and surface properties. Their effectiveness in dye removal was evaluated by measuring the adsorption of two dyes: Toluidine Blue and Congo Red.

The results demonstrated significant dye removal efficiency, with 76% of Toluidine Blue removed at an adsorption capacity of 280 mg/g, and 79% of Congo Red at 300 mg/g, both at a fixed concentration of 1 g/L. The adsorption process followed a pseudo-second-order kinetic model, as indicated by high correlation coefficients. These findings underscore the exceptional potential of magnetite nanofibers as effective adsorbents for organic dyes, offering an environmentally friendly and cost-effective approach for treating wastewater from dye-intensive industries.

Keywords: Water treatment, Magnetite, characterization, nanofiber, electrospinning

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O9-B : Electrophoretic deposition of gold nanoparticles on highly ordered titanium dioxide nanotubes for photocatalytic application: Enhancement of photocatalytic degradation of amido black dye

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The objective of this research is to demonstrate the critical influence of titanium dioxide (TiO2) nanotube geometry on photocatalytic performance. These nanotubes were synthesized using the anodization technique, and subsequent deposition of gold nanoparticles (AuNPs) was achieved via electrophoretic deposition on their surfaces. The impact of electrophoretically deposited gold nanoparticles (Au NPs) on TiO2 nanotubes, with varying deposition times (5 minutes, 8 minutes and 12 minutes), was investigated for their photocatalytic efficacy in degrading amido black (AB) dye. The morphological analysis revealed a well-organized nanotubular structure of TiO2, measuring 15 μm in length and 100 nm in diameter, as observed through Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). Optical examinations, including photoluminescence and diffuse reflectance spectroscopy, provided evidence of charge transfer between the metal nanoparticles (NPs) and the semiconductor. The enhanced photocatalytic activity of the TiO2-NTs resulted from successful Au deposition onto their surface, surpassing that of the pure sample. This improvement is attributed to the higher work function of gold nanoparticles, which effectively promoted the separation of photogenerated electron-hole pairs. The sample Au/TiO2-NTs with a deposition time of 5 minutes exhibited the highest photocatalytic efficiency, achieving an 85% degradation rate after 90 minutes under UV irradiation. The enhancement in photocatalytic activity was attributed to the plasmonic effect induced by Au nanoparticles. Kinetic investigations revealed that the photocatalytic reaction followed apparent first-order kinetics, highlighting Au/TiO2 NTs as a superior photocatalyst for dye degradation.

Keywords: Reactive species · Au decorated TiO2 · Electrophoresis · Photocatalytic intensification

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O10-B : Electrical characteristics of AlGaN/GaN HEMTs: Analysis and Optimization

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This paper investigates the electrical characteristics of High Electron Mobility Transistors (HEMTs) based on AlGaN/GaN heterostructures. AlGaN/GaN HEMTs have attracted significant attention due to their high electron mobility, breakdown voltage, and power efficiency, making them ideal for high-frequency and high-power applications. The study explores key parameters affecting device performance, such as carrier density, electron mobility, threshold voltage, and breakdown characteristics. The influence of Al composition in the AlGaN layer and the use of different buffer layers on device performance are also analyzed. Experimental results are presented, supported by simulations, showing improvements in power efficiency and thermal management. The work contributes to the optimization of HEMT design, offering insights into enhancing device reliability and performance for next-generation power electronics.

Keywords: AlGaN/GaN HEMTs, High Electron Mobility Transistor, threshold voltage, electron mobility, breakdown voltage, power electronics.

O11-B : Stable Ta2O5 nanotubes decorated by PbS by the SILAR method for photocatalytic dye degradation

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After electrochemical anodization, tantalum oxide Ta2O5 nanotubes (NTs) were decorated with lead sulfide nanoparticles (NPs) using the SILAR process, which stands for successive ionic layer adsorption and reaction. X-ray diffraction (XRD), scanning electron microscopy (SEM-EDX), photoluminescence (PL), transmission electron spectroscopy (TEM), and diffuse reflectance spectroscopy (DRS) were used to analyze the PbS NPs/ Ta2O5 NTs. It has been demonstrated that applying an increasing number of SILAR cycles to this substrate causes a change in the bandgap and optical characteristics of PbS NPs/ Ta2O5 NTs. The bandgap for Ta2O5 NTs adorned with 10 PbS SILAR cycles decreased from 3.83 eV to 3.4 eV when compared to naked Ta2O5. Ten SILAR cycles were observed, corresponding to percentages of the decorated Ta2O5 NTs of 1.4 M and 2.7 wt%. Under light irradiation, ten SILAR cycles were needed to generate the fastest degradation kinetics of the Black Amido mediated Ta2O5 (NTs)-PbS NPs. Longer SILAR cycles, however, did not appear to accelerate the kinetics of deterioration because of light screening. Five photocatalytic reuse cycles were demonstrated by the remarkable stability of the produced nanotubes.

Keywords: Ta2O5 nanotubes, PbS nanoparticles, anodization, SILAR, photocatalysis

O12-B : Control Synthesis of Tin Sulfide nanoparticles for degradation of Rhodamine B and Eriochrome Black T

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This study investigates the synthesis of tin sulfide nanoparticles using a sol-gel method with diethyl ether serving as a solvent and $SnCl2$ as a metal precursor and with $SC(NH2)2$ and $Na2S$ sulfide source precursor variance. The synthesized nanoparticles were thoroughly characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), photoluminescence (PL) and UV-visible spectrometry (UV-Vis). The XRD analysis revealed the formation of a $SnS2$ phase with $CS (NH2)2$ and a SnS phase with $Na2 S$. SEM imaging representing agglomerates of varying sizes and shapes for SnS, contrasting with porous spherical formations for $SnS2$. The PL spectra had emissions centered around 414 nm, 530 nm and 646 nm.

In addition, the photocatalytic efficiency of SnS and $SnS2$ nanoparticles was evaluated by degradation of rhodamine B (RhB) and Eriochrome Black T (EBT) under UV and solar radiation. The results highlighted the remarkable degradation performance of SnS and $SnS2$ nanoparticles

Keywords : SnS, SnS2, sol-gel, RhB, EBT, photocatalytic degradation.

O13-B : Efficient photocatalytic performance of Ca-doped ZnO nanoparticles for the degradation of Rhodamine B

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In our study, we focused on the synthesis of Ca-doped ZnO nanoparticles (CZO)by modified sol-gel method using $ZnCl2$ as a precursor and pluronic (EO106 PO70 EO106, F127) as the nonionic surfactant. The influences of Calcium on the morphological, structural, and optical properties were studied. SEM confirms the formation of spherical nanoparticles. X-ray diffraction (XRD) showed that Ca has been incorporated into ZnO and the crystallite size decreased with the increasing of Ca concentration. From the optical studies, it is found that the band gap energy decreased from 3.09 eV to 3.01 eV with increasing Ca concentration. The effect of Ca-doped ZnO on the photocatalytic activity was examined by the degradation of Rhodamine B in water under UV irradiation. As a result, C3ZO had higher efficiencies degradation of 94% and This process was described by the pseudo-first-order kinetic model (k=0,010 min-

Keywords: ZnO,CZO,C3ZO,modified sol-gel, Rhodamine B

O14-B : Simultaneous removal of bacteria and volatile organic compounds on Cu2O-NPs decorated TiO2 nanotubes

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Text of the abstract In this work, we study the effect of decorating TiO2 nanotubes (TiO2-NTs) with Cu2O nanoparticles (Cu2O-NPs) on photocatalytic degradation of volatile organic compounds (VOCs) and on bacterial disinfection. The Cu2O-NPs were loaded on the TiO2-NTs by Successive Ionic Layer Adsorption and Reaction method (SILAR). The butane-2, 3-dione (BUT), chloroform, and Butyraldehyde were used as an indoor/outdoor target VOC-pollutants due their adverse environmental impact (high toxicity and confirmed carcinogenicity). The achieved Cu2O-NPs/TiO2-NTs nanocomposites were characterized using X-ray diffraction (XRD), diffuse reflectance spectroscopy (UV–vis) and scanning (SEM) and transmission (TEM) electron microscopy. In order to investigate the photocatalytic and antibacterial behavior of the Cu2O-NPs/TiO2-NTs, simultaneous removal of *Escherichia coli* (*E. coli*) and VOC were tested with the optimized catalyst. We observed a bacterial inactivation around 98% and a concomitant 90% VOC removal within 60 min and 30 min of visible light irradiation, respectively.

Keywords: TiO2 nanotubes, Cu2O-NPs, photocatalytic performance, Simultaneous removal of E. coli and VOC

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O15-B : Optimizing Electron Transport Layers for High-Efficiency Perovskite Solar Cells using Impedance Spectroscopy

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The best interface for a perovskite solar cell is designed to facilitate effective charge transport in order to achieve a high-power conversion efficiency. Tin dioxide (SnO_2) is widely recognized as an electron transport material for perovskite solar cells, offering advantages such as low hysteresis, low defect concentration, and low fabrication temperature. However, the low conduction band edge of SnO_2 restricts the built-in potential of the solar cell device. In this study, we designed a double layer of electron transport by applying zinc oxide (ZnO) on SnO_2 to improve the electron transport properties in perovskite solar cells. The bilayer of electron transport enhances the interfaces between the perovskite and the electron transport layer, leading to an improvement in the efficiency and stability of solar cell devices up to >11.7%. This study shows that it is possible to achieve high-performance perovskite solar cells by implementing a double layer of electron transport, as demonstrated through electrochemical impedance spectroscopy (EIS) technique. We consolidate various research perspectives on interpreting and analyzing EIS data for electron transport layer perovskite solar cells (ETL-PSCs).

O16-B : Synergistic study of photocatalysis combined with cold plasma in a planar LED reactor: elimination of VOCs and bacteria

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This study investigated the effect of key operating parameters, kinetics, and chemical degradation pathways of photocatalytic removal of Ethyl Acetate (EA) in novel planar LED reactor. The volatile organic compound (VOC) degradation was performed using TiO2 nanoparticle immobilized on a glass fiber tissue (GFT) on a pilot-scale continuous reactor. The performance of elaborated catalyst TiO2/GFT was studied by the control of different parameters such as EA inlet concentration (5, 10, 15, 20 mg/m3), flow rate (1, 2, 4 m3/h), relative humidity (5, 50, 90%), air gap (30, 50 mm) and LED intensities (15, 48, 95 mW/m2). The exploitation of these parameters allows us to understand the performance of the novel planar LED reactor, thus the different phenomena involved and the kinetics of the photocatalytic reaction. Also monitoring the selectivity of CO2 allows us to determine the reactive oxygen species responsible and the reaction pathways of the photocatalytic degradation of Ethyl Acetate. Then, we evaluated different LED intensities model based on Langmuir-Hinshelwood (LH) approach to obtain the kinetic constants. To get close to real condition, a simultaneous removal study was performed on TiO2/GFT with optimal parameters (Cin = 5 mg/m3, D =1 m3/h, RH = 48%, Imax = 95 mW/m2, Air gap = 35 mm). Therefore, the photocatalytic activity was followed by the presence of VOCs with bacteria (Ethyl acetate + E. coli). Finally, in order to intensify this planar LED reactor, a combined removal (plasma-photocatalysis) was maintained. This coupling process exhibit an ecofriendly treatment by decomposing the generated ozone and enhances the removal efficiency.

Keywords: novel planar LED reactor, Photocatalysis, Plasma DBD, VOCs, Bacteria.

O17-B : Electrical and electronic properties of Si5P6O25 : Experimental and theoretical studies

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Proton conductors have attractive a lot of attention during the last decades as electrolytes for solid state electrochemical cells such as fuel cells, batteries and sensors [1]. Here, silicophosphate, prepared from Tunisian siliceous sand, has been explored as a proton conductor in the temperature range of 30-230 °C. This compound was prepared by mixing phosphoric acid and sodium silicate with a weight ratio P2O5:SiO2=54:46 and annealed at 450 °C for 10h [2]. XRD analysis showed the formation of Si5P6O25 rhombohedral as single pure phase. Rietveld refinement confirmed the purity of the compound with the following reliability factors: R=0.0439, wR=0.0677 and χ2=3.487. The conductivity (σdc) increased from 3.45x10-6 S.cm-1 at 30 °C to 0.24 x10-3 S.cm-1 at 230 °C, revealing an Arrhenius-type behavior with activation energy (Ea) of 0.33 eV. The simulation of the proton conduction using the Bond Valence Site Energy (BVSE) model showed a 3D isosurface of migration pathway with calculated activation energy of 0.57 eV. The electronic structure (bond structure and density of states) of Si5P6O25 were studied using Density Functional Theory (DFT). The result showed that Si5P6O25 has a calculated direct band gap energy of 4.76 eV, which is close to the experimental one (4.42 eV) determined by UV spectroscopy.

Keywords: Silicophosphate, Proton conduction, Electronic structure, BVSE, DFT.

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O18-B : Comparative Analysis of Functionalized Magnetite and Maghemite Nanoparticles Coated with CTAB Surfactant for Adsorption Efficiency in the Removal of Chromium from Wastewater

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The removal of chromium from wastewater is a critical process because it poses a threat to human health and the environment. Surfactant-functionalized nanoparticles have demonstrated potential as efficient adsorbents in this regard. In order to demonstrate their potential for chromium removal, we compare the adsorption efficiencies of magnetite and maghemite nanoparticles functionalized with cetyl trimethyl ammonium bromide (CTAB) surfactants in this study.

To improve their adsorption capabilities for the removal of chromium, CTAB surfactants were functionalized onto magnetite and maghemite nanoparticles. Fourier-transform infrared spectrophotometry (FTIR), transmission electron microscopy (TEM), and X-ray diffractometry (XRD) were used to characterize the functionalized nanoparticles.

To assess the effectiveness of chromium removal under different conditions, such as pH, initial chromium concentration, added salt, and adsorbent dose, batch experiments were conducted. The findings showed that the adsorbent dosage, pH, and the chemical/electrostatic interactions between the negatively charged Cr(VI) ions and the cationic surfactant worked in concert.

At low pH levels, both kinds of functionalized nanoparticles showed effective chromium removal; however, CTAB-functionalized magnetite nanoparticles performed better. However, for both kinds of nanoparticles, the effectiveness of removing chromium declined as pH rose.

It's interesting to note that whilst γ-Fe2O3@CTAB showed mostly physical adsorption, Fe3O4@CTAB absorbed chromium mostly through chemical reduction. When compared to maghemite, magnetite nanoparticles performed better because of their distinct adsorption mechanisms. For instance, maghemite@CTAB achieved a high chromium removal efficiency of 95% at pH = 2, with an adsorbent dosage of 5 g/L and a starting chromium content of 1 mg/L. In comparison, magnetite@CTAB, with a pH of 4, an adsorbent dosage of 12 g/L, and an initial chromium content of 98 mg/L, accomplished a chromium removal efficiency of 95.77% in just 7 minutes and 30 seconds.

In addition to emphasizing the value of comprehending the adsorption mechanisms and maximizing conditions for improved performance, this work highlights the potential of CTAB-functionalized magnetite nanoparticles as effective adsorbents for chromium removal from wastewate

Keywords: Magnetite, cetyl trimethyl, and maghemite nanoparticles

O19-B : Aluminum and silica: Symmetric supercapacitor incorporating activated carbon

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A prepared activated carbon from olive seeds was investigated as an active electrode material for electrical double-layer capacitors. It was impregnated with aluminum and silica to improve its electrochemical properties. Carbon materials are characterized using FTIR spectroscopy, XRD, adsorption-desorption of N_2 at 77K and SEM. For the activated carbon electrode, the specific capacitance exhibited by the symmetric supercapacitor was 11 F g^{-1}, for an operating voltage of 0.6 V. However, the supercapacitor composed by the binary composite (AC-Al) and (AC- Silica) electrodes showed an enhancement of the specific capacitance and operated over a larger cell voltage of 1.6 V. Thus, these composites with outstanding electrochemical performance could be a promising electrode material for supercapacitors.

Keywords: Activated carbon, EDLC, Electrochemical performances, supercapacitor.

O20-B : Magnetocaloric properties in Nd1-3xBax Cax SrxMnO3 (x=0.11and 0.133) perovskite manganites

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We investigated the effect of (K) doping at Sr-sites on the structural, magnetic, magnetocaloric and critical behaviors of La0.65Sr0.35-xKxMnO3(x =0.075 and 0.15) manganite. X-ray powder diffraction (XRD) shows that our samples crystallize in the rhombohedral structure within space groupR $\overline{3}$c . The magnetocaloric effect has been evaluated by assessing isothermal magnetization curve at different temperatures close to TC, employing the Maxwell relation. At 5T, $-\Delta S_M^{max}$ and RCP are 4.25 J/kg K and 288 J /kg for x=0.075 and 3.67 J/ kg K and 267 J /kg for x=0.15, respectively. Critical phenomena has been studied using different theoretical models: modified Arrott plots (MAP), Kouvel Fisher (KF) method and critical isotherm (CI) analysis. The obtained critical exponents (β, γ and δ) revealed that the simple x=0.075 is consistent with 3D-Ising model, whereas the critical exponents determined for x=0.15 were close to 3D-Heisenberg model.

Keywords: Perovskites, Magnetic properties, Magnetocaloric effect, Critical behavior, Landau model.

O21-B : Structural and optical properties of Fe-doped WO3 thin films prepared by Spray pyrolysis technique

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Fe-doped tungsten trioxide (WO3:Fe) thin films have been prepared, using the Spray pyrolysis technique, on glass substrates heated at constant temperature of 350°C. The dopant concentrations were 1, 3 and 5% at; after deposit, the thin films were heat-treated at 400 and 500°C for 4 h. The effect of Fe-doping and heat-treatment on the structural and optical properties of these thin films was investigated by profilometry, grazing incidence X-ray diffraction analysis (GIXRD), atomic force microscopy (AFM) and spectrophotometry. The results revealed that Fe-doping has a significant impact on the morphology of the thin films depending on its concentration. In addition, it was evidenced that the thermal treatment promotes the growth of the crystallites and enhance the roughness of the surface. The GIXRD analysis confirmed the polycrystalline character of the films with a monoclinic structure, (ICDD No. 89-4476, P21/c). The structural parameters were found to be both doping and heat-treatment dependent. The thin films display a good optical transmittance over the visible region sensitive to Fe-doping and thermal treatment. Moreover, the thin films exhibit both direct and indirect electronic transitions, where the energy of the indirect electronic allowed transition is red-shifted in all the samples due to Fe-doping.

Keywords: WO3 thin films, Spray pyrolysis, Fe-doping, Roughness, GIXRD, AFM, Spectrophotometry.

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O22-B : Electrodeposited Ni-based coatings as electrocatalytic materials for green hydrogen production

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Hydrogen is being recognized as an important energy sources, that can be an alternative to the carbon-based fuels. Currently, most of the hydrogen is produced from fossil fuels, which is responsible for the emission of significant amounts of CO2 into the atmosphere. With this framework, water splitting is considered an effective alternative to fossil fuels to produce green hydrogen. This environmentally friendly method, without CO2 emissions, also provides high purity H2.

Currently, the highest efficiency electrocatalysts for hydrogen evolution reaction (HER) still belong to the precious metal Pt [1]. However, their high cost and scarcity of hinder their large-scale application. Therefore, recent research efforts have been focused to develop alternative non-noble materials such as nickel alloys [2] transition metal nitride [3] and metal oxides [4].

According to literature, nickel is recommended owing to its electrocatalytic activity, stability, corrosion resistance and low cost in comparison with Pt metal. Moreover, it has been reported that alloying Ni with transition metals Co and Fe (Ni-Co, Ni-Fe) has attracted research attention owing to their numerous interesting properties.

In this study, the Ni, Ni-Fe and Ni-Co films electrodeposited using different electrolytic baths containing Ni, Ni and Fe or Ni and Co precursors, respectively. Then, the as-plated coatings were assessed as potential electrocatalytic materials for green hydrogen production.

The structure and surface morphology were investigated using the scanning electron microscopy and X-ray diffraction. The electro-catalytic activities for HER of the Ni-based were evaluated in 1 M KOH solution using the linear sweep polarization, the electrochemical impedance spectroscopy, cyclic voltammetry and chronopotentiometry methods. The electrochemical results prove the superior catalytic activity for the HER of Ni-based alloy when compared to that of the Pt metal and, consequently these alloys can be considered as promising catalytic materials for water electrolysis.

Keywords: electrodeposition, Electrocatalyst, Ni alloys, Hydrogen evolution reaction

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O23-B : Bottom-up synthesis of silicon nanostructures intended for photovoltaic applications

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The development and progress of nanoscience and nanotechnology have enabled the control, manufacturing and integration of nanostructures into devices to satisfy the industrialization of society. Nanostructuring has concerned many materials such as semiconductors, metal oxides, dielectrics and metals. Crystalline silicon remains the most studied material as it still dominates the semiconductor market. Silicon Nanostructuring, especially porous silicon and nanowires, has paved the way for various applications in microelectronics, photonics, photocatalysis, gas sensors and photovoltaics (PV). In this work, we present the growth of silicon wires (SiNWs) by bottom-up approach using the Vapor-Liquid-Solid (VLS) mode using the plasma-assisted chemical vapor deposition (PECVD) technique [1]. SiNWs are catalyzed by different metal particles such as indium and bismuth [2]. The metallic catalyst is synthesized by two different processes: (1) in ex situ by annealing a metallic layer using a rapid thermal process (RTA) under H_2 gas and (2) in situ under H_2 plasma in a PECVD. Results and challenges of the fabrication of these structures by bottom-up approach are discussed in this work.

Key words: Silicon nanostructures, Bottom-up, PECVD.

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O24-B : Doping Effects on minority carrier parameters in Bulk GaAs

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In this paper, we measured the experimental amplitude and phase of the Photothermal deflection signal for bulk GaAs “silicon” doped n+ type, “chromium” doped n type and “carbon” doped p type in order to determine the nonradiative recombination parameters. The results obtained for non-radiative lifetime and the electronic diffusion agree with those appearing in the literature for similar samples. By comparison with values reported in literature, the increase of doping density favors auger recombination that produce an increase of non-radiative lifetime. We have found that electron mobility in p type C-doped GaAs is about 300 $cm^2/V\cdot s$. In fact, holes motilities are respectively 177 and 193 $cm^2/V\cdot s$ for n+ type Si-doped GaAs and n type Cr-GaAs doped. However, we obtained high values of the recombination velocity for non passivated surface.

Keywords: Non-radiative lifetime, GaAs diffusion length, Surface and interface recombination velocity. Bulk GaAs

O25-B : Numerical simulation of new eco-friendly Rb2PtI6 based double perovskite solar cells with high photovoltaic performance

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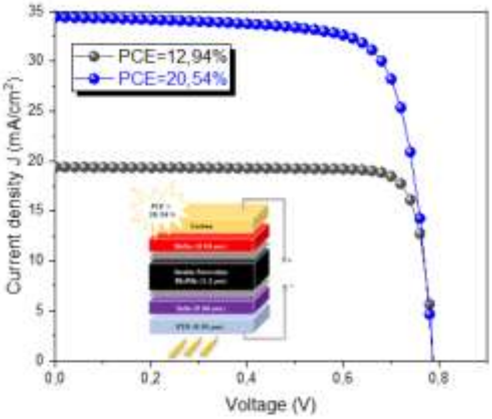

It was shown recently that the double perovskite Rb2PtI6 exhibits excellent electronic and optical properties that are relevant for photovoltaic applications in particular [1]. Herein, we report a deep simulation results of a novel high-performance lead-free halide double perovskite solar cell (PSC) with the architecture FTO/ZnSe/Rb2PtI6/MoSe2/C. The thicknesses of all layers such as: FTO, hole transport layer (HTL), Rb2PtI6 absorber and electron transport layer (ETL) for the device were optimized. The role of electronic band diagram engineering is demonstrated to be essential for the photovoltaic performance of the solar cell. Then the current-voltage characteristics (J-V), and quantum efficiency (QE) are analyzed. Our obtained results shows that this best proposed Rb2PtI6-based device can serve as a potential eco-friendly high efficiency solar cell candidate due to the chemical stability and non-toxicity of its active layer. The best obtained efficiency PCE reaches 20.54% compared to the initial (PCE) of 12.94 %.

To validate our results, we compared the simulation outcomes with other similar double PSC cells previously published: so good agreement is obtained.

Keywords: Double perovskite solar cells based on Rb2PtI6, SCAPS simulation, HTL and ETL materials, Band gap diagram.

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O26-B : Facile and Selective Synthesis of Electrospun Nanofibrous Perovskites for Environmental Applicatons.

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A variety of materials such as polymers, ceramics, and even metals have been electrospun into fibers with well-controlled sizes, compositions, and structures. The outstanding properties of such nanofibers are highly attractive to numerous applications including biotechnology, textiles, filters, sorbents, sensors, and also many environmental applications [1-2]. Benefitting from the unique properties (e.g., nanometric diameter, high porosity, high surface area,) of these nanofibrous structures, considerable effort has been applied to their design and optimization [3-5]. In this study, synthesis of $LaAlO_3$ perovskite structured into nanofibers by electrospinning are described, including the fabrication, post-treatment via calcination and performed properties. The fabrication of the nanofiber details the direct electrospinning nanofiber composites and particularly the use of N-N dimethylformamide (DMF) and Acetic Acid/Water (A-A/W as two solvent systems with different volatilization rates. The calcination is realized at 800 °C in air atmosphere for 2 h. The structure, morphology, nanofiber size distribution, and specific surface area of the samples were investigated and compared. The experimental results indicate that the electrospinning of the composite metal nitrates with A-A/W produced ultrafine as-spun nanofibers with a diameter ranging from 50 to 400 nm. While with DMF solvent, the diameter is in the range of 100-600 nm. After calcination, XRD results confirmed the crystallization of the lanthanum aluminate perovskite. The diameter of resulting nanofibers decreased to attain a range of 80 -200 nm. Likewise, $LaAlO_3$ nanofibers derived from A-A/W still preserved the fibrous structure after thermal treatment. Nevertheless, ones derived from DMF, started to collapse. BET analysis recorded higher pore volume and lager specific surface area for the A-A/W derived nanofibers. Thus, these properties and performance of perovskite nanofibers exhibit high potential to be used in environmental applications, including air filtration, water treatment, gas storage and separation.

Keywords: Electrospun, Nanofibrous stucture, Perovskites, Selective synthesis.

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O27-B :Numerical and experimental study of the performance of a CH3NH3PbI3 perovskite solar cell using Spiro-OMeTAD as the hole transport layer

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Herein, we investigate the methyamnuim lead triiodide (MAPbI3) thin films elaborated with spin coating technique, the MAPbI3 films were studied using X-ray diffraction and scanning electron microscopy and UV-Visible spectroscopy also, the photoluminescence of the material was analyzed to determine its bandgap. High-quality MAPbI3 perovskite films were obtained by using Chlorobenzene as antisolvent which shows good crystallinity, large grain sizes, and higher absorption compared to the MAPbI3 treated by toluene. The performance of FTO/TiO2/ MAPbI3/ Spiro OMeTAD/Au perovskite solar cell structure was evaluated using a numerical simulation utilizing the SCAPS simulator. A study was conducted on the effects of structural and physical parameters on the MAPbI3 absorber layer with the different antisolvents, including thickness, defect density, and donor density. The obtained results are Jsc of 25.85 mA/cm2, PCE of 28.08 %, Voc of 1.233 V, FF of 88.06 % of MAPbI3-based solar cells where MAPbI3 treated by toluene, and for MAPbI3- Chlorobenzene Jsc of 27.96 mA/cm2, PCE of 29.15 %, FF of 87.78 % and Voc of 1.187 V. The use of chlorobenzene showed obvious superiority to toluene when it comes to enhancing the perovskites solar cells performances.

Keywords: CH3PbI3, SpiroOMeTAD, efficiency, antisolvent.

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O28-B : Decoration of TiO2 nanotubes by Cu nanoparticles for environmental applications.

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In the present study, TiO2 nanotubes were synthesized by anodization on Ti sheets and decorated with copper (Cu) nanoparticles using the SILAR method at various cycles. The obtained coatings were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) combined with energy-dispersive X-ray spectroscopy (EDX), and transmission electron microscopy (TEM). XRD confirmed that all TiO2 nanotubes crystallized in the anatase phase after annealing at 400°C, regardless of the anodization potential. SEM indicated that the TiO2 nanotubes were uniformly distributed on the substrate with an ordered and vertically aligned morphology. The surface decoration of the TiO2 nanotubes with copper nanoparticles was evaluated using TEM. Additionally, a new scratch test method called the "wear mode" was conducted to assess the wear resistance of the coatings. The results from the scratch tests demonstrated that the coating decorated with copper nanoparticles improved interfacial adhesion. The critical load (LC3) increased with the number of Cu NP cycles, rising from 4.48 N to 5.1 N when pure TiO2 was decorated with 2 cycles of Cu NPs. The wear behavior was studied using a multi-pass scratch test, and it was found that the wear volume decreased with the incorporation of Cu nanoparticles.

Keywords: , tribological properties, SILAR, Anodization, TiO2 nanotubes, Cu.

O29-B : Improving Proton Exchange Membrane Performance: Integration of Layered Double Hydroxides for Enhanced Performance

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A groundbreaking method was utilized to create ion exchange membranes tailored for fuel cell applications. This innovative technique involved blending Low Sulfonated PolyEther Sulfone Octyl Sulfonamide (LSPSO) with Layered Double Hydroxides (LDH) clay at varying weight ratios (1%, 3%, and 6%). The resulting composite membranes underwent detailed analysis using a range of techniques, including Fourier transform infrared spectroscopy, X-Ray diffraction, scanning electron microscopy, and thermogravimetric analysis to evaluate their surface structure and heat resistance. Notably, the thermal properties of the composite membrane showed significant enhancements compared to the pure LSPSO membrane. The incorporation of 6 wt% Layered Double Hydroxides into the composite membrane resulted in improved proton conductivity when compared to the LSPSO membrane alone. This discovery underscores the potential of the LDH/LSPSO composite membrane as an ideal electrolyte membrane for fuel cells operating at temperatures exceeding 100°C.

Keywords: LSPSO, Layered double hydroxides, Composite membrane, Proton conductivity,

O30-B : Enhancing Conductivity and Flexibility in Bio-nano-composites: A Study of Poly(aniline) Nanocomposites

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Nowadays, the elaboration of bio-nano-composites based on conductive polymers has required the attention of academia and industry thanks to their advantages of polymers (low density, easy processing, in some cases good mechanical properties, etc.) with high charge transport properties.

This present work focuses on the preparation and characterization of biocomposite based on conductive polymer to improve its performance, flexibility and conductive properties. For this, the poly (aniline) (PANI), in particular in its conducting emeraldine salt form, has been used for its low cost of synthesis compared to other conductive polymers, and especially for its good conductive properties making it possible to achieve conductivities greater than 102S.cm-1. Two methods have been reported to process well-dispersed nanocomposites. First, the in-situ polymerization of aniline has processed with an emulsion polymer matrix. A simple solution mixing of a polymer matrix with different amount of PANI has elaborated in a second part.

The synthetic chemistry has enabled the fabrication of thin conductive films with varying concentrations of polyaniline (PANI) (5%, 10%, 15%, and 20%). The obtained films are characterized using FTIR spectroscopy to identify and confirm the formation of desired functional groups, and DSC to gather information on the thermal properties of the material. Additionally, UV-visible spectroscopy is employed to analyze the optical response of the films. The Four Probe method and Hall effect measurements are utilized to determine the conductivity and charge carriers. These analyses provide a comprehensive understanding of molecular mobility and interfacial properties, highlighting the influence of PANI/BioPolymer in terms of dispersion, adhesion, and fragility of the bio-composites.

Key words: bio-nano-composites, polyaniline, conductivity, interfacial layer, dispersion

O31-B : New nanostructured electrolytes for high performance of solid oxide fuel cells

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Reducing of the operating temperature of Solid Oxide Fuel Cells (SOFCs) from 800°C - 1000°C to 400°C - 600°C is of great importance, because it means both a prolonged stack life time and a cost reduction. 8YSZ co-doped with 4 mol% M_xO_y (YSZ-M_xO_y) powders have been elaborated by solid state reaction at 1500°C during 12 h. YSZ-CeO_2, YSZ-ZnO and YSZ-CeO_2-ZnO have been fully stabilized cubic zirconia (c-ZrO_2). Compared to the reference sample (8YSZ), all the doped electrolytes YSZ-M_xO_y have shown a modified dilatometric behavior with much lower linear thermal expansion coefficient in the temperature range 200°C - 1200°C. Electrical measurements between 400°C and 600°C have shown an important improvement of the ionic conductivity of YSZ-CeO_2, YSZ-CeO_2-ZnO and YSZ-ZnO, compared to 8YSZ. Finally, the performance tests of 200 µm thick film YSZ-M_xO_y as an electrolyte of SOFCs, have revealed spectacular results in terms of open circuit voltage (OCV about 1.03 V) and maximum power density (440 mW.cm^{-2}), suggesting that $(ZrO_2)_{0.88}(Y_2O_3)_{0.08}(CeO_2)_{0.03}(ZnO)_{0.01}$ could be a good candidate as electrolyte for Low-Solid Oxide Fuel Cells (L-SOFCs).

Keywords: ceramics; Nanoparticles; SOFCs; Yttria-stabilized-zirconia; Electrical conductivity.

POSTER-B

P1-B: Rare-earth-activated glasses for solar energy conversion

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Luminescent materials doped with rare earth ions are used for many devices such as optical fiber amplifiers, energy up conversion and quantum informatics [1]. Recently, they have also drawn considerable interest for photovoltaic applications to improve the efficiency of solar cells by modifying the solar spectrum.

But at present, the contribution of photovoltaic energy is limited due to its relatively low conversion efficiency. It is well known that one major energy loss in Si solar cells is thermalization, which is due to the spectral mismatch between the incident solar spectrum and the spectral response curve of solar cells. This negative effect is expected to be relatively reduced when a spectral modification, by cutting the absorbed ultra-violet/ blue photon into two near-infrared photons, is presented. This technique, called quantum cutting (QC), is based on energy transfer from donor ion with UV energy absorption to an acceptor ion with NIR emission. In other words, the QC aim is obtaining a laser in the IR.

The aim of this work is to enhance the energy transfer between the two rare earth (cerium and yetterbium) codoped aluminosillicate glasses in order to permit to this material to be a new quantum cutting material.

In our glasses, Ce^{3+} was doped as sensitizer however Yb^{3+} was doped as an activator in order to convert one visible photon into two NIR photons. The figure indicated evidence of energy transfer from the 5d levels of Ce^{3+} to the $^2F_{5/2}$ level of Yb^{3+}. The emission of Ce^{3+} was reduced in intensity with the introduction of Yb_2O_3. This can be considered as direct evidence of energy transfer from Ce^{3+} to Yb^{3+}. However, the excitation band found cannot be attributed to the characteristic transition of Yb^{3+}. Nevertheless, it is very important in the emission of the activator ion. Indeed, it is well known that down conversion integrated two types [2]. The first-order DC is a resonant ET process, which necessity a good overlap between the donor and the excitation spectrum of the acceptor. However, if this overlap is absent, the second order down conversion may become the dominant relaxation process. In this case, one donor excites two acceptors simultaneously. Therefore, since in our case, there is no absorption in the blue wavelength range of Yb^{3+}, we can conclude that the second order down conversion may became the dominant relaxation process.

To gain further insight in the energy transfer processes between Ce3+ and Yb3+, luminescence decay curves of Ce3+ were recorded. The average lifetime decreases when the Yb concentration increases, indicating that an energy transfer occurs between Ce3+ and Yb3+.

P2-B : Crystal structure, morphology and optical properties of orange red emitting $(Y_{1-x}Sm_x)_2Ti_2O_7$ solid solutions

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Rare-earth luminescent materials have a high luminescence efficiency, a strong emission ability in the visible region, resistance to ultraviolet radiation, good thermal stability, and can adapt to the requirements of high-load fluorescent lamps. Therefore, rare-earth luminescent materials are widely used in fluorescent lamps, white diode fluorescents, display imaging, X-ray enhancement screens, and other fields. Rare earth ions Sm^{3+} generally have four characteristic emission peaks, which belong to the intrinsic 4*f*-4*f* transition of $^4G_{5/2} \rightarrow {}^6H_{J/2}$ (J = 5, 7, 9, and 11). The main peak is located at about 599 nm, which is an excellent activator to produce orange or red-orange luminescence in different inorganic matrix lattices [1]. The luminescence performance of doped ions is highly dependent on the choice of matrix. Rare-earth titanates of the general formula $Ln_2Ti_2O_7$ such as $Y_2Ti_2O_7$, which possesses a pyrochlore structure, can therefore be a suitable host for lanthanide ions to emit luminescence [2]. Therefore, in the present work, Sm^{3+} ions activated $Y_2Ti_2O_7$ were synthesized by solid-state reaction, then the phases structures, the phases morphologies, the photoluminescent properties, and the optimum activator ion concentration were investigated. The effect of rare earth activators on the photoluminescence properties and crystal structure were systematically studied. The structural and Raman spectroscopic study of the synthesized phosphors confirm the good crystallinity of the all samples and that they belong to a cubic pyrochlore type structure, with an *Fd3m* space group. Ours results show that the luminescence study of series of $(Y_{1-x}Sm_x)_2Ti_2O_7$ ($0 \leq x \leq 1$) solid solutions provide interesting information for the development of orange-red emitting phosphors under near-UV excitation and exhibit potential optical applications.

Keywords: Luminescence, Pyrochlore, White light-emitting diodes, X-ray diffraction

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P3-B : Structural and Photoluminescence characteristics of Sm3+ activated La2Ti2O7 as orange-red emitting phosphors

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Rare earth materials have been widely used as high-performance luminescent devices, catalysts, and other functional materials based on the electronic, optical, and chemical characteristics arising from their 4f electrons. The unique 4f electronic configuration of rare earth elements makes them perfect phosphors emitting light ranging from UV to NIR. Selecting optical species as activators is a significant factor to produce the luminescent materials. In addition to the activators, the chemical and physical properties of the matrix also have an important influence on the luminescence properties of the material. La2Ti2O7 is a suitable host matrix for luminescence materials owing to its excellent physical and chemical stability [1]. In this work, the main aim is to investigate the structural and luminescent properties of LaSmTi2O7 phosphor elaborated via solid state reaction method and the results were examined in details. The X-ray powder diffraction and Raman spectroscopy analysis were performed to confirm the phase purity and to characterize the structure of the phosphor. The excitation spectra of the phosphor show a broad charge-transfer band in the short wavelength region and several sharp lines in the longer wavelength region originated from Sm3+, which indicates that this phosphor can be effectively excited by UV chips. It was observed that the LaSmTi2O7 oxide emits red–orange light under UV excitation and could be useful for developing new luminescent materials. The results confirmed that this phosphor show a strong orange-red emission in the visible range which may be useful for display technologies and LED applications.

Keywords: White light-emitting diodes, Pyrochlore, Luminescence, X-ray diffraction

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P4-B : Structural and thermal studies of a new 1D coordination polymer based on diphenic acid

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The self-assembly of fascinating coordination polymers (CPs) remains a topical research subject. Materials of interest in terms of applications in several fields, environment, storage, gas separation, catalysis, optoelectronics, etc [1-2]. They result from multifunctional organic ligands combined with metals by coordination bonds, sometimes associated to supramolecular interactions.

In this work, we report the structural description and thermal study of a new complex [Mg(OOC-$(C_6H_4)_2$-COO)$(H_2O)_4$]. The titled complex crystallises in P21/n centrosymmetric space group with ß = 96.361(1)° and Z = 4. The environment around the Mg^{II} is octahedral with four water molecules forming equatorial plane and two diphenate occupying axial positions. The ligand is bis-monodentate and ensure the connexion between two magnesium metals. The resulting structure is described as 1D coordination polymer.

The thermal studies shows a restricted range of thermal stability [Tambient-91] °C. The process of decomposition of [Mg(OOC-$(C_6H_4)_2$-COO)$(H_2O)_4$] done in two successive steps, shows an experimental mass loss of 20.82%, occurring in the range [91-217] °C, in agreement with the theoretical percentage 21.41% corresponding to the simultaneous loss of the four coordination water molecules. On the ATD curve, a significant endothermic peak appears at 172.9°C accompanying this first loss. The anhydrous compound exhibits a significant thermal stability in the range [217-411]° C. The decomposition continues in a single step from 411 °C to 553 °C. Above this temperature, and based on mass calculations, we presume that the residual product is magnesium oxide MgO, theoretical percentages of 11.97% is in perfect agreement of experimental one 11.00 %. It is important to notify that [Mg(OOC-(C6H4)2-COO)(H2O)4] is isostructural to [M(OOC-(C6H4)2-COO)(H2O)4] (M= Ni, Co) and therefore it shows an expected thermal behaviour comparable to that of the latter two[3].

Keywords: Coordination polymers, dicarboxylic acid, TG/TDA

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P5-B : Solid-State Synthesis of Coumarin-Clay Hybrids: Enhanced Optical Properties.

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In this study, we investigate the interaction between luminescent coumarin derivatives and Zinc-exchanged montmorillonite (M-Zn) to create new hybrids with significantly improved photoluminescence. We employed a novel, solvent-free synthesis method to mix six coumarin derivatives (C1-C6) with M-Zn, resulting in hybrids (H1-H6). Notably, C6, which was almost not luminescent on its own, transformed into a highly luminescent hybrid (H6) with a striking white glow upon incorporation into the Zinc-exchanged montmorillonite, despite the clay itself being non-luminescent. Photoluminescence analysis showed that H2 exhibited an enhancement factor of approximately 5.84 times, while H6 demonstrated an impressive enhancement factor of about 18.26 times compared to the clay. These results underscore the remarkable ability of the coumarin-clay interaction to produce glowing hybrids, demonstrating the efficacy of our method in achieving significant optical improvements. This work offers a sustainable and energy-efficient approach for designing advanced solid-state hybrid materials with potential applications in sensing, bioimaging, and other optical technologies.

Keywords: clay minerals, montmorillonite, solvent-free synthesis, photoluminescence, hybrid materials, optical enhancement.

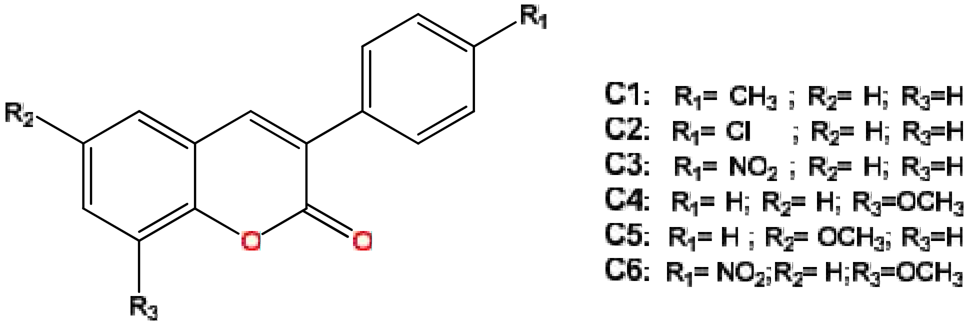

Figure. Chemical structure of Coumarin derivatives C1-C6.

P6-B : Numerical Investigation of Fluid Dynamics and Heat Transfer in a Channel with a Circular Porous Medium Using Nanofluids

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This study presents a comprehensive numerical analysis of Nano-fluid dynamics within a channel containing a circular porous medium. The channel under investigation features a temperature gradient with a heated bottom boundary and a cooled top boundary. The governing equations for the fluid flow are meticulously solved using the finite element method, which is integrated with the Darcy-Brinkman model to accurately represent the interaction between the Nano-fluid and the porous medium. The parameters under scrutiny include the Reynolds number ($1 \leq Re \leq 200$), which characterizes the flow regime, and the Darcy number

($10^{-1} \leq Da \leq 10^{-5}$), which quantifies the permeability of the porous medium. The analysis encompasses a thorough investigation of the average Nusselt number, which provides insight into the heat transfer efficiency, alongside a detailed examination of isotherms and streamlines to map the thermal and flow distributions within the channel.

Key words: Finite elements, Darcy-Brinkman, Reynolds number, Nusselt number, porous medium

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P7-B : Structural Characterization and SWISSADME Profiling of (E)-N'-((E)-1-(2-(furan-3-carbonyl)hydrazono)propan-2-ylidene)furan-2-carbohydrazide

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Hydrazones constitute a distinct category of Schiff bases, arising from the condensation reaction involving hydrazine/hydrazide and either an aldehyde or a ketone.[1] The present study focuses on the synthesis and structural characterization of the title compound, (E)-N'-((E)-1-(2-(furan-3-carbonyl)hydrazono)propan-2-ylidene)furan-2-carbohydrazide. This ligand was synthesized via the condensation reaction between the corresponding hydrazide and acetone in an alcoholic solution. The reaction, upon standing for a few days, yielded yellow single crystals suitable for X-ray diffraction . Single crystal X-ray diffraction characterization revealed that the compound crystallizes in the monoclinic space group P21/n, with unit cell parameters: a = 5.4691(17) Å, b = 31.452(9) Å, c = 7.675(2) Å, and cell angles $\alpha = 90°$, $\beta = 107.158(11)°$, $\gamma = 90°$. The unit cell volume was calculated to be 1261.45 Å^3 with Z = 4. Additional study by FT-IR spectrum shows also the peak at 1665.170 cm ^{1} that indicate the C=N bond, characteristic to hydrazine Shiff base.

The molecular structure is stabilized by several intermolecular interactions, including C-H...O, N-H...O, C-H...C. Additionally, the intramolecular interactions include C-H...N, N-H...C, and N-H...O .

SwissADME predictions indicate that this compound possesses a favorable physicochemical profile with good water solubility, high gastrointestinal absorption, and potential as a drug candidate. It complies with Lipinski's rule of five, shows low promiscuity risk, and has reasonable synthetic accessibility. However, the presence of an imine group warrants caution due to potential impacts on stability and reactivity. Overall, the compound demonstrates significant promise for further pharmaceutical development.

Keywords: Hydrazone ,Single Crystal XRD ,Intermolecular Interactions ,SwissADME, Synthetic Accessibility

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P8-B : Influence of ceria addition in TiO_2 and TiO_2–ZrO_2 aerogel materials on the textural, structural and catalytic properties of supported vanadia in chlorobenzene oxidation

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Vanadia based TiO_2 materials constitute a very important class of catalytic materials resistant against chlorinated volatile organic compounds (Cl-VOCs). Besides, the direct incorporation of zirconium species in the TiO_2 aerogel support prepared by the sol gel route has generated great interest in the catalytic performances of V_2O_5/TiO_2 catalyst in the total oxidation of chlorobenzene. Besides, the combined TiO_2–CeO_2 mixed oxide has also attracted considerable attention recently as active catalyst as well as support. Therefore, the aim of this work is to study the effect of the direct incorporation of CeO_2 in TiO_2 –ZrO_2 and V_2O_5/TiO_2 –ZrO_2 aerogel materials prepared by sol–gel route on the physico–chemical and catalytic properties in the total oxidation of chlorobenzene.TiO_2-ZrO_2 and TiO_2-CeO_2-ZrO_2 materials were prepared via sol-gel method. To obtain mixed oxides, cerium nitrate and zirconium acetylacetonate were added to titanium isopropoxide according to molar ratios Ce/Ti=0.1 and Zr/Ti =0.1. The gels were transformed into aerogels using supercritical drying process. V_2O_5/TiO_2 –ZrO_2-CeO_2 with 2 wt.% of V_2O_5 were prepared using impregnation method. They were calcined for 3h at 500°C under O_2 flow and characterized by means of N_2 physisorption, XRD, H_2-TPR and NH_3-TPD.

According to N2physisorption, all catalysts exhibit high surface areas (>110 m2/g) with homogeneous mesoporous distributions. XRD patterns show, in addition to the prominent TiO2 anatase lines, a few peaks belonging to cubic CeO_2. Moreover, no vanadia and zirconia pattern was observed. The incorporation of CeO_2 increases the surface global acidity of the catalysts (NH_3-TPD). TPR results suggest that the doping with CeO_2 affects the reduction behavior of vanadium species. Catalytic test results reveal that ceria doped materials is beneficial for the improvement of catalytic properties in chlorobenzene total oxidation. In particular, ceria containing titania-zirconia support had improved catalytic properties at high temperature (400°C). However, when vanadia is present, an enhancement in catalytic performanceis observed in the range 350°C -400°C.

Keywords: TiO_2-ZrO_2, TiO_2-CeO_2-ZrO_2, V_2O_5/TiO_2 –ZrO_2-CeO_2, cholobenzene oxidation

P9-B : Degradation of methylene blue by Zn doped CuO Nanoparticles for photocatalyst Application

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In present study a series of Zn doped copper oxyde (CuO) photocatalysts with varying dopant concentrations (5.at.%) were synthesized via solgel process. The codoped photocatalysts were characterized by XRD, FTIR, Raman, and UV-Vis spectroscopy techniques, where methylene blue was used as a probe environmental pollutant. The photocatalytic performances of the synthesized photocatalysts were evaluated under visible power irradiation sources. Analysis of X-ray diffraction patterns suggests the structure of the monoclinic with tenorite phase results demonstrate that in doped CuO the oxidation state of doped Zn metal ions is 2 (Zn^{2+}), . The optical study results reveal the red shift in the doped samples, where with increasing dopant concentration the band gap is reduced. The highest photocatalytic degradation of MB is obtained with 5.at.% Zn doped CuO. This enhancement is attributed to the impurity levels introduced in bandgap and the high absorbance in UV region. The as synthesized 5 at.% Zn, doped CuO provides a highest degradation efficiency (10%) and thus may be practically used in the dyes removal process efficiently.

Keywords: CuO, Sol-Gel, Zn doping, Photocatalys application

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P10-B : X-ray single crystal study of two new one-dimensional oxalate compounds with the formula $ACr(C_2O_4)_2(H_2O)_4$ (A = Li, Na)

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Two new 1D oxalate compounds with the formula ACr(C2O4)2(H2O)4 (A = Li (I), Na (II)) have been obtained and their crystal structures determined by single crystal X-ray diffraction [1]. These two compounds crystallize within two different crystal systems. The compound (I) crystallizes in the monoclinic space group C2/m, whereas the compound (II) crystallizes in the triclinic space group P1, however with somewhat similar features. The asymmetric unit of (I), contains both Li and Cr atoms on 2/m site symmetry, a half oxalate ligand and two independent water molecules lying on the mirror plane. The oxygen atoms of water molecules around the Li atom are disordered and split over two equivalent positions. In the asymmetric unit of (II), all atoms are on general positions except the metallic atoms which are lying on the inversion centre, and there is one oxalate ligand and two independent water molecules. Both crystal structures are made up from octahedral trans-Cr(CO)4(H2O)2 and trans-A(CO)4(H1O)2 units, bridged by the oxalate ligands, forming one-dimensional linear chains. Strong hydrogen-bonds are present as tetrameric synthons $R_4^4(12)$ within the two coordination polymers, linked together to form H-bonded files, and used to extend the metal chains in two-dimensional supramolecular architectures. The two structures differ from each other through the symmetry relationships within the ligand, the role of electrostatic forces in the crystal structure and the molecular interactions of the hydrogen-bonded networks.

Keywords: one-dimensional coordination polymer, crystal structure, two-dimensional framework, single crystal X-ray diffraction, oxalate.

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P11-B : Thermal Optimization of Electronic Components Using Ferrofluids Under External Magnetic Fields

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This study is dedicated to a comprehensive analysis of flow phenomena and thermal transfer within a heat sink. Employing a numerical methodology based on the finite element method, the research primarily aims to evaluate the effects of incorporating a nanofluid and an external magnetic field on enhancing the cooling performance of the heat sink. The investigation rigorously explores several critical parameters. Initially, the Hartmann number is systematically varied from 0 to 50 to assess the influence of magnetic fields on the heat sink's performance. Additionally, the flow dynamics are scrutinized by varying the Reynolds number within the range of 5 to 200. Furthermore, the concentration of the nanofluid is varied from 0 %to 10% to examine its impact. The results derived from this detailed numerical approach are presented through velocity contours, which visually illustrate flow patterns, and Nusselt number plots, which quantitatively measure heat transfer. These visual and quantitative analyses provide substantial contributions to the understanding of heat sink cooling mechanisms, particularly regarding the application of nanofluids under varying operational conditions.

Keywords: Electronic heat sink, Finite elements, Magnetic Fields, Ferrofluids

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P12-B : Synthesis and application of ZnO material

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The objective of this work is to study the catalytic system based on ZnO in the multicomponent reaction of Biginelli type for the synthesis of 3,4 dihydropyrimidin -2-(1H) one (DHPM) using benzaldehyde, ethyl acetoacetate and urea as reagents. The zinc oxide was prepare by sol-gel method and the structural and textural properties of the prepared catalysts were studied by thermogravimetric analysis (TGA), X-ray diffraction (XRD), Brunauer-Emmett-Teller (BET) specific surface area measurement, Barrett Joyner and Halenda BJH method, Scanning Electron Microscopy (SEM) coupled to (EDX). The effects of reaction time, reaction temperature, catalyst mass, and solvant effect on DHPM yields were evaluated. Promising results were obtained. Thus, the catalyst system prepared proved to be very active with yield 64% in DHPM. This yield in DHPM was obtained in the presence of the ZnO catalyst, tested without solvent with a reaction time of 2h, a temperature of 100°C and catalyst mass of 0.01g. The DHPM product obtained was characterized by NMR method (13C NMR, 1H, DEPT 135, DEPT 90, 2D NMR (HSQC)).

Keywords: Biginelli reaction, Heterogeneous catalysis, Zinc oxide

P13-B : Crystal structure, morphology and optical properties of orange red emitting (Y1–xSmx)2Ti2O7 solid solutions

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Rare-earth luminescent materials have a high luminescence efficiency, a strong emission ability in the visible region, resistance to ultraviolet radiation, good thermal stability, and can adapt to the requirements of high-load fluorescent lamps. Therefore, rare-earth luminescent materials are widely used in fluorescent lamps, white diode fluorescents, display imaging, X-ray enhancement screens, and other fields. Rare earth ions Sm3+ generally have four characteristic emission peaks, which belong to the intrinsic 4f-4f transition of 4G5/2→6HJ/2 (J = 5, 7, 9, and 11). The main peak is located at about 599 nm, which is an excellent activator to produce orange or red-orange luminescence in different inorganic matrix lattices [1]. The luminescence performance of doped ions is highly dependent on the choice of matrix. Rare-earth titanates of the general formula Ln2Ti2O7 such as Y2Ti2O7, which possesses a pyrochlore structure, can therefore be a suitable host for lanthanide ions to emit luminescence [2]. Therefore, in the present work, Sm3+ ions activated Y2Ti2O7 were synthesized by solid-state reaction, then the phases structures, the phases morphologies, the photoluminescent properties, and the optimum activator ion concentration were investigated. The effect of rare earth activators on the photoluminescence properties and crystal structure were systematically studied. The structural and Raman spectroscopic study of the synthesized phosphors confirm the good crystallinity of the all samples and that they belong to a cubic pyrochlore type structure, with an Fd3m space group. Ours results show that the luminescence study of series of (Y1-xSmx)2Ti2O7 ($0 \leq x \leq 1$) solid solutions provide interesting information for the development of orange-red emitting phosphors under near-UV excitation and exhibit potential optical applications.

Keywords: Luminescence, Pyrochlore, White light-emitting diodes, X-ray diffraction

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P14-B : The development of a novel organic/inorganic hybrid nanomaterial for biomedical applications

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Hybrid nanoparticles have been developed at the interface between materials chemistry and many other fields, such as biomedical, electronic, pharmaceutical, optical, and catalytic fields [1].

The aim of this study was to evaluate the adsorption of pomegranate peels polyphenols on acid-activated clays for a potential application in biomedical fields. Purified Tunisian clay was activated with sulfuric acid for 1 h and 4 h. The derived clays were characterized by X-Ray diffraction (XRD), X-Ray fluorescence (XRF) and Scanning Electron Microscopy (SEM). All techniques display modifications in the structural and morphological properties of activated clays. The parameters, affecting the adsorption process of pomegranate peels polyphenols on acid-activated clays were examined. Maximum adsorption capacity (56.81 mg/g) was noted for the clay activated 1h, at a pH range 4-6 and a contact time of 4h. The pseudo second-order model (R2>0.98) was found to fit well the kinetic data. The Langmuir isotherm (R2>0.98) was found to match perfectly experimental results.Thermodynamic data revealed that the adsorption process was exothermic ($\Delta H°<0$) and spontaneous ($\Delta G°<0$). A reaction mechanism of the retention process is discussed. It is mainly chemical, including π-interactions, hydrogen bond and/or coordination bond between polyphenols and activated clays surface depending on the surface acidity type (Brönsted and/or Lewis acidity).

Keywords: hybrid, clay, pomegranate polyphenols, biomedical, nanoparticles

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P15-B : Preparation and characterization of sawdust activated carbon coated with nano-sized magnetite particles

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The activated carbon (AC) was prepared from sawdust and magnetized by coating it with magnetite nanoparticles (Fe_3O_4). Fe_3O_4@AC nanoparticles were synthesised using co-precipitation methods.
The composite was characterized using XRD, FTIR, SEM, BET, size distribution, and zeta potential analyses. XRD confirmed the presence of the magnetite phase in Fe_3O_4/AC. The pH_{PZC} and BET surface area of Fe_3O_4/AC were determined to be 6.05 and 160 m²/g, respectively. FTIR analysis revealed functional groups such as C=O, C-O, Fe-O, and OH in the Fe_3O_4/AC structure. SEM images showed that Fe_3O_4 particles were well dispersed and had spherical shapes, while AC particles were larger, in the micron range, with an irregular, plate-like structure. The AC exhibited a highly porous morphology with a smooth surface due to the activation process involving phosphoric acid. After coating, SEM images clearly showed dispersed magnetite nanoparticles, indicating a well-incorporated structure and strong interaction between Fe_3O_4 and AC.

Keywords : Activated carbon, Magnetite, Characterization, Co-precipitation

P16-B : Applications of Fe_3O_4@AC nanoparticles for dye removal

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Activated carbon prepared from sawdust and magnetized with magnetite nanoparticles (Fe_3O_4) was used for the adsorption of Crystal Violet (CV) dye from an aqueous solution. The study identified pH 9.0 as the optimum condition, achieving a maximum removal efficiency of 100%. Isotherm data were modeled using both Langmuir and Freundlich isotherms. The synthetic Fe_3O_4@AC exhibited a Langmuir maximum adsorption capacity of 76 mg/g towards CV. Kinetic studies showed that the data fitted well with the pseudo-second-order model. This nanocomposite serves as an effective adsorbent for CV dye removal, offering advantages such as simple synthesis, economic viability, rapid preparation, and environmental friendliness compared to other magnetic materials.

Keywords : Magnetized activated carbon, Crystal Violet, Adsorption, Isotherms, Kinetics

P17-B : Impact of silicon surface modification on the catalytic performance towards CO_2 conversion of Cu_2S/Si-based photocathodes

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In order to prevent global warming, which is mainly caused by the increase in carbon dioxide level in the atmosphere, it is interesting to produce renewable energy in the form of chemical energy by converting carbon dioxide into alternative fuels and other energy-dense products. Photoelectrochemical reduction of carbon dioxide to value-added products and fuels is a promising and current method. The objective of our study is to develop Cu2S-based photoélectrodes, in which Cu2S is used as CO2 photoelectrocatalyst deposited on nanostructured silicon substrates. Cu2S thin layers were deposited using the chemical bath deposition (CBD) technique. Silicon nanowires and nanopyramids were obtained by alkaline etching. SEM and UV-visible spectroscopy were used to analyze morphology and optical characteristics. By using a potentiostat station, we characterized the photoelectrochemical properties. We performed cyclic voltammetry in presence and without CO2 purging as well as linear voltammetry (LSV) in the dark and under white light irradiation. We perform chronoamperometry to study the stability of our photocathodes. The quality of the nanowires and nanopyramids was visible in the SEM images, and after Cu2S deposition, we could see how the deposition was distributed over the textured surfaces. The inclusion of the Cu2S layer applied on textured substrates significantly reduces the reflectance (R%). The catalytic performance towards CO2 conversion of Cu2S/Si-based photocathodes revealed that the texturing of the silicon surface with nanowires and pyramids have a better photoelectrochemical behavior than those without surfaces modifications.

Keywords: CO2 conversion, PEC, Silicone nanostructured, Cu2S photocathodes

P18-B : Photoelectrochemical Conversion of CO_2 using HCl-PANI/Cu Photocathode

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The present study was aimed to convert CO2 into value-added products such as methanol which not only could address the potential solution for controlling the CO2 concentration level in the atmosphere but also can offer an alternative approach for the production of renewable energy sources. In this perspective, Polyaniline (PANI) thin films were successfully synthesized using the electrodeposition technique from a mixed solution of 0.2M aniline and 0.5M HCl on cupper. The morphological characterizations of the hybrid photoelectrocatalysts with or without sensitization with copper oxide (Cu2O) particles were carried out by Scanning Electron Microscopy (SEM), while the catalytic activity was studied by linear sweap voltammetry (LSV) in dark and under white light irradiation using potentiostat station. Cyclic voltammetry in presence and without purging CO2 was also conducted.

It was observed that the combination of PANI and copper (I) oxide greatly increased PEC carbon dioxide reduction to methanol owing to the enhancement in the carbon dioxide chemisorption capacity by the photocathode surface. Gas chromatography (GC) showed a concentration of 27% corresponding to methanol production, when the copper (I) oxide/PANI/Cu heterostructure was used as a photocathode compared to the unmodified which exhibit 25%, at an applied potential of -1.2 V. From the obtained results, Cu2O/HCl-PANI/Cu could be useful as a promising candidate for the CO2RR to Methanol.

Keywords: Polyaniline, Cu_2O, photocathode, CO_2RR.

P19-B : Olive mill wastewater catalytic degradation over Keggin-type polyoxometalates

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The olive oil industry is a major economic activity, concentrated mainly in Mediterranean countries. Discharges from these oil mills are a serious environmental problem, due to their pollution load and their toxicity for the ecosystem as a whole.1 The aim of this work is to degrade the phenolic compounds found in olive mill wastewater by catalytic oxidation, under batch in the presence polyoxometalates2/oxidant catalytic system. We were interested in this work to the gaseous products resulting from degradation of phenolic extracts, thereby helping to reduce the toxicity of these pollutants. The physico-chemical analysis methods used to study this catalytic tests are UV-Vis and IR spectroscopies, thin layer chromatography and gas chromatography. In addition to these physico-chemical techniques, chemical methods are also used.

Keywords: Olive mill wastewater, Keggin, polyoxometalate, degradation

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P20-B : Optical properties of CdF2 single crystals codoped by Er3+ and Tm3+ ions

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Optical materials have become increasingly vital in modern technology, driven by the growing need to enhance and replace traditional electronic components with optical solutions. Their applications span a wide range of advanced technological fields, including display screens, lighting systems, and biophysics and medicine, etc... Among the diverse range of optical materials, luminescent rare earth ions stand out for their exceptional properties. These ions, characterized by their unique electronic structure, undergo 4f - 4f transitions that are shielded by completely filled outer electron orbitals.

In this study, we investigate the luminescent properties of CdF2 single crystals codoped with Er^{3} and Tm^{3} ions, exploring their potential applications as a white light source. This pair of luminescent ions offers promising opportunities due to their complementary emission spectra. We present a detailed analysis of the fluorescence properties of CdF2 crystals, examining excitation processes that involve direct excitation of the activator ions as well as indirect excitation through sensitizing ions. The incorporation of rare earth ions into various host materials, such as crystals, glasses, and glass-ceramics, significantly enhances their optical performance. The choice of host material is critical, as it influences the phonon energy levels within the material. Lower maximum phonon energies are preferred, as they minimize non-radiative energy losses, thus promoting higher radiative emissions. Our research encompasses a comprehensive examination of the spectroscopic properties associated with visible emission levels. We systematically followed a sequence of measurements to elucidate these properties: first, we conducted excitation experiments; next, we analyzed the visible emission under various excitation wavelengths; and subsequently, we measured the fluorescence decay times of both green and red emissions. Additionally, we evaluated the chromaticity coordinates and the corresponding CIE (Commission Internationale de l'Éclairage) diagram, which provides a visual representation of color space.The results indicate that the codoping of Er^{3} and Tm^{3} ions in CdF2 significantly enhances the luminescent efficiency and broadens the emission spectrum, making it suitable for white light applications. By optimizing the excitation wavelengths and understanding the energy transfer mechanisms between the sensitizer and activator ions, we aim to achieve a more efficient light output. This study not only contributes to the fundamental understanding of luminescent materials but also highlights the potential for developing advanced lighting technologies based on rare earth-doped systems.

P21-B : Nickel Copper Ratio Effect on Nanohybrid Products Electrochemical Performance For Energy Storage

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In terms of energy storage, supercapacitors are currently getting a lot of interest where outstanding performance benefits include their extended lifespan, high energy density, high level of safety, and low cost.

We report in this investigation samples rich in nickel and copper hydroxide with highest specific capacitance and moderate cycle stability. Therefore, high conductivity and rate capability, two distinctive electrochemical features, guarantee the material's practical application potential as an electrode for supercapacitors. So, we present in this work a simple, inexpensive, and environmentally friendly method for producing electroactive nanomaterials based on Ni and/or Cu hydroxides by varying the precursors' ratios from 0 to 2 under optimized growth condition (6 h/120 °C). Hence, XRD, FTIR, FESEM, and BET are most techniques used to characterize the obtained products.

Additionally, we performed their electrochemical tests via a three-electrode arrangement system in 6M KOH electrolyte. We clearly observed a synergistic relationship between the Ni/Cu precursor ratio and the electrochemical performance of the hydroxide-based products.

Keywords: Energy storage, Supercapacitors, Nanohybrids, electro-active materials, Electrochemical measurements.

P22-B : Preparation of quasi-solid biopolymer electrolytes based on extracted waste Potato starch for low-cost dye sensitized solar cells

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Dye-sensitized solar cells (DSSC) are part of the third generation of solar cells that have the advantage of low cost and relatively high efficiency. The massive production of this type of cell remains dependent on the improvement of their life cycle. Alternatives to replacing the volatile and corrosive liquid electrolyte of DSSC with solid or quasi-solid electrolytes are necessary to achieve this goal [1,2]. In this work, a quasi-solid state electrolyte was developped based on low cost and sustainable components; a starch extracted from Potato waste. Lithium salt (Li2SO4) was added to the starch solid biopolymer electrolytes (SBPEs) in order to enhance the charge transport properties and ionic conductivity. A new synthetized green, non-fluorinated ionic liquid with a planar structure called 1-allyl-3-methylimidazolium dicyanamide (AMIM-DCA) was added to SBPEs to obtain a gel-like electroltyte, allowing better diffusion of charge carriers and good interfacial contact between the porous TiO2 nanocrystalline layer and the counter electrode. The SBPEs with Lithium salt were characterized by electrochemical impedance spectroscopy (EIS) using a cell for solid samples made up of two copper sheets (1x1 cm), between which the SBPEs samples were sandwiched. The bulk ionic conductivity (σ) of SBPEs was determined by the equation $\sigma = l \,/\, Rf.\ A$ [3,4], where l is the thickness of the film, Rf is the bulk resistance, and is the contact area between the films and the copper electrodes. The ionic conductivities of Lithium-modified Potato starch SBPEs were measured and the values were as follows : 1.06 × 10–3 S. cm–1 at 20°C. The addition of the ionic liquid AMIM-DCA decreased slightly the ionic conductivity of the SBPEs : 0.8 × 10–3 S. cm–1 at 20°C. These measured ionic conductivities are adequate for the electrolytes used in DSSC which should have high conductivity (~10–3 S. cm–1) [5]. This gel-like biopolymer is a potential candidate as an electrolyte for sustainable dye-sensitized solar cells.

Keywords: Starch, Biopolymer, Electrolyte, Dye-sensitized solar cells.

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P23-B : Study of optoelectrical properties of silicon carbide based energetic microsource

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hydrogenated amorphous silicon carbide (a-SiC:H) is a promising material for various applications in microsource devices. In this work, a-SiC:H films were deposited by PECVD system on silicon substrates. Optoelectronic properties of deposited films as a function of different deposition conditions were established. The electrical properties of the Schottky diodes Metal/a-SiC:H were investigated using admittance spectroscopy over a temperature range of 300–500 K. Complex impedance analysis demonstrated that the relaxation phenomenon was a thermally activated process. Based on the Nyquist diagram (Z″ versus Z’), we extracted the equivalent circuit parameters representing the physical processes occurring in the samples.

Keywords: Amorphous silicon carbide, PECVD, Microsources, Optoelectrical characterization.

P24-B : Synthesis of a bio-sourced three-dimensional absorbent: Application to methyl orange retention.

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The main objective of this present study was the application of illitic clay and zeolite FAU X synthesized from this same non-swelling clay in the adsorption of certain dyes likely to be present in surface waters, particularly methyl orange.

The synthesis of Zeolite is achieved by a relatively low cost and with a fast conversion process. The combination of different analysis techniques (XRD, FTIR, BET, CEC) has shown that pure FAUJASITE X with high CEC, specific surface and large pore volume have been obtained.

The application in the adsorption process allowed us, on the one hand, to obtain some conclusions regarding the importance in the adsorption of dyes, of the nature of the absorbent (zeolite and clay), the influence of pH, contact time, initial concentration and the roles played by the surface charges of the two materials used; and on the other hand, to highlight the probable processes of adsorption of methyl orange on these supports in their raw state and after treatment with a surfactant, "hexadecyltrimethylammonium HDTMA", in order to improve the adsorption capacities of the two adsorbents.

This modification showed significant interest for clay as well as for zeolite whose quantity adsorbed on raw clay goes from 81.55 mg/g to 112.88 mg/g for modified clay and for that of adsorption on zeolite it was possible to improve the retention of the dye from 141.69 mg/g to 192.30. In addition, we concluded that the phenomenon of adsorption of methyl orange on raw clay, synthesized zeolite as well as on these two solids modified by the surfactant, is well controlled by the Langmuir model and that the adsorption is completed in monolayer while considering that the surface is uniform and that there is no interaction between the adsorbed molecules.

Keywords: Illite clay, zeolite, Methyl Orange, Langmuir, CEC, Surface Specific SBET

P25-B : Synthesis of a clay-based geopolymer for methylene blue adsorption application.

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Geopolymer is a material of capital importance given the variety of its properties. In order to promote its participation in innovative applications, various researches have been set up. In this context, a synthesis of geopolymers from three types of clays (smectite, illite and kaolin), under different calcination temperatures (600, 800 and 1000 °C), with different mass ratios (1/1, 1/2 and 1/3) and for two different NaOH concentrations (10 M and 15 M) was carried out to subsequently use in adsorption applications.

The study of the adsorption of Methylene Blue (MB) on the three raw clays was carried out taking into account the effect of pH, contact time and initial concentration. The best adsorbed amount of MB is accorded to smectite with : an optimum pH = 10, one hour was sufficient to reach the maximum adsorption in the form of a kinetics that follows the pseudo second order model and that the initial concentration for the maximum level is of the order of 960 ppm for a maximum absorption amount of 142.9 ppm with a retention that follows the Langmuir isotherm model.

The results of the synthesis of geopolymers by studying the effect of: type of starting clay, calcination temperature, solid/liquid ratio and concentration of the basic solution used for synthesis. The evaluation and selection of the best geopolymer obtained was based on the measurement of the specific surface SBET. The results obtained showed that the best synthesis condition was for: kaolinitic clay, a calcination temperature of 800°C, a solid/liquid ratio of 3 and a NaOH concentration of 15 M (K800-3-15).

Finally, the study of the retention of MB on K800-3-15 showed: an optimum pH equal to 12, the kinetic modeling shows the adequacy of the pseudo first order model for a saturation plateau obtained after 24 hours. On the other hand, the retention modeling according to the two Freundlich and Langmuir isotherms validates the Langmuir isotherm which proves that the retention of MB on k800-3-15 is monomolecular for a maximum adsorption quantity of the order of 184.5 ppm obtained from an initial concentration of 2000 ppm.

Keywords: Clays, Geopolymer, Methylene Blue, Langmuir, Surface Specific SBET

P26-B : Preparation and magnetic properties of Fe_3O_4@rGO Nanocomposite investigated by ESR spectroscopy

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Iron played a crucial role in the evolution of civilizations and technologies, synonymous with progress, inseparable from the greatest technological achievements. Iron oxides have captivated scientific interest for centuries, not only for their ubiquity in nature, but also for their remarkable versatility in technological applications. In this chapter, nanometric material based on Fe3O4 and graphene was synthesized by a simple method. In this study we explore nanometric material based on Fe3O4 and graphene synthesized by a simple method; with a particular emphasis on unlocking the secrets behind its magnetic properties. This class of Fe3O4-carbon hybrid nanocomposites has been tested for various applications. Graphene oxide (GO) has attracted great interest in nanotechnology due to its interesting properties such as mechanical strength, high electron transport capacity a large specific surface area, thermal conductivity , chemical modifiability, elasticity, and tunable optical properties. Additionally, the functional groups present on GO (-OH, -COOH, and -CHO) have made the grafting of multiple organic compounds uncomplicated. Recently, Fe3O4 has been implanted in a non-magnetic graphene matrix to combine the properties of graphene with the magnetic properties of nanomaterials. The combination of graphene oxide with Fe3O4 form Fe3O4@rGO nanocomposites. We used these nanocomposites for the extraction of rare earth elements from a phosphoric acid medium, owing to its excellent anticorrosion properties and facile magnetic recovery and for the application as aqueous electrochemical supercapacitors. The magnetic properties of Fe3O4 NPs in Fe3O4@rGO composites were investigated using electron spin resonance spectroscopy (ESR)

Keywords: Nanocomposites, Fe3O4@rGO, Ferromagnetic state, ESR, Rare Earth Extraction, Supercapacitor

P27-B : Preparation, characterization and application of lignin-based activated

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The development of methods to reuse waste materials is greatly desired and the production of activated carbons from wastes is an interesting possibility. Lignin is a waste which is generally used only for its fuel value. Therefore, it was of interest to prepare a higher value product such as an activated carbon from lignin. In this work, the valorization of lignin was studied. Olive stone used to prepare activated carbon which is modified by lignin. The carbon materials were characterized by TGA-DTA, FTIR spectroscopy, adsorption-desorption of N_2 at 77K, Boehm titration and the measure of pH_{PZC}. All the techniques were correlated and they confirm that modified activated carbon- lignin can be used as a natural adsorbent, an electrode for supercapacitor application and a biofuel.

Keywords: Lignin, activated carbon, valorization.

P28-B : Photocatalytic activity under sunlight by copper Oxide Thin Films

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Copper oxide is a P-type semiconductor material that is black in color with a slight transparency. It is an interesting material for various applications due to the abundance of its components in nature, its good thermal stability and its structural and optical properties. This property allows it to be almost excellent in many applications such as catalysts, solar cells and batteries [1] ... In this work-in-progress, the solution was prepared by the Sol-Gel method and thin films of CuO were deposited on glass substrates by Dip Coating technique, this study focused on different film thicknesses by varying the frequent number of layers deposited. The structural analysis by X- ray diffraction (XRD) shows that all the samples are polycrystalline with monoclinic crystal structure. The optical properties of the films were characterized by UV–Visible spectrophotometry, which shows that the films show high absorbance in the visible region. Their optical band gap decreases from 2.10 to 1.80 eV when varying the frequent number of layers deposited increases from 2 to 5 layers. The photocatalytic performance of nanocomposites synthesized under sunlight was studied in the degradation of crystal violet (CV) dye as a target pollutant for 150 min.

Keywords: Sol–Gel, Dip-Coating, Copper Oxide, Thin Films, photocatalytic.

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P29-B : Response surface statistical optimisation for Efficient synthesis of high-pure hierarchical Faujasite via alkali synthesis using raw Tunisian clay material

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Because of their distinct physicochemical characteristics, FAU zeolites are indispensable in a wide range of advanced technological sectors and have gained significant attention of researchers. In the present study, the process conditions for the hydrothermal synthesis of FAU zeolite from calcined illite are optimised using the response surface methodology (RSM). Illitic tunisian clay was used for preparing faujasite (FAU) type zeolite. It was activated and the synthesis was conducted via alkali fusion method that used crystal techniques and lowered reaction conditions.The optimal synthesis conditions were investigated using the Box-Behnken design and the only FAU phase could be obtained with the following agent parameters NaOH/clay ratio(χ1) is 1.2, the crystallization temperature (χ2) is 60 °C, the crystallization time (χ3) is 24 h. The raw clay and prepared FAU-type zeolites were characterized by diverse analytical method such as ,DTA-GTA, XRD, SEM and FTIR. A ahigh pure FAU zeolites was synthesized under the optimal conditions with the SiO2/Al2O3 ratio of 2.2 and the specific surface area of FAU zeolite is 360 m2/g. The FAU zeolite with high crystallinity was utilized later for many application of wastewater treatment via adsorption or photo fenton process or for VOC capture in gaseous phase.

Keywords: FAU zeolite, alkali fusion, illite, response surface methodology (RSM).

P30-B : Insights into electrical conduction of rod-like shaped magnesium oxide

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Rod-like magnesium oxide was prepared by a cost-effective precipitation method. Electrical conduction of the obtained MgO was studied in depth using complex impedance spectroscopy technique. Analysis of impedance data pointed out that alternative current (ac) conduction follows the universal power law. The recorded conduction is thermally activated and involves localized hops of charge carriers between neighboring sites. From the change in the power law exponent ‘S’ with the temperature, the ac-conduction can be described by the non-overlapping small polaron tunnelling (NSPT) model in the range 400-500°C, while for higher temperatures, the correlated barrier hopping (CBH) model is more suitable for explaining the conduction in MgO lattice. According to the temperature, the motion of charge carriers thus occurs by translating (NSPT) or hopping over (CBH) the energy barrier. Finally, the activation energy was also estimated for both the direct and the alternative current conductivities using the Arrhenius relation. The obtained values showed a decrement with frequency rise, indicating a faster mobility of charge carriers.

Keywords: MgO, Conduction, Activation energy, CBH model, NSPT model

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P31-B : Investigation of the Optical and Structural Properties of Er3+ Doped Oxyfluoride Glass for Laser Applications

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This work focuses on the creation and investigation of the spectroscopic characteristics of an oxyfluoride glass enriched with Er3+ ions, based on the GeO2-PbF2-PbO system. The spectroscopic behavior of this sample was examined using a semi-empirical Judd-Ofelt (J-O) method. We identified the Judd-Ofelt parameters (Ωt = 2, 4, 6), which turned out to be lower than those found in similar glasses, indicating that the material has less rigidity, a more ionic Er-O bond, and reduced asymmetry around the Er3+ ion sites.

These parameters allowed us to compute the probabilities of radiative transitions between different energy levels of the 4fN electron shell, along with the branching ratios for these transitions, and the radiative lifetimes of the main emission levels, particularly for the transition from the metastable 4I13/2 level to the ground 4I15/2 level of the Er3+ ion, in comparison with other Er3+-doped glasses. Furthermore, we explored emissions in the visible region using a Stokes-type excitation, enabling us to examine the excitation spectrum and determine chromaticity coordinates. These findings suggest that this glass holds significant potential for use in laser applications and optical amplifiers, especially at wavelengths of 543 nm and 1512 nm.

P32-B : Effect of Solvent on the Structure and Microstructure of Perovskite Nanofibrous Membranes

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Lanthanum aluminate (LaAlO3) electrospun membranes were prepared by low cost, simple and facile electrospinning technique. Two solvent systems such as N-N dimethylformamide (DMF) and Acetic Acid/Water (A-A/W) were chosen to dissolve the perovskite precursors. The structure, morphology, fiber size distribution, surface area, pore diameter and pore volume of the prepared perovskites were compared and investigated. The obtained results showed that by using green solvent (A-A/W), lanthanum aluminate membrane with good textural properties can be obtained. In fact, LaAlO3 nanofibers derived from DMF solvent exhibit lower surface area (SBET of 101 m2.g-1) and lower pore volume (Vp of 0.145 cm-3.g-1) when compared to the (A-A/W) derived sample (SBET = 176 m2.g-1 and Vp = 0.69 cm-3.g-1). As for the perovskite fiber diameter, it was strongly influenced by the solvent system. Indeed, it is of 78 nm for the (A-A/W) derived sample and it reached 214 nm when DMF was used.

This work describes an ecofriendly alternative of electrospinning method for the preparation of lanthanum aluminate nanofibrous membranes by an appropriate choice of the solvent. The obtained textural properties are promising for many environmental applications.

Keywords: Perovskite, Nanofiber, Electrospinning, Green, Nanomaterials.

P33-B : Microencapsulation of Beeswax with Calcium Carbonate for Enhanced Thermal Energy Storage

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PCMs, especially solid-liquid types, can store and release heat effectively but have low conductivity and leakage issues. Encapsulation with inorganic materials like calcium carbonate can address these problems [1]. This study aims to encapsulate beeswax, a bio-based PCM, within a calcium carbonate shell due to its environmental benefits and compatibility.

A series of phase change material BW@CaCO3 were elaborated. The resulting composites primarily consisted of vaterite and calcite phases, as confirmed by FT-IR and XRD analysis. Sodium dodecyl sulphonate (SDS) was employed as an anionic surfactant during the microencapsulation process. However, DSC measurements revealed a decrease in encapsulation efficiency, thermal stability, and a slight reduction in melting point (0.2 to 1.9°C) compared to pure beeswax. The influence of varying CaCl2 concentrations on the microcapsules' performance was also investigated. Despite these findings, the potential of CaCO3-based microcapsules for thermal energy storage applications remains promising, warranting further research and development [2].

Keywords: Beeswax, Calcite, Vaterite, PCM@CaCO3 microcapsules, Thermal energy storage

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P34-B : The impact of Silver Nanoparticles on Seed Germination and Seedling Growth in Wheat (Triticum durum)

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The increasing use of silver nanoparticles (Ag NPs) in various fields, including agriculture, is due to their powerful antimicrobial properties. However, their interaction with the environment and living organisms raises concerns about their ecological impact and potential toxicity. The phytotoxicity of Ag NPs has become a crucial area of study due to its effect on key processes such as plant germination. This study aims to evaluate the effect of AgNPs on plant germination to guide their use while minimizing negative impacts on the environment and human health.

In the present study, Ag NPs were synthesized using the precipitation method. The synthesized nanoparticles were characterized using UV-visible spectrophotometry and X-ray diffraction (XRD).

To evaluate the effect of Ag NPs on seed germination of Triticum durum, various concentrations of nanoparticles (0.01, 0.05, 0.1, and 1 mg/mL) were used to assess their impact on germination rate, root length, and leaf length.

UV-visible spectrophotometry and X-ray diffraction (XRD) analysis confirmed the formation of Ag NPs, and the average size, calculated using the Scherrer XRD equation, is 25.88 nm.

The results of this study reveal the significant influence of Ag NPs on the germination rate and growth of wheat seeds. The increase in Ag NPs concentration leads to a decrease in all measured parameters, thus indicating their toxicity.

At high concentrations, Ag NPs have a toxic impact on the entire plant, affecting the length of roots, shoots, and germination rate.

Keywords: silver, nanoparticles, Seed Germination, Seedling Growth

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P35-B : Down-Shifting in Ce3+- Tb3+ co-doped phosphate glasses for solar cells application

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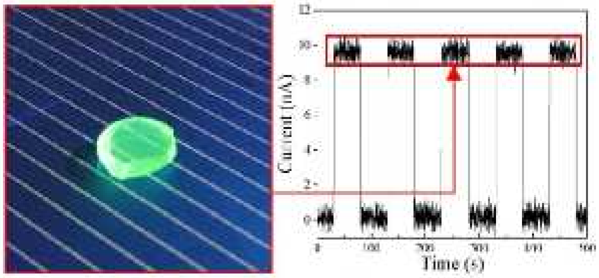
The Down-Shifting (DS) of UV photons into the visible range has been attracting much attention for lighting appliances and solar cells. In this study, a series of phosphate glasses co-doped with 0.5 Ce3+-xTb3+ was synthesized using the melt-quenching method to investigate the energy transfer producing downshifting to Tb3+ ions. Our focus was on photoluminescence and decay time of Ce3+ and Tb3+, revealing trends of higher Tb3+ concentration leading to increased photoluminescence intensity and decreased luminescence intensity of Ce3+. Additionally, investigation into down-shifting luminescence in Ce3+-Tb3+ co-doped phosphate glasses unveiled energy transfer from Ce3+ to Tb3+. Placement of a co-doped glass over a silicon solar cell generated photocurrent after UV excitation at 280 nm, indicating a potential for improve the solar cell efficiency.



(a)

(b)

a) Photo of a monocrystalline silicon solar cell with a co-doped glass sample on the top under 280 nm excitation and b) Temporal measurements of the photocurrent in a solar cell with and without sample under an excitation at 280 nm.

Keywords: Photoluminescence; lanthanide ions; Energy transfer; Cross relaxation; solar cell

P36-B : Poster Porous industrial activated carbon modified by Titanium in supercapacitors application

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Supercapacitors have attracted increasing attention due to their enhanced electrochemical properties, including fast charge-discharge rates, high specific power, and excellent cycling stability. These devices also offer high reversibility and power density, which makes them promising for use in renewable energy systems. However, their energy density still lags behind that of batteries [1]. In this study, we present a composite material (AC-Ti) based on activated carbon (AC) and titanium dioxide (TiO2) as a potential electrode for future supercapacitor applications. The materials were characterized using a variety of techniques, including X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR) and differential scanning calorimetry (DSC). Additionally, electrochemical properties were evaluated through cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). The electrochemical tests further demonstrated that the composite exhibited excellent capacitive behavior. This performance marks a significant improvement over the individual components, suggesting that the AC-Ti composite is a promising material for supercapacitor applications.

Keywords: supercapacitors, activated carbon, titanium dioxide, grafting, composite, specific capacitance.

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P37-B : Synthetize and electrochemical performances of CP/(Ni-Fe-V) Ternary-LDHS Hybrid materials for electrochemical storage

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Supercapacitors are known as energy storage devices that can deliver quick bursts of energy and high power density compared to batteries and conventional capacitors. Hybrid CP/LDHs for supercapacitors refer to a combination of Carbon paper and Ternary Layered Double Hydroxides (LDHs) used as materials in the construction of supercapacitor electrodes. Research and development in this area focus on optimizing the composition and structure of these materials to achieve higher energy densities, faster charge/discharge rates, and longer cycle lifetimes for supercapacitors used in various applications such as energy storage systems, portable electronics, and hybrid vehicles.

This present work reports the development of free-standing CP/Ni-Fe-V (LDHs) electrodes. Which are synthesized on the CP substrate by a simple hydrothermal technique (140°C/12h). We investigate how element proportions affects the electrochemical properties of the electrode. The synthetized materials are characterized by microscopy (SEM) and spectroscopy (XPS). The electrochemical performance of a CP/Ni-Fe-V electrode are evaluated with cyclic voltammetry (CV), charge-discharge (CDG) and electrochemical impedance spectroscopy (EIS), using a three electrode cell with Ag/AgCl as reference in a neutral electrolyte 1M Na2SO4. Our results reveal the exceptional potential of the CP/ternary LDHs hybrid composition, showcasing superior electrochemical performance with a higher specific capacitance at a scan rate of 20 mV/s, in a three-electrode cell. This cost-effective method provides excellent specific supercapacitor characteristics and promising advancements in energy storage technology.

Keywords: supercapacitors, hybrid materials, neutral electrolytes.

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P38-B : Investigation of nonradiative recombination parameters in GaAs/InAs/GaAs QDs by means of photo-thermal deflection technique (PBD)

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The photo-thermal deflection (PBD) technique is employed to investigate non-radiative recombination processes in InAs/GaAs quantum dot (QD). We have developed a PBD theoretical model based in both of the resolution of thermal and electronic diffusion equations in the three-layer. The fitting of theoretical to experimental ones permits to extract the nonradiative recombination parameters namely electronic diffusivity, non-radiative lifetime, and interface recombination velocity. Significant results include a reduction in mobility from 21.58 cm²/Vs to 4.17 cm²/Vs (±12.9%) and a decrease in the minority-carrier diffusion length from 0.62 µm (±5.8%) to 0.14 µm (±10%) with the increases of the InAs(QD) density. Additionally, the PBD measurements show that the two interface recombination velocity S2/3 and S1/2 increase as a function of increasing InAs QD density. Specifically, S2/3 increases from 477.7 (± 6.2%) to 806.5 (± 4%) cm/s and S1/2 from 75 (± 7.8%) to 148.1 (±5.5%) cm/s.

Keywords: Nonradiative lifetime, InAs diffusion length, electronic diffusivity, interface recombination velocity, InAs/GaAs Quantum Dot density.

P39-B : Effect of surfactant on electrochemical performance of Co3O4 electrode and its application in supercapacitor

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Highly dense and defined Co_3O_4 nanofibers were prepared by Hydrothermal method using different polyvinylpyrrolidone (PVP) concentration Co_3O_4 nanofibers are prepared by technique and they are characterized by thermogravimetry analysis X-ray diffraction (XRD) and scanning electron microscopy (SEM) studies. Electrochemical properties of the electrospun Co_3O_4 nanofibers electrode performance are characterized by cyclic voltammetry (CV) and galvanostatic charge-discharge measurements in a 6 M KOH electrolyte using a three-electrode system. The electrospun Co_3O_4 nanofibers exhibit a specific capacitance of 407 F g^{-1} at a scan rate of 5 mVs^{-1}. Futhermore, the Co_3O_4 nanofibers show an excellent cycle stability and better capacity rentation with 94% after 1000 continuous charge-discharge cycles at a constant current density of 1 Ag−1. Moreover, the enhanced supercapacitor performance is mainly due to its unique nanofibers structure provides larger reactive surface area capable of fast ion and electrone transfer. The results are compared with the existing reported systems in the literature.

Keywords

hydrothermal ;Cobalt oxide ; Nanofibers ; Supercapacitor ; PVP

P40-B : Enhancing Copper Oxide Thin Film Synthesis Using Aerosol Chemical Vapor Deposition (ACVD)

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The development of effective thin-film synthesis methods for semiconductor applications remains crucial for advancing modern electronics. This research highlights the use of Aerosol Chemical Vapor Deposition (ACVD) as an innovative approach to deposit copper oxide (CuO) thin films. The study examines how varying substrate temperatures, ranging from 100°C to 300°C, affect the structural and physical properties of CuO films. Key findings reveal that lower temperatures enhance film thickness due to diminished solvent evaporation rates, while higher temperatures improve crystallinity. Energy Dispersive X-ray Spectroscopy (EDX) confirms uniform copper deposition, with minor areas of incomplete coverage. Scanning Electron Microscopy (SEM) analysis shows temperature-induced variations in surface roughness and grain size, correlating to enhanced crystallinity. Raman spectroscopy, in conjunction with photoluminescence data, indicates the co-presence of CuO and Cu_2O, particularly at a deposition temperature of 200°C. This study contributes valuable insights into optimizing ACVD for high-performance CuO films, with implications for semiconductor technology advancements.

C. Structural Materials & Computational Materials Science

ORAL-C

O1-C : Enhanced thermal performance of mortar through recycled waste integration

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This study addresses the urgent need for sustainable innovation in the construction sector by exploring the integration of various waste materials into cement mortar. In particular, the thermal, mechanical and chemical effects of partial incorporation of expanded polystyrene waste, expanded perlite waste, human hair waste, textile fiber waste, and paraffin waste sand substitute are investigated. Using various proportions of these waste materials, mortar samples were prepared and a series of tests were carried out to measure properties such as thermal conductivity, flexural strength, compressive strength and chemical composition. The results show that at a waste substitution level of 50%, the thermal conductivity was reduced by 28%, 55%, 44%, 67% and 67% for expanded polystyrene, expanded perlite, textile fibers, human hair and paraffin mortars with compressive strength decrease, respectively by 75%, 71%, 50%, 79% and 81%. Despite these changes in thermal and mechanical behavior, the chemical composition of the mortar remained largely unchanged. The study highlights the importance of adopting sustainable construction practices to reduce the overall environmental footprint of buildings throughout their life cycle.

Key words: Thermal insulation, Mortar, Energy efficiency, Buildings, Sustainability, Waste.

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O2-C : Optical properties of Sm3+ doped phosphate glasses for potential orange laser applications

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Undoped and Sm3+doped 45P2O5–45Na2O–2Al2O3–8BaO glasses were synthesized by the melt-quenching technique. The glass structure and luminescence properties were investigated by using Raman spectroscopy, scanning electron microscopy (SEM), spectroscopic ellipsometry, Judd-Ofelt theory and photoluminescence. Electron microscopy showed the homogeneity of samples. Raman spectroscopy revealed that the overall structure of the glass was unaffected by the doping of Sm3+ and ellipsometry was used to measure the optical constants. Judd-Ofelt (JO) analysis was performed on the absorption bands of Sm3+ (4f5) and the three phenomenological parameters (Ω2, Ω4, and Ω6) were computed and then used to determine radiative properties such as the radiative transition probability (Ar), the fluorescent branching ratio (βr), the stimulated emission cross-section (σe) and the radiative lifetime (τrad). Photoluminescence (PL) spectrum showed the typical four transitions of Sm3+ at wavelengths of 564, 600, 645 and 703 nm corresponding to 4 G5/2 → 6 H5/2, 6 H7/2, 6 H9/2 and 6 H11/2, respectively. The spectroscopic quality factors Ω4/Ω6, the predicted lifetime (τrad) calculated using the JO method and the experimentally lifetime (τexp) for the 4G5/2 level were calculated and discussed. The glass color purity is as high as 98%, which makes it a potential candidate for laser emission.

Keywords : samarium doped phosphates glass , photoluminescence , Judd felt theory

O3-C : Prediction of enthalpies of formation of Ag-rare earth (RE) binary compounds.

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are materials for Ag-rare earth (RE) binary alloys major electronic applications [1]. They attract theoretical and industrial research interests.

In the production of these materials, knowledge of the phase diagram and thermodynamic properties is essential. There are many literature data on binary RE–Ag systems, especially those from phase diagrams. But large discrepancies exist between the data from different sources.

The alloys to be studied are binary alloys based on rare earth silver (R-Ag) with R= Ce, Gd, La and Yb).

These alloys have a large number of defined compounds at different concentrations.

The common compositions between these binary alloys are: R_2Ag_9, R_2Ag_7, R_3Ag_2, R_5Ag_2, R_2Ag_4, RAg, R_5Ag_3.

In this work we present results of prediction of enthalpies of formation fpr AgRE binary compounds using Miedema’s model.

Key words: Miedem’s Model, rare earth compounds, enthalpy of formation.

O4-C : Probing noncovalent interactions in hybrid organic-inorganic materials by dispersion-corrected density functional theory (DFT-D)

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Hybrid organic-inorganic materials provide a versatile platform for tailoring physical and chemical properties, making them highly relevant for applications in catalysis, optoelectronics, and energy storage. A key factor influencing the stability and functionality of these materials is the role of noncovalent interactions, which govern the overall molecular architecture. Here, we explore these interactions using quantum chemistry techniques, specifically focusing on dispersion-corrected density functional theory (DFT-D). We present three case studies of hybrid compounds with cobalt(II), cadmium(II), and iron(III), where organic amines (organoammonium) act as precursors rather than coordinating to the metals, as these are class I hybrid materials. Our analyses, demonstrate how quantum mechanical approaches can predict and explain noncovalent interactions, enabling the design of hybrid materials with targeted functionalities. Overall, this research enhances the broader understanding of structure-property relationships in hybrid organic-inorganic materials and underscores the importance of advanced computational techniques in materials science.

Keywords: Hybrid organic-inorganic materials, Noncovalent interactions, Quantum chemistry, Density functional theory

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O5-C : Spectroscopic properties of BeH+ ionic system

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The BeH+ molecule has not yet been well reported. In this paper, potential energy curves, as well as relevant permanent and transition dipole moments, for X1 Σ+–101Σ+, of BeH+ were computed using a standard quantum chemistry approach based on pseudopotential for Be+ and H+ cores, Gaussian basis sets, efective core polarization potentials and full confguration interaction calculations. Based on the efective Hamiltonian theory and an efective metric, a diabatization procedure was used to produce the quasi-diabatic potential energy. The adiabatic and quasidiabatic potential energy curves were computed. Spectroscopic constants (Re, De, Te, ωe, ωeχe and Be) were also determined. In addition, numerous avoided crossings between electronic states of 1Σ+, symmetrie were localized and analyzed. For the BeH+ molecule, these avoided crossings can be explained by the ionic interactions between Be+ and H−, and Be+ and H+. The permanent dipole moment of BeH+ revealed both ionic characters related to electron transfer and yielding Be+H− and Be−H+ arrangements. These transition dipole moments were used to evaluate the radiative lifetimes of the vibrational levels trapped in the two excited states. Added to bound–bound contribution, the bound–free term was calculated using two methods: the Franck–Condon (FC) approximation and the sum-rule approximation.

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O6-C : Synthesis, Spectroscopic Characterization and Solid State Molecular Structure of the New Hydrogencarbonato Iron(II) Meso-arylporphyrin Complex

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A new iron(II) porphyrin–dihaptohydrogencarbonato complex [Na(2,2,2-crypt)][FeII(TpivPP)(η2-O2COH)] (TpivPP = α,α,α,α–tetrakis(o-pivalamidophenyl)porphyrin known as picket fence porphyrin and 2,2,2-crypt is the cryptand-222) is synthesized, and spectroscopically and structurally characterized. The UV-visible and IR spectroscopic data are in accordance with hydrogencarbonato ferrous porphyrinates.

The X-ray structural analysis indicate that the Fe(II) cation is high-spin (S = 2) and has the $d_{xy}{}^{2}\ d_{xz}{}^{1}\ d_{yz}{}^{1}\ d_{z^2}{}^{1}(d_{x^2-y^2})^{1}$ ground state electronic configuration.

The average equatorial iron-pyrrole N bond length (Fe-Np = 2.111(1) Å), the distance between the iron and the 24-atom mean plane of the porphyrin ring (Fe-PC = 0.7169(10) Å) and the distance between the iron and the plane made by the four pyrrole nitrogens (Fe-PN = 0.6276(16) Å) confirms the high-spin-state of the hydrogencarbonato derivative and shows that the coordination sphere of the iron atom is strongly affected by the asymmetric bidentate (η2) mode of the hydrogencarbonato axial ligand. This is probably due to the significant electronic repulsion of the $d_{x^2-y^2}$ and d_{xy} orbitals by the negative charge of the pyrrole N atoms.

Keywords: iron(II) porphyrin; hydrogencarbonato complex; UV/Vis spectroscopy ; X-rays diffraction.

O7-C : Enhanced thermal performance of mortar through recycled waste integration

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This study addresses the urgent need for sustainable innovation in the construction sector by exploring the integration of various waste materials into cement mortar. In particular, the thermal, mechanical and chemical effects of partial incorporation of expanded polystyrene waste, expanded perlite waste, human hair waste, textile fiber waste, and paraffin waste sand substitute are investigated. Using various proportions of these waste materials, mortar samples were prepared and a series of tests were carried out to measure properties such as thermal conductivity, flexural strength, compressive strength and chemical composition. The results show that at a waste substitution level of 50%, the thermal conductivity was reduced by 28%, 55%, 44%, 67% and 67% for expanded polystyrene, expanded perlite, textile fibers, human hair and paraffin mortars with compressive strength decrease, respectively by 75%, 71%, 50%, 79% and 81%. Despite these changes in thermal and mechanical behavior, the chemical composition of the mortar remained largely unchanged. The study highlights the importance of adopting sustainable construction practices to reduce the overall environmental footprint of buildings throughout their life cycle.

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O8-C : Design and Characterization of a Zn(II)-Imidazole Hybrid: Insights into Structural, Electrical, and Antibacterial Properties

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The design and synthesis of hybrid compounds combining organic and inorganic components have garnered significant attention due to their versatile properties and potential applications in materials science and biomedicine. In this study, we report the synthesis and comprehensive characterization of a new layered hybrid compound, bis-(5- nitrobenzimidazolium) tetrachlorozincate monohydrate, based on an imidazole derivative and Zn(II). Structural analysis via X-ray diffraction reveals that the compound crystallizes in the monoclinic system (space group C2/c), with alternating corrugated layers parallel to the (102) planes. The layers are composed of (C7H6N3O2)+ cations, [ZnCl4]2− anions, and water molecules, stabilized by extensive hydrogen bonding between organic groups, inorganic anions, and water molecules. The supramolecular architecture was further investigated using Hirshfeld surface analysis and contact enrichment ratios to elucidate the nature of intermolecular interactions. Electrical and dielectric properties were assessed through complex impedance spectroscopy, offering valuable insights into the potential electronic applications of the material. Molecular docking studies demonstrated that the compound exhibits a stable and spontaneous interaction with double-stranded DNA, suggesting possible therapeutic relevance. Additionally, antibacterial activity was evaluated using disk diffusion methods, revealing a synergistic effect of the Zn(II) complex, particularly in combination with antibiotics, against Klebsiella pneumoniae and Staphylococcus aureus. The study highlights the multifaceted potential of this hybrid material, bridging structural chemistry, materials science, and biomedicine, with promising applications in electronic devices and antimicrobial therapy.

Keywords: Keywords Hybrid materials, Zinc (II), XRD, FT-IR, UV–vis, DNA-interactions, Antibacterial activity, Electric-dielectric properties

O9-C : Numerical Modeling of Joint Strength in Resistance Spot Welding Using a FEM-SPG Coupling

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Resistance Spot Welding (RSW) is a widely used technique in the automotive industry for assembling metal sheets, ensuring the structural integrity of vehicles and the safety of occupants. The performance of RSW joints is therefore critical to meeting reliability requirements under complex loading conditions. In this work, we modeled two standard static performance tests for joints: the single-lap shear test and the peel test, using LS-DYNA software. An innovative coupling between the Finite Element Method (FEM) and the Smoothed Particle Galerkin (SPG) method was applied to simulate the tensile-shear strength of steel sheets joined by RSW. The region-based discretization optimizes computational efficiency by applying FEM to stable zones and SPG to critical areas where failure is expected. The experimental tests conducted as part of this work show good agreement with the numerical simulation results, validating the effectiveness of this coupling in accurately predicting the behavior of welded joints.

Keywords: Resistance Spot Welding (RSW), FEM-SPG Coupling, Steel Sheets, Single-Lap Shear Test, Peel Test.

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O10-C : Exploring theoretical approaches to improve Non-Fullerene Acceptor Molecules based fluorene core in organic photovoltaic applications.

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In search of novel high-performance materials for use in organic solar cells, we designed a series of non fullerene acceptors derived from the recently synthesized small molecule acceptor, named DICTIF, with fluorene as the central block and 2-(2,3-dihydro-3-oxo-1H-inden- 1-ylidene) propanedinitrile as the end-capping groups, using density functional theory (DFT) and time dependent-DFT calculation (TD-DFT). We have simulated the effect of changing the end groups of DICTIF molecule by five different acceptors, in order to improve their electronic properties, optical absorption and performance in organic solar cell (OSC) applications. After identifying the suitable DFT functionals to accurately describe the initial structure DICTIF, we delved into optimizing their performance in organic solar cells. Using these functionals, we show that the designed non fullerene acceptors offer better performances compared to the synthesized molecule, such as lower highest occupied molecular orbital (HOMO), narrower energy gap, larger absorption range. Various key factors that are crucial for efficient non fullerene acceptors such as exciton binding energy, frontier molecular orbitals (FMOs), absorption maximum (λmax), open circuit voltage (VOC), reorganization energies (RE) and Electron-hole overlap of have also been studied. Low reorganizational energy (holes and electrons) values provide high charge mobility, and all the designed compounds are efficient in this regard. Our results showed that designed molecules are suitable candidates for the fabrication of highly efficient photovoltaic materials.

Keywords: Electron hole analysis, Density functional theory, Absorption maximum, Planar geometries.

POSTER-C

P1-C: Synthesis Of Chromene-3-Carbonitrile Under Microwave:Studies on Molecular Docking

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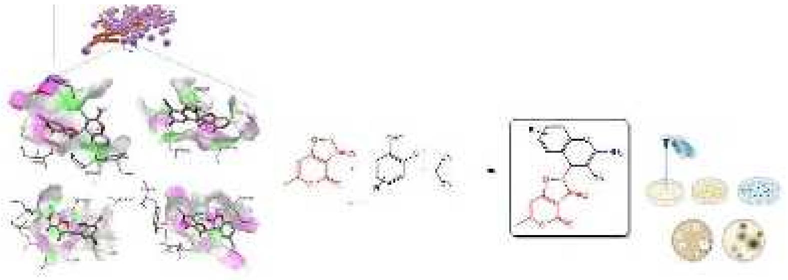
Dehydroacetic acid (DHA) and derivatives are widely used in the synthesis of pharmacologically active heterocyclic compounds. Biologically, DHA and derivatives have been reported as antimicrobial, cytotoxic and antitumor compounds [1]. Structure-activity-relationship conclusions have stressed on the presence of a furano or pyrano ring fused with a polycyclic aromatic system. Besides, the 4 H -chromene compounds may exhibit a variety of biological activities depending on the nature of their substituents on the 4 H -pyran or adjacent rings [2] . Recently, the 2-amino- 4 H -chromenes have been used in technological areas, for instance, as laser dyes, optical brighteners, fluorescence markers, pigments, cosmetics and biodegradable agrochemicals . In addition, the 2-amino-4 H -chromene with a cyano group has been tested in the treatment of rheumatism, psoriasis and cancer [3].

Docking simulations have been carried out targeting *S. aureus* penicillin binding proteins group (PBP2, PBP3 and PBP4) and thymidylate kinase (TMK) and the cell division Z ring protein (FtsZ) using AutoDock Vina software. The validity of docking results have been confirmed based on the best affinity scores and types of interactions. The molecular mechanisms of the synthesized heterocycles towards target proteins involved in *S. aureus* growth have been predicted through molecular docking studies.



Keywords: Dehydroacetic acid, Chromene-3-carbonitriles, Molecular docking

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P2-C: Novel approach to phosphate glass purification for improved solar cell protection

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P_2O_5-BaO-Al_2O_3 (GPBA) glasses were synthesized using the melt-quenching technique. In this study, we explore the effects of thermal treatment and acid leaching on the structural, optical, and electrical properties of the samples. X-ray diffraction (XRD) analysis confirms that the phosphate glasses retain their amorphous structure after purification. Scanning electron microscopy (SEM) reveals that annealing induces the formation of rod-like crystals and the migration of impurities to the surface, while purification results in an ultra-smooth surface free of crystals and impurities. Optical transmittance spectra show an increase from 35% to 92% following purification, attributed to the reduction of surface defects. Atomic absorption spectroscopy (AAS) indicates a significant decrease in metallic impurities, raising the glass purity from 99.92% to 99.99% after multiple purification cycles. The electrical conductivity of GPBA glass decreases with increasing annealing temperatures, but rises after acid leaching, suggesting the removal of impurities and defects. These findings indicate that the purified glass could serve as an effective protective material for photovoltaic applications, thanks to its enhanced optical transmittance and electrical conductivity.

Keywords: phosphate glass, purification, acid leaching

P3-C: Indole Derivative as a Possible Treatment for Breast Cancer

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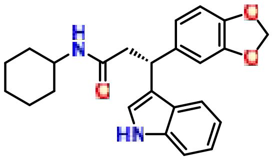
EGFR and HER-2 are epidermal growth factor receptors that are members of the ErbB family of receptor tyrosine kinases; their overexpression affects the development and progression of breast cancer. The current drugs are subject to resistance, and new drugs with novel mechanisms of action are required. Indole compounds are well-known to have promising biological activity along with good anticancer activity. Herein, we attempt to screen a database of 9,753 indole derivatives against epidermal growth factor receptors EGFR and HER2. High throughput virtual screening followed by standard precision and extra precision docking identified 20 compounds as possible inhibitors for EGFR proteins. These 20 compounds were docked against the active site of the five mutations of HER2, including D769Y, L755S, T798I, V777L, and Del755-759, along with the wild type. The preliminary results showed that compound 5886 has a promising activity, with a docking score of -6.904 kcal/mol against EGFR and -9.65, -9.51, -9.79, -9.69, -10.05, -9.77 against wild, D769Y, L755S, V777L, T798I, and Del755-759, respectively. Further molecular dynamics simulation for 500 ns revealed that compound 5886 was stable inside EGFR and HRE2T798I, indicating the promising activity of this compound against BC. Further, in vitro testing and ADME profiling for this compound are considered.



5886

Keywords: Docking, molecular dynamics, Cance, Drug design, HTVS

P4-C:Photo-physical characterization of conjugated helicene structures

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We have studied 3 helices that differ in conjugation length and conformation. The experimental results provided by the team that developed these products are complemented by theoretical calculations based on DFT. Several bases have been tested. The PBE combines with 6-31G(d,p) gives results close to the experimental results therefore we used this functional to complete the experimental observations. As a result we have reduced the optical properties as well as molecular orbitals and optical transitions. These results show that depending on the architecture of the helicene the electron density is affected which will induce properties that can be modulated for an application in EO.

Keywords: Helices, organic, DFT, TD-DFT

P5-C: Synthesis, Characterization, Corrosion inhibition of a new Schiff Base

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Schiff bases are typically synthesized through the condensation of primary amines with active carbonyl groups. These compounds are significant due to their diverse biological activities and numerous industrial applications. They exhibit pharmacological properties including antimalarial, anticonvulsant, anti-inflammatory, anticancer, antitumor, anti-HIV, antibacterial, and antifungal activities.

In view of the above importance of Schiff bases, we report herein the synthesis of new Schiff bases by condensing sulfanilamide and 2-Hydroxy-3-methoxybenzaldehyde. This study deals with the preparation and corrosion inhibition investigations of 4-[(2-hydroxy-3-benzylidene)amino]benzenesulfonamide, Due to their performance as corrosion inhibitors, their easy synthesis, and being an eco-friendly molecules, schiffbases have attracted a great deal of interest. To evaluate the anti-corrosive properties of the studied molecule on steel and aluminum alloy corrosion in HCl 0.5 M, potentidynamic polarization tests were performed.

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P6-C: Hydrothermal synthesis and characterization of CdSe nanoparticles and their application in radiation detection

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The nanostructured semiconductor samples of Cadmium Selenide (CdSe) powder were prepared hydrothermally and subsequently heat-treated by annealing at 200 °C for various durations (0, 4, 8, and 12 hours).

To obtain well-crystallized powders with a stable phase structure, the structural and morphological properties were thoroughly studied. The results were analyzed by observing changes in behavior under increasing annealing times until satisfactory outcomes were achieved. Additionally,

The diffractograms of the two CdSe powders after a certain annealing time showed a crystallization of hexagonal structure of the CdSe wurtzite phase with crystallites of nanometric size, approximately 13 nm, confirmed by Environmental Scanning Electron Microscopy (ESEM) images, we also observed granular type morphology. Energy dispersive X-ray (EDX) spectra confirmed the existence of stable phase elements formed CdSe. FTIR analysis confirms these results.

Keywords: Annealed, CdSe Nanoparticles, Hydrothermal synthesis, radiation detection

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P7-C: Synthesis, Characterization of 5-Acetyl-6-methyl-4-phenyl-3,4-dihydro-1H-pyrimidin-2-one Molecular Docking and Computational Studies

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A novel approach to the synthesis of 5-Acetyl-6-methyl-4-phenyl-3,4-dihydro-1H-pyrimidin-2-one. Today there are a wide variety of reaction conditions suitable for carrying out the Biginelli condensation reaction. In our work, the Bijinelli reaction was carried out without solvent at 80 ° C [1]. with stirring with the use of a new catalyst which is $Mg\ (NO_3)_2.\ 4H_2O$ and with a good yield 90%. Multi-component reactions play an important role in this approach, as they enable catalyst to form polysaccharide compounds from three or four reagents [2]. It is within this concept that the systematic based on the catalytic study of Mg complexes, with the aim of improving to improve synthesis strategies through simple, cost-effective and environmentally friendly environmentally friendly experimental procedures. The structure of the prepared compound was confirmed by means of ^{1}H NMR, ^{13}C NMR, UV-vis and FT-IR. The most stable conformation of titre compound was delineated using the density functional theory (DFT)/ B3LYP method with 6-311+ G (d, p) basis set. , HOMO–LUMO energies, electronic properties, reactivity (ELF, LOL, Mulliken and NBO ASD analyses), NCI-RDG and molecular electrostatic potential (MEP) on surface of the main compounds were calculated and described. A molecular docking study, molecular dynamics (MD) simulation and *in silico* ADME study were performed.

Key words: Synthesis, DFT, NMR, FT-IR, molecular docking.

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P8-C: Poster DFT study of iron-based superconductors compounds

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We have studied in this work the electronic structures and magnetic properties of CuFeAs and CuFeSb using first principle calculation. These compounds, which share the same structure, are isostructural to iron-based superconductors. We used the linearized augmented plane wave method (FP-LAPW) as part of the functional density theory (DFT), also using the Wien2K code. We have treated the exchange and correlation term by the PBEsol approximation. The total energy with respect to the volume was minimized to obtain the equilibrium lattice parameters. The antiferromagnetic ground state of CuFeAs is compatible with metallic antiferromagnetic superconductors of iron pnictures and chalcogenides. CuFeSb differs significantly from Fe-based superconductors by the height of the anion ZSb from the Fe plane, which is much larger than the ZAs height in FeAs compounds. CuFeSb exhibits a metallic, ferromagnetic (FM) state driven by the paramagnetic instability of Stoner. We found that this ferromagnetism is due to the high ZSb anion height. Therefore, the nature of the magnetic coupling (FM or AF) in these two compounds is highly depended on the height of the Zanion.

Keywords: Electronic and magnetic properties, CuFeAs, CuFeSb, Wien2k, DFT

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P9-C: Crystal Structure and Hirshfeld Surface Analysis of E-1-(3-nitrophenylazo)-2-naphtol

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In the title compound, the molecule C16H11N3O3 belongs to the family of azo dyes, and the asymmetric unit displays an intramolecular N—H O hydrogen bond. In the light of a single crystal X-ray study, it is evident that of the tautomeric forms (Azo-hydrazone), the hydrazone form is the predominant form in the solid state. The naphthol and benzene fragments attached to the -N=N- moiety adopt the s-trans conformation. Furthermore, the molecules are nearly coplanar, implying a dihedral angle of 2.63 (5)°. There are only two types of intermolecular interactions in the crystal structure: strong hydrogen-bonding C—H···O interactions and π-π stacking interactions. The importance of C— H· · ·O interactions in the molecular packing is reflected in the relatively high contributions made by O· · ·H/H· · ·O contacts to the Hirshfeld surface, i.e., 28.5%.

Keywords: azo dyes, X-ray diffraction, crystal structure, intermolecular interactions, Hirshfeld surface.

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P10-C: Theoretical study of novel square planar nickel (II) complex with (o-tolyldiazenyl) naphthalen-2-ol ligand and experimental structural and optoelectronic properties

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The creation of a novel nickel (II) complex dye [Ni-L2] and its ligand [HL] is the focus of this investigation. Elements, IR, NMR, UV-vis, X-ray crystallography, optoelectronic characteristics, and Hirshfeld surface analysis have all been used to analyze the materials. HL is known to exist in two tautomeric forms (Azo - Hydrazone), with the second tautomer being more stable, according to spectroscopic research. The X-ray analysis has revealed that the Ni-L2 contains a monoclinic structure. To create a square planar geometry, two oxygen and two nitrogen atoms from chelating ligands made up the coordination sphere surrounding the metal center. Using Hirshfeld surface analysis, the significance of numerous interatomic interactions has also been assessed and examined. Finally, important optoelectronic properties such as experimental spectroscopic, optical band gaps, refractive indices, dispersion and media behavior of the nickel complex dissolved in different solvents have been extensively investigated.

Keywords: azo dyes, X-ray diffraction, crystal structure, Hirshfeld surface.

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P11-C: Synthesis, Physico-Chimical Characterization, Experimental Theoretical study by DFT Optimization of Novel 4-(2 ammonioethyl)morpholin-4-ium dichloridodiiodidocadmate/ Chloridotriiodidocadmate hybrid compound

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This study presents the synthesis, characterization, and application of a novel hybrid organic-inorganic material (C6H16N2O) [CdCl1.90I2.10].Comprehensive physical and chemical characterization was performed using X-ray diffraction, FTIR spectroscopy, and thermal analysis. Hirshfeld surface analysis provided insights into the intermolecular interactions within the crystal structure, while Density Functional Theory (DFT) optimizations elucidated the electronic properties and provided valuable information on the orbital interactions and charge distribution.

DRX analysis shows that the crystal lattice of this compound is built up from the packing of one cation 4-(2-aminoethyl) morpholine [NH3 (CH2)2NH(CH2)4O]2+ and One tetrahalidocadmate anion with average composition [CdCl1.90I2.10]2-.

Infrared (IR) spectrum of the title compound was used to characterize the vibrational properties of the system. TGA thermal analysis reveals that the compound remains stable up to 610.15K, and DSC shows that it undergoes two thermic anomalies around 431.87 K and 557.35 K. We are mainly interested on this study to investigate the optical properties of hybrid compound (C6H16N2O)[CdCl1.90I2.10] thanks to UV-visible measurements carried out at ambient temperature.

Four peaks are detected at 213,243,298 and 353 nm. The x-intercept of the linear region of the curve (αhν)2 versus (hν) gives a value of 3.19 eV for the optical band gap, suggesting that the studied compound behaves as semiconducting material. The value of Eu is calculated from the inverse of the slope of Lnα versus hν; the value obtained is 0.361eV, this latter indicates the presence of disorder in the studied compound.

To gain deeper insights into the electronic structure and bonding characteristics, we performed Hirschfeld surface analysis, which revealed the nature and extent of intermolecular interactions in the crystal structure. Density Functional Theory (DFT) optimizations were carried out to elucidate the electronic properties, providing valuable information on the orbital interactions and charge distribution.

Keywords: DRX, crystal structure, TGA/DSC, Hirshfeld surface analysis, UV-visible, DFT optimization

P12-C: Crystallographic and electronic structure characterizations of a supramolecular non centrosymmetric 2,6-Diaminopyridinium perchlorate

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The growing needs for new materials in the field of transport, storage, and information processing in particular, motivate laboratories to intensify research on compounds with suitable electro-optical properties. Hybrid organic-inorganic supramolecular compounds, belonging to the class I of hybrids [1], represent an interesting opportunity for the development of new materials in different fields of application, such as dielectrics, semiconductors, or NLO materials. In this context, we are interested in mixed hybrids salts of perchlorates combining aromatic amine. The synthesis of a supramolecular hybrid perchlorate salt using the aromatic amine 2,6-diaminopyridine afforded non centrosymmetric structure type [2]. The obtained material with formula (C5H8N3)ClO4 crystallize according to the monoclinic symmetry (S.G. P21). The observed supramolecular crystal structure, consisting of only weak interactions in all the three dimensions, built from hydrogen bonds and through Anion…π+ interaction, is rarely observed for similar compounds. The electronic and optical properties are characterized at the theoretical level using DFT; these characterizations demonstrate a large direct band gap and a high optical anisotropy in the visible range. Our results provide the essential information about structural, electronic and optical properties of (C5H8N3)ClO4, which are useful for guiding the future studies.

Keywords: Hybrid salt, supramolecular, electronic, optic, DFT calculations.

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P13-C: A DFT Study of structural, elastic, electronic and thermodynamic properties of Rb_2TiI_6 and Cs_2TiI_6 compounds.

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Halide perovskite semiconductors are attracting more attention due to their new outstanding photovoltaic and potentially in- expensive fabrication technology [1]. Perovskite materials A_2BX_6 have great interest for optoelectronic applications [2-4]. In this work we investigate electronic, structural, elastic and thermodynamic properties of A_2TiI_6 (A= Rb and Cs) using DFT-based Quantum Espresso, Thermo_pw package and Gibbs2 program [5-6]. Generalized gradient approximation in the Perdew-Burke-Ernzerhof (PBE) form is used in this work. The calculated lattice parameters are in good agreement with the experimental data values. The calculated band gaps for the studied compounds are 0.77 eV for Rb_2TiI_6 and 0.91 eV for Cs_2TiI_6, respectively. The band gap values exhibit strong alignment with those acquired through the HSE method (0.75 eV for Rb_2TiI_6 and 0.90 eV for Cs_2TiI_6). Studied compounds are thermodynamically stable. The calculated Pugh's and Poisson's ratios revealed that Rb_2TiI_6 and Cs_2TiI_6 are brittle materials. The resulting calculated heat capacity, C_V, at high temperature is egal to 224 J/mol.K for both studied compounds. Results presented in figure 2 are discussed in detail.

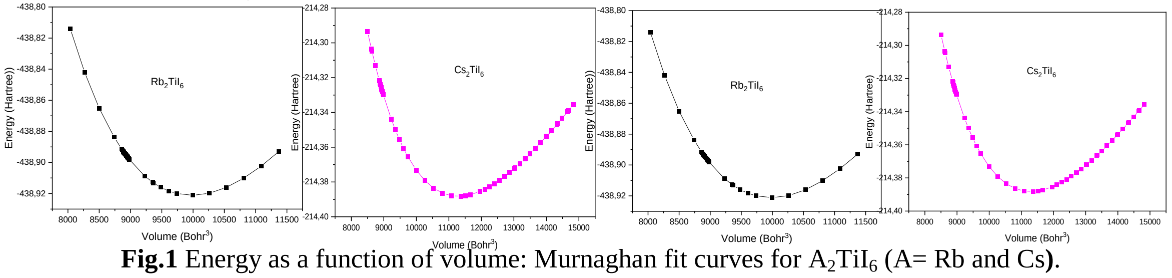

Fig.1 Energy as a function of volume: Murnaghan fit curves for A_2TiI_6 (A= Rb and Cs).

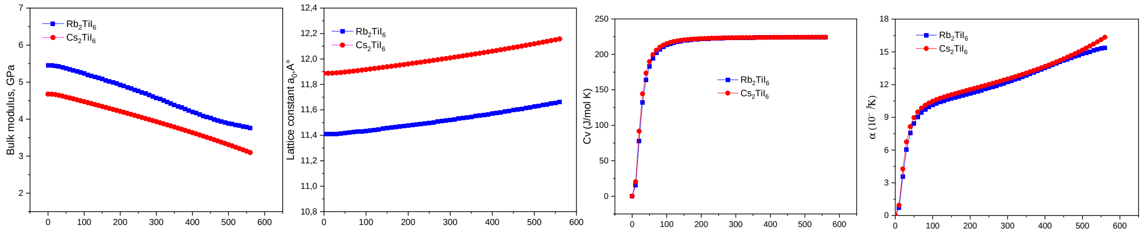

Fig.2 Lattice constants a_0 , bulk modulus, heat capacity C_V and volume expansion coefficient α versus temperature at zero pressure for A2TiI$_6$ (A= Rb and Cs).

Keywords: First principles, A2TiI$_6$, electronic structure, Elastic, Thermodynamic, Properties

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P14-C: A Novel 1D Cadmium-Based Perovskite: Synthesis, Structural Characterization, and Multifunctional Properties

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This research presents the synthesis and comprehensive analysis of a new one-dimensional polymeric chain perovskite compound, $(C_5H_6ClN_2)[CdCl_3H_2O]\cdot H_2O$. The study encompasses the synthesis, structural characterization, and physicochemical properties of this material, along with theoretical calculations and its biological implications. The compound was successfully synthesized through a slow evaporation process, and single-crystal X-ray diffraction revealed that it crystallizes in the monoclinic system (space group P21/n, no 14) with cell parameters a = 17.8596 (9) Å, b = 7.5766 (2) Å, c = 18.2245 (9) Å, and β = 95.068 (4)°. The crystal structure consists of infinite polymeric chains of $[CdCl_3\ H_2\ O]^n$, which align with organic cations to form layers parallel to the (10–1) plane, held together by hydrogen bonds and Van der Waals interactions. Hirshfeld surface analysis provided insights into the supramolecular assembly. Infrared spectroscopy confirmed the presence of the organic groups and their vibration modes. Optical studies indicated a semiconductor behavior with a relatively low bandgap of 2.8 eV, suggesting potential applications in tandem solar cells. The Arrhenius relation was applied to explain the material’s conductivity, while impedance spectroscopy data aligned well with an equivalent circuit model consisting of a resistance in series with two parallel circuits (R//CPE). The study also explored the chemical properties and nonlinear optical effects (NLO) of the compound. Molecular docking studies assessed interactions with breast, lung, liver, and colon cancer proteins, supplemented by PLIP analysis, and pharmacological properties were evaluated using Swiss-ADME analysis. Additionally, the antimicrobial efficacy of the cadmium complex, in combination with antibiotics, was tested against pathogenic microorganisms such as Klebsiella pneumoniae and Staphylococcus aureus, addressing the critical issue of antibiotic resistance.

Keywords: Cadmium complex, X-ray diffraction, Supramolecular assembly, Optical properties, Molecular docking, Nonlinear optical effects, Antimicrobial activity, Swiss-ADME analysis.

P15-C: Triazoles as HER2 Inhibitors to Overcome Brest Cancer Resistance

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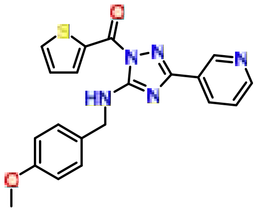
Cancer, a major global health issue, is a broad set of horrifying diseases characterized by unchecked cell growth. Activating the epidermal growth factor receptor (EGFR) promotes tumor development, invasion, and metastasis, making it a crucial component in epithelial malignancies. HER2 is a protein expressed at increased levels in 15% to 20% of breast cancers, and these tumors are referred to as HER2-positive breast malignancies. Triazoles are a significant category of heterocyclic compounds with interesting pharmacological properties. In this research, we attempt to find new drug candidates against breast cancer using in silico techniques. A database of 4000 triazole derivatives was screened against EGFR using HTVS, and the best compounds were further investigated for their potential as inhibitors for HER2 wild type along with the most common mutations that include D769Y, L755S, T798I, V777L, and Del755-759. The docking result showed that compound D116-0314 has a good docking score throughout all mutation and wild types with a docking score of -7.968 kcal/mol against HER2T798I compared to -6.321 kcal/mol of lapatinib. Molecular dynamic simulations revealed the stability of D116-0314 inside the active site of HER2T798I, suggesting promising activity toward breast cancer. In vitro testing and ADME profiling of the compound is under investigation.



D116-0314

Keywords: Docking, molecular dynamics, Cance, Drug design, HTVS

P16-C: Preparation, Spectroscopic Characterization and Solid State Molecular Structure of the acétato Iron(II) Meso-arylporphyrin Complex

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An iron(II) porphyrin–acetato complex [Na(2,2,2-crypt)] [Fe^{II}(TpivPP)(OAc)] (TpivPP = α,α,α,α–tetrakis(*o*-pivalamidophenyl)porphyrin known as picket fence porphyrin and 2,2,2-crypt is the cryptand-222) is synthesized, and spectroscopically and structurally characterized. The UV-visible and IR spectroscopic data are in accordance with acetato ferrous porphyrinates.

The X-ray structural analysis indicate that the Fe(II) cation is high-spin (S = 2) and has the $d_{xy}{}^{2}\ d_{xz}{}^{1}\ d_{yz}{}^{1}\ d_{z^2}{}^{1}(d_{x^2-y^2})^{1}$ ground state electronic configuration.

The average equatorial iron-pyrrole N bond length (Fe-N_p = 2.104(1) Å), the distance between the iron and the 24-atom mean plane of the porphyrin ring (Fe-P_C = 0.619(10) Å) and the distance between the iron and the plane made by the four pyrrole nitrogens (Fe-P_N = 0.592(16) Å) confirms the high-spin-state of the acetato derivative and shows that the coordination sphere of the iron atom is strongly affected by the asymmetric monodentate of the acetato axial ligand. This is probably due to the significant electronic repulsion of the $d_{x^2-y^2}$ and d_{xy} orbitals by the negative charge of the pyrrole N atoms.

Keywords: : iron(II) porphyrin; acetato complex; UV/Vis spectroscopy *;* X-rays diffraction.

D. Materials for civil Engineering

ORAL-D

O1-D : The Impact of Adding Phosphogypsum to Composite Materials on Mechanical Properties and Environmental Effects

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Participant's name: Prof. Noureddine Hamdi

Phosphogypsum (PG), an industrial by-product of phosphate production, has potential applications in civil engineering, provided its integration is well understood. The different mixing stages of composites play a crucial role in the final properties of the material. In this study, we mixed water, plaster, and standardized sand using two methods: before (M1) and after (M2) the addition of either raw or washed PG. The sand/plaster ratio (S/P) was set at 0.50, while the water/plaster ratio (W/P) varied between 0.75 and 0.90 in increments of 0.04. Mechanical property tests were conducted on fifteen mixtures. The results indicate that the maximum compressive strength (10.31 MPa) and flexural strength (3.16 MPa) were obtained with the M1 mix, containing 14.20 % PG and a W/P ratio of 0.90. Furthermore, the addition of PG allowed for a reduction of more than 16.00 % in the amount of plaster used, leading to significant cost savings and a reduction in environmental impacts, particularly through decreased CO_2 emissions during plaster production.

Key words: Plaster, Phosphogypsum, Mechanical properties, Environmental impact.

O2-D : Analytical characterization of cracks at a self-compacting concrete reinforced with GFRP/Steel bars

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Based on experimental pull-out test results of Sdiri et al [1] applied on a self-compacting concrete specimens reinforced with GFRP rebars, this contribution deals with the analytical study of a tension tie model in order to predict the crack patterns of concrete elements reinforced with GFRP rebars and steel Ones. At first, the first crack proprieties were determined: the transfer length; the crack widths and their spacings. Furthermore, the stress of the rebars and the concrete was deduced for the crack formation stage. It was deduced the reinforced concrete element with the GFRP rebar presents a longitudinal strain more than the strain determined in the steel reinforcement case. Hence, the GFRP reinforced element undergoes cracks more opened than the cracks presented in the reinforced steel element. At a final stage, an analytical prediction of the Stress-strain developments for GFRP/Steel reinforced element were elaborated and compared to the rebars behaviors.

Key words: concrete., GFRP, steel, crack

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O3-D : Utilization of Olive Solid Waste in Concrete: Effects on Structural and Thermal Properties

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The incorporation of agro-sourced materials in the construction sector is attracting growing interest. This study focuses on the use of Olive Solid Waste (OSW) in concrete production, with particular emphasis on waterproofing treatments applied to the OSW using lime, polyvinyl alcohol, cement, and Sikagard prior to concrete mixing. The research investigates the physical, mechanical, and thermal properties of OSW-based concrete, where conventional aggregates are partially replaced by 10%, 20%, and 30% of raw OSW, saturated OSW, and cement-treated OSW. The results indicate a reduction in both structural properties and workability of the concrete as the proportion of OSW increases. This decline in compressive and flexural strength becomes more pronounced at higher substitution rates. Nevertheless, a key finding of this study is the improvement in thermal conductivity observed in OSW-based concrete.

Key words: Concrete technology, Olive Solid Waste(OSW),waterproofing, mechanical properties, thermal behavior.

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O4-D : Optimization of Brick Formulation Using Mixture Design with Two Clay Types

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Bricks are among the oldest and most widely used construction materials, and they continue to play a crucial role in modern building practices. This study investigates the formulation of bricks using two types of clay, A1 and A2. Thermo-structural and geotechnical characterizations revealed that neither A1 nor A2 can be used alone for brick production, as they contain 18.5% and 33.7% sand, respectively. A mixture design approach was applied to optimize the brick formulation. The workable sand content intervals were identified as [0.6; 0.9] for A1 and [0.1; 0.4] for A2. Using an experimental matrix generated in Minitab, a two-component mixture design was performed with varying firing temperatures of 800°C and 900°C. The relationships between mechanical strength, shrinkage, porosity, and water absorption of the fired products, in relation to the proportions of A1 and A2 in the mixture were assessed. The optimization process resulted in an optimal formulation consisting of 60% A1, 40% A2, and a firing temperature of 800°C. The resulting technical properties of the fired brick, including strength and durability, meet the standards required in the clay brick industry, confirming the suitability of this formulation for various construction applications.

Keywords: Bricks, clay, mixture design, optimization, technical properties

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O5-D : Study of the impact of water associated with phosphogypsum on the physiochemical, geotechnical, and mechanical characteristics of two clay soils from Gabes region

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Due to the large stockpiles of phosphogypsum waste (byproduct of the phosphate industry), which require management because of their environmental hazard, this study examines the potential of using two soils from southern Tunisia as a natural impermeable barrier in landfills for these by products.

The effect of water associated with phosphogypsum on the soil samples was tested in the laboratory for several parameters: mineralogical characterization (via X-ray diffraction and infrared spectroscopy), chemical analysis (via X-ray fluorescence), and geotechnical proprieties (via Atterberg limits), and mechanical analysis (via direct shear tests and compressibility). A comparative study of the different parameters was carried out using tap water and water associated with phosphogypsum. The results showed changes in the physicochemical, geotechnical, and mechanical properties of the tested samples. Laboratory data indicated a significant decrease in shear strength cohesion in the presence of acidic water, with respective values of 77 kPa with tap water and 49 kPa with acidic solution for Soil-1, while an increase in cohesion was observed for Soil-2 (from 83 to 148 kPa). However, under the same conditions, compressibility was minimally affected for both soils: the compression index (Cc) of Soil-1 slightly increased from 0.354 to 0.359, while for Soil-2 it decreased from 0.201 to 0.164. The results suggest that the structure of the soils was influenced by the phosphogypsum solution, which could have implications for its use as a natural layer in phosphogypsum storage sites.

Keywords: Solid waste, storage sites, shear strength, clay, southern Tunisia.

O6-D : Nanocoating Technology for Enhancing compressed Earth Blocks

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This research investigates the application of nanocoating technology to enhance the durability of two traditional earth-based construction materials: compressed earth blocks (CEBs) and adobe blocks. These materials have long been recognized for their sustainability and low environmental impact. The study formulates and applies a specialized nanocoating, composed of carefully selected nano materials, to assess its impact on the structural integrity and longevity of both CEBs and adobe blocks.
Through comprehensive testing and comparative analysis between coated and uncoated blocks, significant improvements are observed in multiple key parameters. The coated blocks exhibit heightened resistance to environmental factors such as weathering, erosion, and moisture ingress. Structural strength and load-bearing capacity are notably enhanced, showcasing the potential of nanocoatings to reinforce and extend the lifespan of these traditional earth-based materials in contemporary construction practices.

This study underscores the transformative potential of nanocoating technology in augmenting the resilience and durability of traditional earth blocks, presenting a promising avenue for sustainable construction practices that leverage the strengths of time-honored building materials.

Keywords: Nanocoating, Nanomaterials, Ecoconstruction, compressed earth block, adobe block

O7-D : Effect of calcined clay on the fire behaviour of mortars.

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The use of pozzolanic materials has grown due to the desire to enhance the performance of cement-based materials. The use of natural calcined clay as supplementary cementitious materials to replace a portion of cement has become more and more intriguing. The purpose of its usage is to decrease the amount of cement used in mortars and concrete production, as well as to enhance the strength and durability of concrete construction. When concrete is exposed to elevated temperatures, serious damage may result. Therefore, this work aims to examine how elevated temperature and calcined clay at 600 °C for one hour of calcination can affect the mechanical and physical properties of cementitious composites. Thus, for this study, two high temperatures were chosen (220 °C and 550 °C). A different amount of supplemental cementitious material (5 %, 10 %, and 20 % by weight) was used for experimental tests. Weight loss and residual compressive strength were analyzed after exposure to high temperatures. According to the results, adding 10 % of calcined clay at high temperatures has a beneficial effect.

Keywords: high temperature, calcined clay, residual compressive strength, weight loss.

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O8-D : OPTIMIZATION OF THE RECYCLING WASTE INCORPORATION TO CEMENT MORTAR BY RESPONSE SURFACE METHODOLOGY

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Concrete is the most construction's material used in the world. However, the production of portland cement, an essential constituent of the concrete, leads to the release of a large amount of CO_2 (greenhouse gas). Environmental impacts play an important role in sustainable development of the cement and concrete industry; hence the need to replace part of cement by industrial waste and biosourced materials to reduce pollution caused by the cement industry is becoming a priority.

In this context, we would study the possibility of using egg shells powder , glass waste and Posidonia fiber ; as substitues to Portland cement.

The experimental design methodology, which allows the variation of several factors at the same time while reducing the number of tests and the time of realization, was adopted to conduct this work. The aim was to provide clarification and to able to establish mathematical models allowing the highlighting of the individual and combined effects of the factors .

This work will be based on a coupled multi-scale and multi-techniques approach assessing in details, the link with mechanical properties (flexion and compression tests), consistency tests , setting time , of synthetised materials to asses the revelance of these new cements.

The main objective is the development of an ecological cement respectful of the environment with improvement of these mechanical performances by using a response surface methodology (Doehlert Design).

O9-D : Behavior of fiber-reinforced concrete beams: material, normative and multi-scale approache

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Fiber Reinforced Concrete (FRC) represents a major development within the category of specialized concretes. During the last three decades, increasing numbers of investigations have been undertaken with the aim of improving knowledge of the mechanical behavior of FRC. However, in the absence of international standards and guidelines for the design of FRC members, it was difficult for FRC to gain wider acceptance as a solution with recognized structural value. Until recently FRC was used mainly to increase durability by crack control, and the possible structural benefits were largely neglected. This attitude has changed only gradually in the past decade with the publication of the national and professional committees design codes and recommendations [1]. In this paper, a fiber-reinforced concrete beam is studied using various approaches. The first approach is to consider fiber-reinforced concrete as high-performance concrete (HPC) coupled with a standard commonly used in Tunisia (e.g. BAEL or Eurocodes). The second is to use the fib Model Code. It introduced The basic principles governing the structural design of FRC elements made of regular concrete, following a performance-based design approach to fiber-reinforced concrete and provides detailed information on materials, fiber properties, test methods and design criteria [2]. The third approach is a multi-scale approach. A fiber and concrete cell are constructed, and its properties are fed into a global finite element beam model. Results from different approaches are presented and compared.

Key words: FRC, Fiber, Constitutive model, Model Code, Design.

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O10-D : Engineering composites in/for construction: use of Interfacial indentation test to study steel /concrete adhesion in reinforced Self-Compacting Concrete.

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To ensure reinforced concrete bars applications in more severe loading conditions, the contact between the steel bar and concrete must be strongly adhesive. This adhesion constitutes an important property for the use of reinforced concrete. That is why many techniques were developed with the aim of determining this property. Adhesion can be easily found out by standard pull-out test machine. However, in this work, the adhesion was measured for the first time using Interfacial Indentation test. In this work, given the lack of results obtained using the interfacial indentation test in the literature so that we can compare our results with, the alone alternative found is to compare them with those of the pull out test. Using reinforcing bars, adhesion was measured using Self-Compacting Concrete (SCC) and Normal Vibrated Concrete (NVC) specimens. The impact of water-to-binder ratio variations and concrete type on steel bar/concrete adhesion has been the incentive of the present study.As a main conclusion, interfacial indentation test can be more properly represent the actual Steel /concrete interface adhesion compared to the pull-out test, which is a more global test.

Keywords: Self-Compacting Concrete; Adhesion; Interfacial indentation test; Water-to-binder ratio.

O11-D : Innovative Approach to Sustainable Road Construction: Integrating Olive Mill By-Products for Enhanced Environmental Performance

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In Tunisia, the olive oil industry poses significant environmental challenges due to the large quantities and high pollutant load of its by-products: olive mill wastewater (OMW) and olive pomace (OP). Additionally, road construction is a resource-intensive industry, consuming significant amounts of high-quality water and non-renewable materials. This study investigates the use of OMW and OP as substitutes for water and aggregate base materials in road construction, offering a potential solution to mitigate water scarcity and reduce the depletion of mineral resources, all within the context of sustainable development. The effects of organic matter from olive mill wastes on the environmental, physical, and mechanical properties of the innovative road materials were also examined. The results show that substituting the aggregate base with olive pomace (OP) increases the optimum water content while reducing the dry density at Proctor optimum. California Bearing Ratio (CBR) tests revealed that, at substitution rates of 10% and 20% OP, the Immediate Bearing Index (IBI) decreased by an average of 58% compared to the control value of 113.2 for the aggregate base. The organic matter content in mixtures containing 10% and 20% pomace was measured at 4.5% and 9.4%, respectively. On the other hand, using diluted olive mill wastewater (OMW) as compaction water at concentrations of 10% and 20% led to increases in the IBI of 27.5% and 63.2%, respectively. Additionally, the organic matter content remained within acceptable limits for road construction standards, ranging from 2.2% to 4.4%.

Key words: Road construction, olive mill wastewater (OMW), olive pomace, organic matter

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O12-D : High-Performance Concrete (HPC): A Revolution for Organic Forms and Art

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High-performance concrete (HPC) is revolutionizing both architecture and contemporary art by providing innovative solutions for the design of complex and organic forms. This presentation offers an in-depth exploration of the technical characteristics of HPC, such as its enhanced compressive strength (> 100 MPa), exceptional durability, and malleability. These qualities allow for the surpassing of traditional construction material limitations, paving the way for groundbreaking architectural and artistic achievements.

In the context of organic-shaped buildings, HPC enables the realization of fluid structures that meet both aesthetic and functional requirements in terms of insulation, weather resistance, and thermal performance. The use of fiber-reinforced composite materials, such as GFRC (Glass Fiber Reinforced Concrete), and the incorporation of nanoparticles (e.g., silica fume and superplasticizer admixtures) improve the mechanical and aesthetic performance of these constructions while also reducing their carbon footprint.

In the field of art, HPC provides artists and designers with new opportunities to create durable sculptures and installations that are weather-resistant and capable of capturing intricate forms with a high level of detail. Research into chemical admixtures, such as latex polymers and reinforcement fibers, also enhances the adhesion and finish quality of these artistic pieces.

Finally, this presentation will highlight real-world examples from the practice of *Ismant Concrete Design*, a company specializing in the creation of concrete design objects. These examples will demonstrate how HPC technologies are applied not only in the realm of organic architecture but also in the production of small series of functional art objects and furniture, combining robustness, aesthetics, and durability.

O13-D : Use of Mixture Design Approach for the Optimization and Performance of Cost-Effective Cementitious Quaternary System: Portland Cement–Fly Ash–Silica Fume–Phosphogypsum

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This research aims to save environment from pollution with recycling solids wastes materials especially fly ash, silica fume and phosphogypsum as partial replacement of Portland cement in order to improve more the mechanical strength of ordinary Portland cement and to accelerate the initial setting time for specific applications. Based on response surface methodology, a compromise between setting time, compressive strength and flexural strength was successfully found and the optimum proportions of different constituents are as follows: 85.3% of cement, 3% of purified phosphogypsum, 6.7% of silica fume and 5% of fly ash. These conditions allow the development of cement with initial setting time of 111.2 min, compressive strength of 49.54 MPa and flexural strength of 18.85 MPa which are more important than that of the ordinary Portland cement.

Keywords: Portland cement, Mixture design, Fly ash, Phosphogypsum, Silica fume, Mechanical strengths

POSTER-D

P1-D: Potential of Phosphogypsum in Civil Engineering Composites: A Study of Mechanical Properties

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Phosphogypsum “PG”, an industrial by-product of phosphate production, presents promising potential for civil engineering applications, provided that its conditions of use are optimized. The preparation steps of composites play a crucial role in their mechanical performance. In this study, we conducted physical, morphological, and chemical characterizations of the materials, before proceeding with the mixing of water, Tunisian plaster, and standardized sand. Two methods were tested: a first mix (M1) before adding PG, and a second (M2) after incorporating PG, either raw or washed. The water/plaster ratio (W/P) was maintained at 0.75, while the sand/plaster ratio (S/P) varied from 0.00 to 0.50 in increments of 0.12. Tests conducted on fifteen formulations showed that the maximum compressive strength “CS” (14.06 MPa) and flexural strength “FS” (2.81 MPa) were obtained with the M2 mix, containing 9.70 % PG and an S/P ratio of 0.37. However, with the addition of washed PG, a significant decrease in CS (45.86 %) and FS (18.27 %) was observed for this ratio. Therefore, to optimize performance, regardless of the state of the PG, an S/P ratio of 0.50 is recommended for future research.

Keywords: Plaster, Phosphogypsum, Compressive strength, Flexural strength.

P2-D: Cement Kiln Dust (CKD): An Economical Alternative for Stabilizing Drilling Muds, Cuttings, and Petroleum Solid Wastes

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This research focuses on the stabilization and solidification of water-based drilling mud and petroleum solid waste at the petroleum site of Sidi-El-Itayem, as well as cement kiln dust (CKD) from the Gabes cement factory in Tunisia. Seven sets of samples, comprising Mud/Binders and Petroleum Solid Waste (PSW)/Binders, were prepared with a water-to-binder ratio (W/B) of 0.50.

The evaluation of the consolidated products, through leaching tests, short- and long-term compressive strength tests, and Wetting/Drying tests, indicates that the cemented matrix effectively adsorbs and encapsulates pollutants. This leads to a significant reduction in the concentrations of toxic elements in the leachate solutions.

Key words: **C**ement, stabilization, solidification, pollution control, waste treatment, drilling mud, petroleum solid waste, CKD.

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P3-D: Formulation and characterization of an eco-concrete: incorporation of resources with a low environmental footprint.

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In the interest of environmental protection, it seems that the time has come to explore the possibility of recycling all environmental waste entering the composition of concrete, and what is known as environmental or low-carbon concrete has become a contentious issue. In the construction sector in recent years, with the increasing awareness of environmental impact, our problem is that buildings and infrastructure continue to grow, and it is necessary to make our buildings human and environmentally friendly, including preserving our planet. Because buildings generally consume more cement, this material has Specific risks such as:

- Impact on the oceans represented by carbon dioxide emissions
- Technical difficulty in preparing these materials
- Sharp increase in the benchmark price

In this work, basing ourselves on how to obtain low-carbon or ecological concrete, including the possibility of estimating the value of waste, in the field of construction, including the formulation of self-compacting concrete. We hope to achieve unprecedented performance, achieving environmental balance at the lowest appropriate level. Cost. Therefore, in our research, we addressed the use of specific waste from Ain Temouchent, which were recycled and incorporated into the composition of concrete, resulting in reducing the amount of cement and replacing it with waste represented by (glass, vases, and brick waste). The obtained concrete is then subjected to tests in fresh and hardened states, and its strength is compared to the reference concrete.

Key words: recycling, self-compacting concrete, low-carbon, fresh state, hardened state, Resistance.

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P4-D: Magnesium/Carbon Nanocomposites as Promising Adsorbents to Removal of Heavy Metals in Polluted Water

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Carbon nanofibers (CNFs) have a wide range of applications across various fields due to their unique properties. Their high surface area and unique structural properties make them effective in catalyzing reactions in fields such as fuel cells, water purification, and chemical synthesis. Water pollution has become a critical issue around the world, and heavy metals contribute to major pollution in water. The magnesium/carbon nanocomposites through the arc plasma method with different currents 50, 75, and 100 A in Double distilled and de-ionized water (DDDW). Transmission electron microscope images (TEM), UV visible spectrophotometer, X-ray diffraction (DRX), Fourier-transform infrared spectroscopy (FTIR), and other analytical methods were used to characterize the properties of the prepared Nanomaterials. The AAS analyses showed that the Mg-NPs coated CNFs can adsorb the heavy metals in polluted water. The concentrations of Pb, Cu, Zn, and Mn in 100mL polluted water in the tested 100mL polluted water were 0.06, 0.024, 0.05, and 0.01mg/L, respectively. It was demonstrated that the merged sample of nanocomposites of magnesium nanoparticle-coated carbon nanofibers in the polluted water significantly reduced the concentrations of Pb, Cu, Zn, and Mn, which achieved the values of 0.019, 0.013, 0.011, and 0.007 mg/L. These results provide the efficiency of magnesium/ carbon nanocomposites in water treatment and research ideas for environmental applications were prepared for this phenomenon as Heavy metals adsorbent.

Keywords: arc plasma, carbon nanofibers, Magnesium nanoparticles, water pollution, Heavy metals, adsorbent

P5-D: OPTIMIZATION OF THE RECYCLING WASTE INCORPORATION TO CEMENT MORTAR BY RESPONSE SURFACE METHODOLOGY

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Currently , Cement is one of the most consumed materials in the world. The construction sector, through the massive use of concrete, is responsible for 5 to 10% of global carbon dioxide emissions.

In that scope, cement industry is turned towards the development of news binders which could replace Portland cement , the main component of concretes.

In this project, we would study the possibility of using polyurethane waste and Optunia Ficus indica , mainly cladode powder and cladode juice , as substitutes to Portland cement.

The aim is not to invent a new technology but to optimize synergy between these compounds in developing new binder matrix.

This work will be based on a coupled multi-scale and multi-techniques approach assessing in details, the link with mechanical properties (flexion and compression tests), setting time , of synthetised materials to asses the revelance of these new cements.

In the best to our knowledge , The main objective is to examine the impact of partially replacing Portland cement with OFI cladods (powder and juice) and polyurethane foam powder on various aspects of the performance of mortar and to provide an initial experimental exploration of utilizing experimental design methodology (Doehlert Design).

P6-D: Static Fracture Mechanics Properties Determination of Self-Compacting Concretes Using Instrumented Indentation Tests

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The main objective of this paper (whose principal results are experimental) is threefold:
1- To show that the fundamental characteristics of the concrete, namely fracture toughness (K_{IC}), can also be determined experimentally from the slopes of the graphs ($C_{3/2}$ = f (P)) deduced from load-displacement (P = f (h)), using the instrumented indentation test.
2- To study of the water to binder (w/b) ratio effect on this fracture parameter.
3- To compare between fracture parameter of self-compacting concrete (SCC) and normal Vibrated concrete (NVC) with same compressive strength.
For this purpose, five mixing compositions of self-compacting concrete (SCC) with different water/binder ratios of 0.33 to 0.41 (water/cement ratio = 0.44 to 0.56) and two mixing compositions of normal vibrated concrete (NVC) were prepared. The fracture behavior of both (SCCs) and (NVCs) with laboratory-size specimens under instrumented indentation test (IIT) was investigated. It was found that the fracture toughness values of self-compacting concrete increased with decreasing of (w/b) ratio. The largest values of the stress intensity factor K_{IC} was showed by concretes with the lowest (w/b) ratio (w/b = 0.33, the case of SCC5). Moreover, it is confirmed that self-compacting concretes exhibit good fracture toughness than those of normal vibrated concretes at same compressive strength. The obtained results indicated that there is a remarkable relationship between the water/binder (water/cement) ratio, fracture behavior and mechanical properties of these materials. It is shown that the instrumented indentation technique can be very useful for determination of fracture parameters.

Keywords: self-compacting concrete; Critical stress intensity factor; Fracture toughness; Water to binder ratio, Indentation tests. Crack.

P7-D: Optimizing Sustainable Gypsum Composites Reinforced with Reused Waste Materials

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This study aims to optimize and develop an innovative gypsum material by incorporating hybrid waste compounds. First, a preliminary study was conducted on three types of gypsum reinforced with different waste materials: paper, polystyrene, and polyester. The results revealed that gypsum developed using all three wastes achieves a good balance for optimizing mechanical and physical properties, which is superior to using these residues separately with gypsum. Next, the Design of Experiments (DoE) and Response Surface Methodology (RSM) concepts were introduced to develop, optimize, and compare waste's effect on gypsum. The optimal formulation parameters resulted in a significant 33% reduction in bulk density, a 43% reduction in thermal conductivity, a notable 42% increase in flexural strength, and a significant reduction in compressive strength by approximately 50%, while still meeting the 2 MPa standard. The new samples exhibit ductile behavior, highlighting gypsum's potential as a load-bearing material with excellent thermal insulation properties and impressive fire resistance. This research significantly enhances our understanding of the efficiency of a gypsum composite incorporating hybrid waste, aligning this approach with sustainable development goals.

Keywords: Gypsum, Composite Materials, Physico-mechanical Properties, Fire resistance, Circular economy, Sustainable Development

P8-D: Examining the effects of lime treatment on the behaviour of an expensive soil

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Saline soils pose one of the most significant challenges in soil science worldwide, particularly in Algeria where they cover vast areas. While various solutions have been proposed to remediate saline lands for construction purposes.

This study investigates the potential of lime stabilization to improve the geotechnical properties of saline soil from Chott El-Hodna, Algeria. Results from identification and mechanical tests indicate that the addition of lime significantly enhances the consistency, bearing capacity, and compressive strength of the clay, offering a promising solution for the remediation of saline soils.

Keywords: Saline soils, lime, stabilization, consistency, compressive strength.

E. Polymer Science & Engineering materials

ORAL-E

O1-E : Techno-functional characterization of gelatin extracted from the smooth-hound shark skins: Impact of pretreatments and drying methods

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Gelatin derived from marine by-products could be an interesting alternative to classic mammalian gelatin. The pretreatment and extraction conditions could influence the size of the resulting peptide chains and therefore their techno-functional properties. Thus, it is important to optimize the production process to get a gelatin for the appropriate applications. Skin pretreatment was done by microwaves or oven-drying and the extracted gelatin was dried by spray- or freeze-drying. Freeze-dried gelatin extracted from untreated skin (FGUS) had the highest gelatin yield (10.40%). Gelatin proximate composition showed that proteins were the major component (87.12–89.95%), while lipids showed the lowest contents (0.65–2.26%). Glycine showed the highest level (299–316/1000 residues) in the extracted gelatins. Proline and hydroxyproline residues of gelatins from untreated skin were significantly higher than those from pretreated skin-gelatin. FTIR spectra were characterized by peaks of the amide A (3430-3284 cm−1), B (3000-2931 cm−1), I (1636–1672 cm−1), II (1539–1586 cm−1) and III (1000–1107 cm−1). Spray-drying decreased the gelling properties of gelatins, since it reduced gelling and melting temperatures compared to freeze-drying. Skin pretreatment significantly reduced the gel strength of gelatin by about 50–100 g depending on the gelatin drying method. The FGUS showed better surface properties compared to other gelatins. The highest emulsion activity index (39.42 ± 1.02 m2/g) and foaming expansion (172.33 ± 2.35%) were measured at 3% FGUS. Therefore, the promising properties of freeze-dried gelatin derived from untreated skin, gave it the opportunity to be successfully used as a techno-functional ingredient in many formulations.

Keywords: Smooth-hound shark (Mustelus mustelus) skin; Drying; Gel strength; Foaming property; Emulsifying property

O2-E : Structure and physical properties of Kappa/iota hybrid carrageenan microgel extracted from red algae

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Hybrid-carrageenan hydrogels are characterized using novel techniques based on high-resolution speckle imaging, namely image dynamic light scattering (IDLS) and ultra-small-angle light scattering (USALS). These techniques, used to probe the microscopic structure of the system in sol-gel phase separation and at different concentrations in the gel phase, give access to a better understanding of the network's topology on the basis of fractals in the dense phase. Observations of the architecture and the spatial and the size distributions of gel phase and fractal dimension were performed by USALS. The pair-distance distribution function, P(r), extracted from USALS patterns, is a new methodology of calculus for determining the network's internal size with precision. All structural features are systematically compared with a linear and non-linear rheological characterization of the gels and structure-elasticity relationships are identified in the framework of fractal colloid gels in the diffusion limit.

Key words: hybrid carrageenan; image dynamic light scattering (IDLS); ultra-small-angle light scattering (USALS); pair-distance distribution function P(r); rheology; strain hardening.

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O3-E : The effect of varying casting solution on the microstructure and mechanical properties of polycaprolactone films

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This study aims at studying the effects of addition of oils and alkanes to the casting solution on the morphology and thermos-mechanical properties of polycaprolactone films. Several types of terpenes and alkanes including pinene, limonene, castor oil hexadecane and cyclohexane were added to the polymer casting solution. The polymer films were fabricated through casting films onto a mold and evaporation in air. The addition of the oils significantly affected the morphology and thermal and mechanical properties of the films. Dense and nonporous films were obtained without adding oils to the casting solution. Addition of most of the oils produced films with porous microstructure, except for the films prepared with cyclohexane and castor oil. In terms of mechanical properties, neat PCL films (i.e. without oils) and those prepared with cyclohexane were the strongest among other films with a tensile strength of about ~ 11.5 MPa, followed by pinene and limonene with a tensile strength of about 7 and 6 MPa for, respectively. The weakest films were obtained with hexadecane at tensile strength of ~ 3.5 MPa. Fims prepared with limonene showed the highest elastic modulus (~ 350 MPa), followed by cyclohexane (~ 150 MPa), and castor oil and hexadecane (~65 MPa). All films showed high ductility with an elongation at break of (> 400%). The addition of oil slightly affected the thermal transition temperatures of the films with melting temperatures (55-59 ^{o}C), glass transition temperature around (-60 ^{o}C). Films prepared with terpenes shoed highest degree of crystallinity compared with other films, whereas the lowest crystallinity was obtained with castor oil.

Keywords: Oil, morphology, thermal properties, mechanical properties, Polycaprolactone; film casting.

O4-E : Experimental and theoretical investigations on the photophysical and electronic properties of new synthesized organic small molecule for optoelectronic applications

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A new π-conjugated system using a Wittig reaction was chemically synthesized. The chemical structure of the synthesized molecule named 1,4-Bis((*E*)-2-(1-methyl-pyrrol-2-yl)vinyl)benzene (**BisPyrBz**) was supported by Fourier transform infrared spectroscopy. The optical properties were investigated first using optical absorption (O.A) and steady-state photoluminescence (PLs) tools. Otherwise, transient photoluminescence (TRPL) and quantum yield measurements (PLQY) are present in a diluted solution and condensed state. Theoretical investigations on the synthesized molecule were performed using density functional density (DFT). Experimental and theoretical data show the formation of a planar π-conjugated system. The obtained molecule presents a blue emission with high PLQY, at around 35% in the solution state. The emission is red-shifted to the green color, with a drastic decrease of the PLQY to around 1% indicating a possible aggregation-caused quenching behavior in the condensed state. The use of the synthesized **BisPyrBz** as a π linker in a newly designed A-π-D small molecule permits to obtain a newly near-infrared absorbing material with a weak energy gap $Eg = E_{LUMO} - E_{HOMO}$, which is at around 1.93 eV, and a weak optical band gap which is estimated to be 1.67 eV.

Keywords: π-conjugated system, optical absorption (O.A), steady-state photoluminescence (PL), dye, density functional density (DFT).

O5-E : Synthesis of PVP/PEG hydrogel and optimization of reagents proportion using a mixture experimental design

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This work is devoted to the synthesis of a hydrogel and the study of its porosity in order to be used to encapsulate an active ingredient. Hydrogel was synthesized in different proportions based on a mixing plan developed by the NemrodW software. Hydrogels were synthesized using gamma ray radiation at a dose rate of 25 kGy sufficient to sterilize samples [1].

For the characterization of samples, we performed gelification experiments followed by hydration and dehydration behavior analyses of synthesized hydrogels.

It was found that with sample 9 composition, we reached almost 90 % of gelification due to the absence of PEG in hydrogel composition and that the better gelification percentage reached in the presence of PEG is 59% for sample 28 [2].

Key words: NemrodW software, hydrogel, crosslinking, hydration, dehydration

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O6-E : Optimization of PC/ABS/PMMA blends using mixture design

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Due to their chemical stability, versatility, lightweight, and lower cost compared to metals and ceramics, plastics have become ubiquitous in modern life [1]. In 2019, global plastic production reached approximately 368 million metric tons. However, only 9% of this production was recycled, while 12% was incinerated, and the remaining 79% accumulated in landfills or the environment [2] [3]. Recycling offers a promising solution to mitigate this carbon footprint. This study focuses on the recovery and recycling of plastics from end-of-life computers. Specifically, mixtures of polycarbonate (PC) and acrylonitrile-butadiene-styrene (ABS) were selected. Various PC/ABS blends, with and without the inclusion of a coupling agent poly(methyl methacrylate) (PMMA) were produced using a contra-rotating twin-screw extruder, followed by injection molding. The optimal blend formulation was determined through an experimental approach using mixture design techniques.

Keywords: polycarbonate, poly(methyl methacrylate), Poly(acrylonitrile/butadiene/styrene), coupling agent, mixture design, twin-screw extruder, injection moulding

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O7-E : Advanced Antifouling Polysulfone-Based Hybrid Membranes for Cadmium Removal Efficiency

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In this study, hybrid ultrafiltration membranes were developed using the phase inversion method, incorporating Tween 20 as a surfactant, PEG as a pore-forming agent, and zeolite-Y at varying concentrations (1 and 3 wt.%) as an adsorbent. SEM and AFM analyses revealed that integrating zeolite-Y into the selective layer significantly increased surface roughness and enhanced hydrophilicity, leading to notable improvements in antifouling properties. The membranes demonstrated reduced fouling tendencies, which contributed to their enhanced operational stability. Additionally, thermal and mechanical evaluations showed that the modified polysulfone membranes exhibited superior structural integrity and durability.

The study also assessed the membranes' performance in cadmium removal, with zeolite-Y enhancing adsorption and ion-exchange processes. Membranes containing 1 wt.% zeolite-Y achieved a cadmium removal efficiency of 82% and maintained effective performance even after multiple regeneration cycles, showcasing their reusability. These findings highlight the membranes' potential for sustainable and efficient heavy metal removal in water treatment applications, emphasizing their longevity and reduced fouling characteristics.

POSTER-E

P1-E: SYNTHESIS OF MIXED POLYMER-NANOPARTICLE MATRIX MEMBRANES

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the current trend is to develop new materials and membrane structures in order to reduce fouling effects hydrophilic membranes tend to swell in water, which results in a loss of mechanical strength and saves a reduction in retention. biocompatibility and other specific functions. In our work we have manufactured PES membranes, by varying the mixture of collodion solution, with ZnO nanoparticles and MoF.

The physicochemical characteristics in summer carry out the manufactured membranes have perform permeability and retention tests. these membranes were characterized by FTIR and SEM and ATG and ATD to determine functions and morphologies.

To determine the selectivity of these elaborate membranes, they were placed in a cell with two compartments into which solutions are introduced a mixture of copper, nickel and zinc metal ions.

Keywords: Membranes, polymer, polyelectrolyte, nanoparticle and metals

P2-E: Elaboration and characterization of a polyanion-protein complex

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The aim of this study is to determine the hydrodynamic radius of four characteristic pH values ($pH_{\varphi1}$, pH_c, $pH_{\varphi2}$, pH_{opt}).in order to determine the autocorrelation function. The analysis of these results provides us with information on the different states of complex formation of a strong polytectrolyte and a globular protein on the structure, dynamics and stability of the mixture variation in the amount of protein influences the shrinkage process of the NaPSS chain adsorption of the protein onto the NaPSS backbone by binding called patches is affected by the presence of repulsive electrostatic interactions of neighboring proteins.

Key words: DLS, polyelectrolyte, NaPSS, protein, ovalbumin, hydrodynamic radius.

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P3-E: Study of a protein/polyelectrolyte complex (PSSMA/OVA) by SALS

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This research aims at achieving several major objectives: determining the radius of gyration, assessing the system's state, analyzing the domain and intensity of diffusion by establishing specific conditions through turbidity studies, while maintaining interactions beyond this formation phase. Analyses were conducted using two complementary techniques: UV-VIS spectroscopy and Small Angle Light Scattering (SALS or DLPA). The results highlight the main conclusions of the research, turbidity measurements revealed four significant pH values at the core of our investigations (pH_c, $pH_{\varphi 1}$, pH_{opt}, and $pH_{\varphi 2}$). Characterizing the acidic PSSMA-OVA mixture based on pH measurements allowed the plotting of curves of I versus q and ln(I) versus ln(q) using specialized software such as ImageJ and Origin, along with images obtained through DLPA. These curves, reflecting the system's state, facilitated the measurement of the radius of gyration using the specific software BioXTAS RAW, compared to expected results for other similar complexes. The unexpected discovery of the optimal pH (R_G = 1.16 µm) suggests aging of the sample, in addition to the diffusion domain D_f = 0.15. The confirmation of these results by the sample's turbidity at this pH reinforces our conclusions, although this turbidity should remain maximal.

Keywords: Protein-polyelectrolyte complex, OVA-PSSMA, SALS, turbidity, UV-VIS spectroscopy, specific pH values, pH_{opt}, R_G, D_f.

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P4-E: Physico-mechanical and barrier properties of edible gelatin film from camel skin

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Physicochemical properties of edible films based on cuttlefish skin gelatin extracted without (G0) or with different concentrations of pepsins (5 (G5), 10 (G10) and 15 U/g of skin (G15)) were investigated. Edible films prepared with partially hydrolyzed gelatins had lower tensile strength (TS) and elongation at break (EAB), but higher water vapour permeability (WVP) and water solubility than the control film. FTIR spectra of obtained gelatin films revealed a significant loss of molecular order of the triple helix. In addition, differential scanning calorimetric (DSC) analysis indicated that partially hydrolyzed gelatine films exhibited lower transition temperature and enthalpy compared with those of control film. The properties of the films were related to their microstructure, which was observed by scanning electron microscopy. Films with G0 and G5 had a smooth surface and a more compact structure, while films prepared with G10 and G15 had coarser surface. Thus, the chain length of extracted gelatin directly affected the properties of corresponding films.

Keywords: Edible gelatin film; Enzymatic treatment; Microstructure.

P5-E: Amphiphilic covalent hybrid hydrogels from PEG/PLA-based thermoreversible networks

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Being a hydrophilic, biocompatible and a FDA-approved material, polyethylene glycol (PEG) is one of the most commonly applied polymer in pharmaceutical and biomedical applications. Nevertheless, this polymer is not biodegradable, which limits its applications in biomedical fields [1]. In this respect, combining PEG with polylactic-acid (PLA), a biobased, biocompatible and biodegradable polyester [2], represent a potential solution to enhance its utilization in regenerative medicine and tissue engineering. In this study, a series of thermosensitive PEG-PLA hydrogels were synthesized through the Diels-Alder reaction with tunable hydrophilicity and hydrophobicity.

The Diels-Alder reaction (DA) was used as a friendly approach for the preparation of hydrogels with high selectivity, reduced derivatives and under mild reaction conditions. This chemical reaction occurs between a conjugated diene and dienophile [3]. Herein, PEG was end-functionalized with furan groups (diene), whereas, PLA was grafted with maleimide moieties (dienophile). The designed polymers were allowed then to react with each other via Diels-Alder chemistry in a solvent free process and gave with success the expected hybrid networks. Hydrogels were thereafter obtained after immersion in water.

The success of using Diels-Alder reaction was proved by rheological studies, confirming the formation of cross-linked networks and its thermal dependence. Swelling measurements revealed that the chemical composition influenced the swelling and the water diffusion mechanism of hydrogels.

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P6-E: Synthesis and Properties of Biobased Aliphatic Anionic Oligoesters

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In the last years, the incorporation of sulfonated units in the structure of biobased aliphatic polyesters such as poly (butylene succinate) and poly (butylene adipate) received great interest from several research projects [1]. They are among the most promising materials for biomedical applications and environmental protection [2], [3]. In this context aliphatic Biobased sulfonated oligoesters with 10 to 30% of sulfonated units were successfully synthesized by melt polycondensation of biobased monomers such as diethyl succinate, z-octadec-9-enedioic acid, dimer fatty acid, sodium (sulfonated dimethyl succinate), and various diols like 1,4-butane diol and isosorbide. The structures of the resulting oligoesters were investigated by ^{1}H NMR and their regular structures were evidenced. Thus, the MALDI-TOF MS analysis showed the presence of expected linear species but also cyclic species resulting from cyclisation reactions commonly observed in polycondensation. It was also highlighted that end groups are in majority hydroxyl but that acid functions can also be detected. The thermal analysis (DSC, TGA) indicates that the resulting oligoesters are amorphous or semicrystalline that essentially depend on the nature of monomers. Films of oligoesters treated in acidic, basic, and natural media at 37°C over the period of four weeks show that the remaining weight depends essentially on the composition of oligoesters. This study allows tuning their properties as a function of the final applications.

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F. Advanced Materials for Medicine, Agriculture and Food Safety

ORAL-F

O1-F: Assessing Nanographene Oxide Toxicity in Endothelial Cells: A Step Towards Enhancing Nanocarriers for Targeted Drug Delivery in Cerebral Cavernous Malformations Treatment

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Cerebral Cavernous Malformations (CCMs) are vascular abnormalities in the brain and central nervous system, characterized by enlarged capillary channels that can bleed and cause neurological symptoms such as headaches, paralysis, and seizures. Surgery is the primary treatment but carries risks of severe complications. Conventional drug delivery systems face challenges in targeting CCM specifically. Nanocarriers, like Nanographene Oxide (NGO), offer a promising alternative. NGO, with its unique properties, was fabricated and tested on Human Umbilical Endothelial Cells (HUVECs) and in Sprague-Dawley (SD) rats. The optimal NGO size was 100 nm, and it did not adversely affect cell viability or proliferation for the first three days as demonstrated by cell proliferation counting, Lactate Dehydrogenase (LDH) cytotoxicity assay, or (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assays. However, some cell detachment occurred by day four. In vivo testing in rats showed no significant toxicity in blood or brain tissues

O2-F: Eco-Friendly Synthesis of Superparamagnetic Iron Oxide-Gold Core-Shell Nanoparticles for Enhanced MRI and CT Imaging of Triple-Negative Breast Cancer - Early Detection Applications.

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Cancer remains a significant global health concern, with breast cancer, particularly triple-negative breast cancer (TNBC), ranking as a leading cause of mortality among older women worldwide. TNBC, comprising approximately 20% of invasive breast cancers, is notably associated with younger age demographics.[1] Despite advancements in diagnostic imaging modalities such as MRI, CT, PET, and mammography, early detection remains a considerable challenge due to various limitations, including high radiation exposure in PET and CT, elevated false-positive rates, and limited sensitivity in mammography.[2] MRI and CT stand out as premier noninvasive imaging modalities, offering superior spatial resolution and exceptional soft tissue imaging capabilities.[3] Enhancing the efficiency of prognosis and early detection is paramount to improving TNBC treatment outcomes and reducing associated mortality rates.[4] Addressing this critical need drives ongoing efforts to enhance medical imaging strategies and contrast agents for improved tissue characterization. Metallic nanoparticles, including gold and iron oxide nanoparticles, have garnered significant interest in biomedical applications due to their unique biological and physicochemical properties.[5] Gold nanoparticles (AuNPs) exhibit favorable physical and chemical characteristics, particularly in medical imaging enhancement.[6] Iron oxide nanoparticles demonstrate superparamagnetic properties, making them promising candidates for MRI enhancement. Traditional synthesis methods for metallic nanoparticles often involve chemical reduction, posing concerns related to environmental pollution, energy consumption, and potential toxicity.[7] This study aims to employ green and eco-friendly synthesis methods using Ficus Carica Latex extract as a reducing and stabilizing agent to fabricate superparamagnetic core-shell iron oxide-gold nanoparticles (Fe_3O_4@Au NPs). The iron-oxide core provides superparamagnetic properties suitable for MRI enhancement, while the gold shell offers distinctive attributes, including high atomic number and remarkable photothermal conversion rates, making it ideal for CT enhancement. Utilizing these multifunctional nanoparticles aims to enhance the early detection of TNBC through both CT and MRI imaging modalities. The proposed green synthesis approach promises simplicity, rapidity, safety, eco-friendliness, biocompatibility, and cost-effectiveness, thereby broadening the clinical and biomedical applications of these nanoparticles.

Keywords: Superparamagnetic nanoparticles, Green synthesis, Iron oxide-gold core-shell, MRI and CT imaging, Triple-negative breast cancer detection.

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O3-F: Carbonaceous Nanomaterials for Electrochemical Sensing of Pesticides

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In today's agriculture, pesticides play a part in meeting the demand for population growth. However, pesticides are utilized for more than just agriculture; they are extremely hazardous to the environment and human health due to their highly poisonous nature. Therefore, when they are used widely and without safety precautions, they have a detrimental effect on farmers and cause social unrest.

In this study, we report an electrochemical sensing method that can detect cymoxanil fungicide at low concentrations. It is less expensive, extremely sensitive, and non-selective. We have performed various electrochemical experiments using two types of carbonaceous nanomaterials on GC electrodes: quasi-amorphous carbon (activated Biochar micro nano-system) and nanostructured carbon (f-MWNTs and Graphene oxide). Because of the high capacities of these selected carbonaceous nanomaterials due to their specific surface area and functional groups, the modified electrodes have improve the pesticide sensor performance. Their enormous surface-to-volume ratio aspect, great mechanical strength, outstanding electrical conductivity, quick electron transfer kinetics, and environmental friendliness all contribute to their electrochemical sensing capabilities.

Furthermore, the electrochemical tests conducted on the targeted analyte under optimal conditions were carried out using appropriate cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) techniques.

Keywords: Biosensor, Biochar, Carbon nanotube, Graphene oxide, Fungicide.

O4-F: Rheology of wheat flour dough enriched with dietary fibers: a structure-function relationship study

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Nowadays, consumers demand dietary fiber-enriched bakery products of appropriate organoleptic features, owing to their growing awareness concerning the health benefits of the consumption of such functional foods. Diseases such as diabetes, obesity, chronic bowel disease, colon cancer, and cardiovascular diseases have spread in the last decades due to the conventional rich in sugar, salt, and fat, but poor in fibers diet. Recently, there has been an increasing tendency to adding dietary fibers (DFs) into cereal products to improve their daily intake by consumers. Several studies have focused on the enrichment of bakery flour with DFs from different origins. However, several negative effects on the wheat flour breadmaking performances and dough/bread qualities were reported when it was enriched with DFs [1].

The aim of this study was to assess the effect of high levels of dietary fiber enrichment on the rheological and structural properties of wheat flour dough. Three commercial DFs, namely pea fiber (PF), insoluble wheat straw fiber (IWF) and carboxymethylcellulose (CMC), were used at different substitution levels, to develop novel high fiber bread flours, in order to get a better understanding of their effects on the structure-function relationships of wheat flour dough for bread making. Fourier transform infrared (FTIR) spectroscopy was used with empirical and fundamental rheological (dynamic oscillatory shear) essays, to provide more insight into the dietary fiber structure-function relationships [1].

The empirical rheological study of the enriched doughs revealed significant differences in most properties, mainly water absorption, stability time, resistance to extension and extensibility. The fundamental rheological investigation confirmed the structural findings. Our results showed that a high concentration enrichment with PF or IWF raised the elastic and viscous moduli, while declined the loss factor, which was attributed to a strengthening of the gluten protein network by its interaction with DFs [1]. Whereas a high concentration substitution with CMC was seen to register lower viscoelastic moduli, and higher loss factor than the control dough, which was attributed to a weakening of the gluten network by disconnecting the protein aggregates [1].

Keywords: Wheat flour dough, dietary fiber, structure-function, rheology, structural properties.

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O5-F: Integrated Pest Management of the Red Palm Weevil (Rhynchophorus ferrugineus) in Date Palms in Palestine

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INRAT

This study focuses on effectively implementing integrated pest management (IPM) strategies for controlling red palm weevil (*Rhynchophorus ferrugineus*) in Palestine. The research involved extensive field surveys in date palm plantations to assess infestation levels and evaluate the effectiveness of various control techniques. Management strategies included cultural practices, biological control agents, and chemical treatments, all tailored to local agricultural conditions. The study aimed to develop a sustainable IPM approach that reduces pesticide reliance, promotes environmental health, and increases palm productivity. Findings indicated that combining these strategies significantly reduced weevil populations while enhancing date palm production.

Key Elements:

Field Surveys: extensive assessment of weevil infestation levels across various plantations in Palestine.
Management Techniques: Evaluation of cultural, biological, and chemical methods in controlling weevil populations.
Sustainability: focused on reducing pesticide use through IPM while maintaining or improving production.
Outcomes: The study demonstrated the benefits of IPM in mitigating the wicked threat and promoting sustainable agricultural practices in Palestine.
This study is vital for improving pest control measures for date palm growers in Palestine and other regions affected by the red palm weevil.

POSTER-F

P1-F: Inhibitory Effect of Carlina Oxide Isolated from Carthamus caeruleus Essential Oil on Alpha-Amylase

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Reducing postprandial hyperglycemia is a therapeutic approach that may prove beneficial in the treatment of diabetes. The best therapeutic method for reducing postprandial hyperglycemia is to delay glucose absorption by the enzymes in the digestive organs that hydrolyze carbohydrates. Alpha-amylase is one of the enzymes that catalyze the breakdown of starch into maltose and glucose, and inhibition of this enzyme leads to a reduction in blood glucose levels. *Carthamus caeruleus* is an annual plant similar to thistle known also under the name "blue cardoncelle" and it belongs to the Asteraceae family. In Algeria the roots of *Carthamus caeruleus* are used as a natural treatment of burns (healing) either in powder or as a cream prepared in milk. Carlina oxide is an organic molecule consisting of furan, benzyl units and acetylene groups. First isolated in 1889, it is one of the oldest polyacetylenes to have been discovered. These oxides are mainly found in certain plants of the Asteraceae family, such as *Carlina acaulis*, *Carlina acanthifolia* and *Carlina radix*[1-3]. From the essential oil of *Carthamus caeruleus* plant roots; we isolated carlina oxide by column chromatography. The isolated molecule was then identified by IR, ^{1}H and ^{13}C NMR. We then carried out in-vitro alpha amylase inhibition activity of *C. caeruleus* and carlina oxide. *In-vitro* tests showed that this molecule significantly inhibits alpha amylase, suggesting a promising alpha amylase inhibition effect. These results pave the way for future studies to elucidate the mechanisms of action and assess the therapeutic potential of this molecule in more complex models.

Keywords: Carthamus caeruleus, carlina oxide, alpha amylase, postprandial hyperglycemia.

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P2-F: Arbuscular mycorrhizal fungi associated with Citrus sinensis L. in relation to soil physicochemical properties in Tunisian citrus orchards

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The relationships between arbuscular mycorrhizal fungi (AMF) development levels and soil physicochemical properties remain poorly known in citrus. In our study, rhizospheric soil and root samples of Maltaise sanguine blood orange (*Citrus sinensis*) have been collected from thirteen representative sites in the Cape region in the Northeastern part of Tunisia. Soil physicochemical properties, spore density (SD), AM colonization rate, and the contents of easily extractable glomalin-related soil protein (EE-GRSP) and total glomalin-related soil protein (T-GRSP) were determined in the rhizosphere soils. The results indicated that SD, the frequency of mycorrhizal colonization, and T-GRSP concentration were significantly different among the study sites. Pearson correlation analysis showed that SD was negatively correlated with T-GRSP and available phosphorus. The frequency of mycorrhizal colonization was positively correlated with soil pH. The intensity of mycorrhizal colonization was negatively correlated with the soil concentration of exchangeable Na while arbuscules abundance was positively correlated with soil-available phosphorus. T-GRSP was positively correlated with available phosphorus, soil organic matter, and total nitrogen while negatively correlated with soil pH. The obtained results demonstrated that soil physicochemical properties are important in determining AMF development in Maltaise citrus orchards.

KEYWORDS: Citrus sinensis • soil physicochemical properties • arbuscular mycorrhizal fungi • spore density • mycorrhizal colonization • glomalin related soil protein

P3-F: Augue Toxicity Test and Histopathological Study Of Hyoscyamus Muticus L. Subsp falezlez (Coss) Maire

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Hyoscyamus muticus L. subsp *falezlez* (Coss) Maire is a toxic species, highly responded to in the Algerian Sahara, and played an important role in the traditional medicine of the Tuareg. It is one of the Solanace ae richest in tropane alkaloids (especially atropine), which constitute a large group of secondary metabolites. The objective was to study its toxicity to exploit the data in the valori sation of this endemic species. The acute toxicity study and the calculation of the LD50 were carried out on Wistar mice and using the tinctures of the plant collected from the Adrara Sbaa station (southwest of Algeria). A histopathological ex amination of the organs after the mice dissection was carried out. LD50 determination from the plant tinctures confirmed its extreme toxicity and was estimated at 0.85± 0.27g/kg dry plant. Functional ab normalities were detected in the heart and liver of mice injected with the lethal dose (6.3g/kg); significant vasodilation was observed. Content of the results obtained, the toxicological potential of the plant has been highlighted especially in acute. However, it would be interest ing to explore chronic toxicity.

Key words: Hyoscyamus; Toxicity; histopa thology; Algeria

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P4-F: Contribution to the study of germination of a plant species, Hyoscyamus muticus L. subsp. falezlez (Coss.) Maire, from the Algerian Sahara

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Hyoscyamus muticus L. subsp. *falezlez* (Coss.) Maire is a toxic species, very well responded in the Algerian Sahara, and has played a considerable role in the traditional medicine of the Tuareg. It is one of the richest Solanaceae in tropanic alkaloids, which constitute a large group of pharmaceutical secondary metabolites. It is an untapped species that must be valued. The germination of seeds is complicated and conditions the success of the *in vitro* culture. It can reduce the yield by 60% in the event of failure.The experimentation focuses on germination seeds from three harvesting stations in Algerian Sahara, Abadla, Adrar, and Tamanrasset. Three culture media (nutrient agar (GN), potato dextrose agar (PDA), and NaCl 3 g/L) and the Control, were tested at 25 °C and 40 °C. Seed germination rates were statistically compared, using the ANOVA test. Synthetic media allowed the seeds of the three study stations to germinate, with a low contamination rate (9%). Seeds stations (Adrar Sbaa and Tamanrasset) showed great adaptability to sprout in different conditions. The germination rates reached 100% in the PDA medium and 86% in the GN medium. The ANOVA analysis showed that the germination rate of the PDA medium is higher than others culture media (73.85± 1.5%), and the difference is significant between groups. The germination mean of all culture media at 25°C is significantly higher (52.58± 2.28%) than the germination at 40°C (42± 2.41). The results obtained constitute a database for future studies on the cultivation the plant, under laboratory conditions.

Key words: *Hyoscyamus*; Germination; Culture Media; Sahara; Algeria

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P5-F: ASSESSMENT OF OULED-DJELLAL LAMB MEAT QUALITY DURING FROZEN STORAGE FOR UP TO 12 MONTHS

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Freezing stands as one of the preferred and primary methods for preserving meat over the long term. Nonetheless, the product remains susceptible to physical and biochemical reactions that could undermine its long-term qualities. This study aimed to track the quality changes in vacuum-sealed Ouled-Djellal lamb meat stored in a freezer (-20°C) over four different frozen storage periods (0, 3, 6, and 12 months). Significant alterations in physical parameters were observed across various frozen storage periods, such as an increase in pH, heightened yellowness (b*), and total drip loss, alongside reduced water activity, brightness (L*), and browning (a*). Regarding biochemical characteristics, there was a decline in meat protein solubility, while lipid oxidation values (TBARS) substantially rose with prolonged frozen storage duration. The frozen practice can be used to preserve Ouled-Djellal lamb meat. However, there are some changes in meat traits that deserve attention, mainly regarding lipid oxidation, meat color, and cooking losses, as these types of modifications are undesirable and can cause consumer rejection during purchase, preparation, and subsequent product consumption.

Key words: Ouled-Djellal lamb, freezing, quality, frozen storage periods.

P6-F: Prevention of Metallic Biomaterials Corrosion Using PLA and Bioceramic Coatings

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Corrosion of metallic implants poses a major challenge in the biomedical field, leading to the release of metallic particles that can trigger inflammatory responses, allergic reactions, and systemic complications. This degradation also reduces the mechanical properties and longevity of the implants, sometimes necessitating premature surgical replacement. To address these issues, this study proposes a biodegradable coating composed of polylactic acid (PLA) reinforced with bioceramics to enhance bioactivity and corrosion resistance.

Stainless steel 316L, widely used for medical implants due to its strength and biocompatibility, was chosen as the substrate. The initial corrosion current density of bare 316L is 6.34 µA/cm². After optimizing the composition of the PLA-bioceramic coating, a formulation was identified that reduced this density to 0.24 µA/cm². This optimization was validated through X-ray diffraction (XRD) and atomic absorption spectroscopy (AAS) of simulated body fluid (SBF) solutions. The results demonstrate that the applied coatings significantly improve corrosion resistance and promote the formation of bioactive hydroxyapatite, which is essential for osseointegration.

Keyword : 316L, Mixture design, Corrosion resistance, Bioactive coating.

P7-F: Phenology of the Pine Processionary and Microbiological Control of Forest Pests in Coastal Pine Forests

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This study analyzes the distribution of nests and infestation by the pine processionary moth (Thaumetopea pityocampa) in two coastal pine forests of the Tipaza region. It also evaluates the efficacy of microbiological treatments based on Bacillus thuringiensis kurstaki (BTK), Bacillus subtilis (strains VIII3 and 9372), and the entomopathogenic fungus Metarhizium anisopliae var. acridum on two pests of Aleppo pine: T. pityocampa and the pine aphid (Cinara maghrebica). We studied the distribution of T. pityocampa nests in two coastal stations and evaluated the efficacy of microbiological treatments in the laboratory and in the field. Treatments include BTK and strains of B. subtilis as well as M. anisopliae. T. pityocampa infestations were more severe in the southern station, with a higher average number of nests per tree. In the laboratory, BTK showed a mortality rate of 78% of caterpillars after 7 days, higher than B. subtilis strains (40% and 36%) and M. anisopliae (64.18%) for Cinara maghrebica. In the field, M. anisopliae was the most effective with 63.47% mortality, compared to BTK (51.51%) and B. subtilis strains (47.92% and 44.33%). The results indicate that microbiological treatments, particularly BTK and M. anisopliae, are effective against T. pityocampa and C. maghrebica. M. anisopliae was the most effective in the natural environment. These treatments could offer promising solutions for pest management in coastal pine forests.

Keywords: Pine processionary moth, Pine aphid, Infestation dynamics, Microbiological control, Bacillus thuringiensis, Bacillus subtilis, Metarhizium anisopliae.

G. Circular economy Recycling and reuse of waste materials

ORAL-G

O1-G: Lithium, Manganese, Cobalt and Nickel Recovery from Spent Lithium-Ion Battery via Functional Ionic Liquid Extraction for Effective Battery Recycling

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Sustainable management of spent lithium-ion batteries, LIBs, is an urgent and critical challenge due to the number of such devices reaching the end-of-life. Recycling can offer a path for the recovery of valuable raw materials such as lithium, manganese cobalt and nickel whose supply is critical. Thus, it is mandatory to develop efficient ways for the selective recovery of Li, Mn, Co and Ni from the cathode degradation processes. In this study the most updated organic acids-based processes for the degradation of $LiCoO_2$ and $LiNi_xMn_yCo_zO_2$, the most common LIBs cathode, is explored to obtain a leached solution containing Li and Co. The possibility to exploit the 3-methyl-1-octylimidazolium thenoyltrifluoroacetone, Omim-TTA, ionic liquid was demonstrated to efficiently separate Li and Co. In particular it was possible to recover >70 % of Li and separate it from Co using this ionic liquid, independently from the organic acid used for the leaching procedure and adding EDTA to the aqueous phase. The quantification was carried out through AAS and ICP analysis; the recovering of the unaltered ionic liquid was also demonstrated, to further increase the global sustainability of the process.

Keywords: Recycling, Spent Lithium ion battery, Energy storage, Leaching, Solvent Extraction, Electric vehicles, Energy economy, Market research, Environmental Assessment.

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O2-G: Energy and Environmental Valorization of Olive Oil Production By-products (Olive Mill Wastewater and Raw Olive Pruning) through Hydrothermal Carbonization.

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Hydrothermal carbonization (HTC) is a promising process for the energy conversion of biomass in subcritical water (180 – 250 °C) at low pressure (10 - 40 bars)[1]. This process generates a carbonaceous solid material called 'hydrochar'. The global objective of this work is to optimize the HTC process by evaluating the performance of hydrochars both as an energy source and as a bioadsorbent for the removal of water pollutants such as heavy metals, dyes, solvents, etc. This analysis focuses on the influence of temperature, residence time, biomass composition, and initial mass on the nature and the quality of the hydrochars, as well as on the gaseous by-products. Our primary results showed that temperature has the most significant effect on the physicochemical properties and on the yield of hydrochar. By using by-products from Tunisian olive oil production, such as dried olive mill wastewater (OMW) and Raw Pruning (ROP), we observed that these materials underwent dehydration and decarboxylation reactions during HTC, producing less humid hydrochars. The results highlighted that the yield and properties of hydrochar depend mainly on the process temperature.

Keywords: Hydrothermal carbonization, hydrochar, olive mill wastewater, Raw Olive Pruning, bioadsorbent.

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O3-G: Treatment of chlorpheniramine by using an advanced oxidation process : Boron doped diamand electrode

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The increasing production of pharmaceuticals has led to significant water pollution, posing threats to ecosystems and human health. Consequently, the removal of pharmaceutical contaminants from wastewater is a critical concern. Anodic oxidation processes have shown promise in this area, particularly due to the high oxidation potential of hydroxyl radicals (OH°) in aqueous solutions. This study focuses on the anodic oxidation of chlorpheniramine (CLP), an antihistamine, using a boron-doped diamond (BDD) electrode. We investigated the influence of various operating parameters, including initial CLP concentration, electric current density (J), treatment duration, and reaction medium temperature. A Doehlert experimental design was employed to optimize these conditions. The optimal parameters identified were a CLP concentration of 40.81 × 10^{-5} M, electric current density of 87 mA cm^{-2}, treatment time of 8 hours, and a temperature of 37 ºC. Under these conditions, we achieved a 98% reduction in chemical oxygen demand (COD) and a 95% formation of nitrate ions, highlighting the effectiveness of anodic oxidation on BDD for chlorpheniramine removal from aqueous solutions.

Keywords: Electrochemical treatment, Chlorpheniramine, BDD, COD determination.

O4-G: Analysis of the mechanical and microstructural properties of sand concrete incorporating two types of textile sludges

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Environmental protection against industrial pollution has become a significant concern globally and in Tunisia, particularly in the textile sector, which has substantial environmental impacts during both production and waste management. Tunisian textile industries generate a large amount of sludge, often discharged directly into the environment without prior treatment, posing risks to soil and groundwater. Consequently, there is a need to develop sustainable methods for stabilizing and solidifying this textile waste in cementitious materials[1]. In this context, this experimental study evaluates the incorporation of textile sludge into sand concrete[2]. Both primary and secondary textile sludges were used as partial substitutes for natural siliceous sand in concrete, with volume substitution ratios of 25% and 50%. The mechanical and microstructural properties of the reference concrete made with natural sand were assessed and compared to those of the concrete containing the two types of textile sludge.The findings indicate that concrete incorporating primary textile sludge exhibits mechanical properties comparable to those of the reference concrete. In contrast, the compressive and tensile strengths of sand-based concrete with secondary sludge were significantly lower and decreased progressively as the sludge proportion increased. This reduction in strength can be attributed to increased porosity, as observed through scanning electron microscopy (SEM).Overall, concrete containing primary textile sludge is appropriate for non-load-bearing applications, such as pavement blocks, with a sand substitution rate of up to 50%. However, concrete made with secondary sludge is suitable for insulation applications.

Key words: Textile sludge, sand concrete, mechanical properties, microstructural properties,

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O5-G: Sustainable recovery of liquid refinery waste and its reuse for efficient Soap industry wastewater treatment: An approach toward the circular economy

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The concept of circular economy (CE) has gained popularity in the field of both research and businesses (Stefano Cairone et al., 2024). The main purpose of the CE is to bring economic development by ensuring that the products after the end of their life can be converted into resources for another application, thereby closing the loop. Industrial wastewater has been undermanaged for a long time in developing nations due to rapid industrialization. Improper disposal of industrial wastewater can result in the contamination of the receiving environment. The composition of wastewater may differ from industry to another depending on the raw materials used and the manufacturing process. In this frame, the present work aims to improve the sustainability of a Tunisian industry through a CE approach, using a wastewater flow from the vegetable oil refinery (VORW) as a source of dilution water for an efficient physicochemical treatment of soap industry effluents (SIE) heavily loaded with organic pollutants in a sustainability concept that aims for "zero liquid discharge". The use of the VORW to dilute the SIE is justified by the equal volumes of effluents discharged by the same Tunisian industry. The coagulation/flocculation (CF) process is commonly used in the treatment of industrial wastewater that involves adding coagulants (such as aluminum or iron salts) to destabilize colloidal particles and remove suspended solids in water and then adding flocculants (such as polyelectrolytes) to promote the aggregation of these destabilized particles into larger particles or flocs (Zhao et al., 2021). In this regard, the present study investigate a sustainable approach for the SIE treatment by CF process which is an effective and simple method for treating various types of wastewater (Bouyakhsass et al., 2023). In this work, the discharges from the soap manufacturing plant and the VORW industry were mixed in equal volumes and treated using Alum ($Al2(SO4)3$) as coagulant material, to achieve the highest removal of turbidity and chemical oxygen demand (COD). Then, Box–Behnken design was applied to optimize the CF efficiency and determine the ideal coagulant/flocculant doses. Under the following optimal operating conditions: coagulant concentration of 20 g/L, flocculant dosage of 209 mg/L and initial pH of 5, CF treatment of SIE diluted with VORW allows to achieve very considerable removal percentages of turbidity and COD of 100% and 82%, respectively. The final characterization of the treated water allows its reuse in the soap manufacturing sector of the same industry, allowing the implementation of the "zero liquid discharge (ZRL)" concept, which is an industrial treatment system that reduces wastewater discharge and optimizes water recovery. These promising results prove that CF treatment is a viable option for the treatment of a mixture of various types of industrial effluents, which represents a major ecological and sustainable solution for water treatment managers to achieve the ZLD in this industry.

Keywords: Soap Effluent, Refinery wastewater, Circular Economy, Coagulation/Flocculation, Response surface methodology.

FUNDING: *The authors are grateful for the financial support of the Tunisian-Algerian research and development project COPERER (Design and Optimization of an Eco-friendly Process based on Membrane Technology for the Treatment of Soap Manufacturing Wastewater for Sustainable Reuse), provided by the Ministry of Higher Education and Scientific Research of Tunisia.*

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O6-G: Some recent advances in 2D materials using ab initio calculations

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In the field of nanosciences, research on materials has made spectacular progress over the last twenty years. In this talk, I will present, through some examples from recent works, how ab initio calculations can provide a better understanding of the physical and chemical properties of different compounds. In particular, I will discuss our recent works on the properties of 2D systems interfaced with other bidimensional systems such as graphene, silicene, AlN, or ZnO [1, 2, 3]. Then I will present our recent results concerning the electronic structure of 2D silicene nanoribbons system [4]. Finally, I will discuss our calculations on the structural and electronic properties of 2D quaternary monolayers and their vdW heterostructures [5].

Key words: 2D materials,ab initio calculations, graphene, nanoribbons,

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O7-G: Enhancing poultry eggshells as a biogenic calcium carbonate source: A treatment process transforming the CaCO3 structure into nanoparticles and microparticles for biological and industrial uses.

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This study delves into the use of chicken eggshells as a valuable source of biogenic calcium carbonate. The focus is on incorporating these eggshells into animal feed and converting the CaCO3 structure into nanoparticles and microparticles. Various treatment methods are explored for their applications in both biological and industrial settings. In addition to the positive aspects of the product, our solution provides an eco-friendly alternative to calcium carbonate obtained from limestone quarries, thereby reducing costs. Furthermore, the inherent properties of our eggshells offer additional benefits. Depending on specific application needs, several techniques for synthesizing CaCO3 microparticles and nanoparticles are investigated. Therefore, this section aims to offer a comprehensive analysis of these techniques, with precipitation being a commonly used method for producing these particles.

From an environmental standpoint, our project gives new purpose to a residual material with significant potential for valorization, contributing to a circular and local economy. Additionally, the physicochemical and microbiological analyses of both the raw material and the final integrated feed meet standards, with a calcium content of around 7.58%, exceeding values typically obtained with rocky calcium bicarbonate. The microbiological analyses of the eggshells confirm their safety for inclusion in the formula. Nonetheless, there is a continued need to optimize the techniques for synthesizing nanoparticles and microparticles to meet industry requirements.

Keywords: consumed eggshell, valorization, calcium supplement, nanoparticles, microparticles.

O8-G: Synthesis and Spectroscopic Properties of the bis Tetrafluorothiophenolato Iron(III) “Picket Fence” Porphyrin Complex

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The reaction of picket fence iron(III) porphyrin complex [Fe(TpivPP)(SO_3CF_3)(H_2O)] with cryptand solubilized KC_6HF_4S yields the hexa-coordinate porphyrin species [K(crypt-222)][Fe^{III}(TpivPP)(C_6HF_4S)$_2$] C_6H_5Cl. The low-spin (S = 1/2) bis(tetrafluorothiophenolato) iron(III) “picket fence” porphyrin has been synthesized and characterized by UV-vis, IR and NMR ^{1}H. The X-ray molecular structure of the chlorobenzene solvate of the metalloporphyrin derivative has been determined.

The new complex [K(crypt-222)][Fe^{III}(TpivPP)(C_6HF_4S)$_2$] C_6H_5Cl crystallize in the monoclinic system with:

a = 15.055(5) Å ; b = 16.032(6) Å ; c = 21.525(6) ; = 93.323(7)° ; Z = 2, and space group P_2. The iron atom is hexacoordinated by the four nitrogen atoms of the pyrrole rings and the two sulfur atoms of the $C_6HF_4S^-$ group. The crystal structure of this new bis(tetrafluorothiophenolato) iron(III) metalloporphyrin indicates that the mean equatorial distance between the central ion and the four nitrogen atoms of the pyrrole ring of the porphyrin (Fe--Np) is equal to 1.997(6) Å indicating that complex is a ferric low-spin complex (S = 1/2).

Keywords: Porphyrins, tetrafluorothiophenolato iron(III), X-ray molecular structure.

POSTER-G

P1-G: The recycling of Aluminum/plastic multilayer packaging waste to produce sodium aluminate: catalyst material

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Tetra Pak Al/PE multilayer films (TPW) are widely used for beverage packaging, however their composite structures slow down their recycling and valorization [1]. This research explores a novel and simple process of recycling of these wastes to produce catalyst material for the reaction of cement hydration. The process consists of alkaline hydrolysis of Al/PE laminated films with different concentration of NaOH, temperatures and times. Sodium aluminate with porous and lettuce like morphology is generated as by-product of the reaction of hydrolysis of Al films. Its catalytic ability to accelerate the reaction of hydration of cement was tested through DSC analysis and temperature evolution [2]. It was shown that sodium aluminate reduced the Portland cement hydration setting time from 285 to 87 min.

Keywords: Multilayer packaging waste, Aluminum, Sodium Aluminate, Cement hydration.

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P2-G: Valorization of olive by-products using new ecofriendly solvents

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Olive byproducts, such as olive leaves and pomace, represent an abundant source of bioactive compounds traditionally used in folk medicine or as livestock feed. These products have garnered a significant interest due to their multiple biological activities, including antioxidant, antimicrobial and anti-inflammatory properties, which can be revalorized and reused in the food, cosmetics and pharmaceutical industries [1] [2]. This study aims to describe a novel ecological method using green solvents to extract polyphenols from tunisian olive byproducts.

In the first step, we employed our previously prepared green solvents in our laboratory to extract polyphenols from olive leaves and pomace in a combination with a traditional solid-liquid extraction method conducted at a fixed temperature. A screening was then made to determine total phenolic compounds using the Follin Ciocalteu method, total flavonoid and antioxidant activity using DPPH radical scavenging assay, all our extracts were then compared with ethanol extracts.

Under the same extraction conditions, the sugar-based solvents (1), (2) and (3) showed a superior phenol extraction capacity from olive pomace compared to ethanol. However for olive leaves, only solvent 1 (76.27 mg GAE) extracted 24% more phenolic compounds than ethanol (58.04 mg GAE), otherwise than solvents (2) and (3) that extracted less phenols (37.14 mg GAE) and (28.97 mg GAE). Similarly, for flavonoid content, solvents (1), (2) and (3) showed a higher total flavonoid content extracted from olive pomace than ethanol extract, for olive leaves, ethanol outperformed the green solvents in extracting flavonoides. Concerning the DPPH radical scavenging assay, our results revealed that both olive pomace and olive leaves ethanol extracts had a better inhibition percentage than solvents 1, 2 and 3 extracts.

In summary, the results of this study demonstrate the promising potential of the green sugar-based solvents in bio-phenol extraction from olive oil byproducts. These solvents demonstrated a high polyphenol and flavonoid content extraction as well as considerable antioxidant activity when compared with ethanol extracts. This research sets the stage for an ecological revalorization of olive byproducts for reuse in food, cosmetics and pharmaceutical fields.

Key words: olive byproducts, green solvents, bioactive compounds, polyphenol extraction.

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P3-G: Potential use of Tunisian Cherts Cementitious Mineral Binder

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This study addresses the dual challenge of reducing the carbon footprint of the cement industry and valorizing chert waste from phosphate mining in Tunisia. The cement sector, responsible for about 7% of global CO_2 emissions, urgently requires sustainable alternatives to traditional production methods [1]. Concurrently, the phosphate industry in Tunisia generates significant quantities of chert as a by-product, often discarded despite its potential [2, 3]. Our research explores the feasibility of incorporating these cherts into cement production as pozzolanic additives and alternative raw materials for clinker [4]. To achieve this objective, we systematically collected chert samples from various Tunisian phosphate deposits, ensuring a representative range of geological variations [3]. These samples underwent rigorous preparation, including grinding and homogenization then they were characterized by several physicochemical methods. Afterward samples were calcined at temperatures ranging from 500°C to 900°C, characterized and their pozzolanic reactivity was tested by chemical method [5].

Key words: pozzolan, clinker, Cherts, Pozzolanic activity, cement.

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P4-G: Characterization of waste from a pomace recovery unit and their recovery

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Tunisia is one of the main olive oil producing countries. However, quantities of olive mill waste water and pomace are generated. In recent years, the recovery of this waste has evolved and several avenues have been developed. This work consists, firstly, of a characterization of waste from a soap manufacturing unit. Three types of waste were used, namely: pomace, pomace powder and pomace kernels. Different parameters were determined such as pH, conductivity, humidity, organic matter content and polyphenol content. Secondly, these wastes were used to prepare a seedling and planting substrate. The results did not show significant differences in the pH of different wastes studied whereas electrical conductivity, humidity, organic matter content and polyphenol content were more important in the pomace powder. After sowing melon and squash seeds and planting fig cuttings, the germination as well as the budbreak rates were high in the substrate based on pomace powder. An improvement of growth was observed and it due to the richness of this waste in organic matter. So, the olive mill wastes can be used directly in nurseries or combined with peat or other compounds.

Keywords: olive, pomace, substrate

P5-G: DFT Study of Gas Detection on Polar ZnO Surfaces and Gr/ZnO Heterostructure

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Our study investigates the gas sensing capabilities of polar surfaces of ZnO and graphene/ZnO heterostructures using Density Functional Theory (DFT). The focus is on the adsorption of graphene on polar surfaces of ZnO and its impact on gas detection performance. Since we found that the O-polar surface of ZnO is more stable than the Zn-polar surface, we examined the adsorption behavior of NH3 and NO2 gas molecules, both on the O-polar surface of ZnO and on the Gr/ZnO heterostructure. We analyze the structural and electronic properties of each structure for different adsorption sites.

ZnO's polar surfaces are known for their high sensitivity in gas detection, and the adsorption of graphene improves the electronic properties, leading to improved detection performance.

Keywords: Graphene, Zinc oxide, DFT calculations, gas sensor.

H. Ceramic & composite materials

ORAL-H

O1-H:Synthesis and Characterization of Cordierite-Mullite Ceramic Phases from Tunisian Kaolin, Granite and Talc

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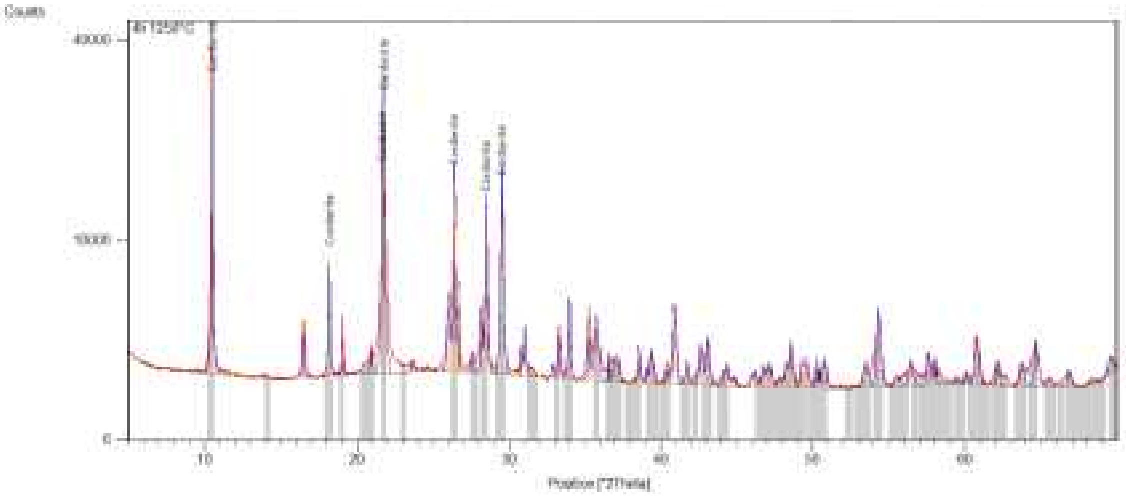
This study explores the synthesis of cordierite-mullite ceramic phases from natural raw materials such as Tunisian kaolin, granite and talc. The materials were characterized using X ray fluorescence (XRF), X-ray diffraction (XRD), scanning electron microscopy coupled with energy dispersive spectroscopy (SEM-EDX), infrared spectroscopy (IR) and differential thermal and thermogravimetric analysis (DTA-TG). The raw material mixture was thermally treated at temperatures ranging from 1000°C to 1200°C. Cordierite and mullite phases were observed at 1200°C with an average porosity of 45.7% and a density of 1.51 g/cm³. The microstructure of the samples was also studied confirming the formation of stable ceramic phases. These results provide a better understanding of phase transitions in kaolin-granite talc systems and open the door to a potential application in refractory materials manufacturing.

Keywords: Cordierite, Mullite, Kaolin, Granite, Talc, Ceramic refractory.



O2-H: Investigations of sintered dry-pressed alumina using synthesized organic copolymer

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Polyelectrolytes containing both carboxylate and hydroxyl functions noted (PV2A) have been synthesized to provide the dual function of dispersant and binder for dry pressed alumina. The incorporation of PV2A in the ceramic formulation improved tensile strength of pressed products from low concentrations (1wt%), showing a good binding effect.

The effect of copolymer content and sintering temperature were examined on the microstructural and mechanical properties of sintered compacts. Characterized by a low glass transition temperature, PV2A copolymers have a plastic character. This quality ensured a high densification. Such property makes synthesized copolymers more promising than the industrial additives ensured a homogeneous microstructure of sintered parts and high relative density (99.2% with addition of 1wt% of PV2A against 97.7% in the presence of commercial PVA + PEG at 1650 °C).

The plastic character and the minimal amount of organic additives in the alumina formulation prevent microstructure defects during sintering, and improve the mechanical properties of sintered parts to reach a tensile strength of 357.5 MPa at T=1700°C with the addition of 2wt% of the copolymer.

KeyWords*:* Organic Copolymer, sintered dry pressed alumina, glass transition temperature.

O3-H: Impact of ZnO content on microstructural, tribological and electrochemical properties of titanium dioxide TiO2+ZnO nanocomposites deposited using spray pyrolysis

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A variety of TiO_2-ZnO thin films with different ZnO molar ratios were produced by spray pyrolysis. Investigations were done into how the molar ratio affected the electrochemical characteristics, tribology, and crystalline structure. The surface morphology and the phase composition were investigated using a scanning electron microscopy (SEM) and X-ray diffraction (XRD). In addition, a novel scratch test method known as "wear mode" was employed to assess the coatings' resistance to wear. The outcomes of the scratch tests demonstrated that the interfacial adhesion of the ZnO nanoparticle-doped coating was enhanced. The electrochemical behavior of TiO_2 coatings was determined by potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) analyses to investigate the corrosion resistance of TiO_2-ZnO coatings. The results of the corrosion test showed that the TiO_2 + 20% ZnO coating had a lower corrosion potential (about −393.1 mV) and a lower corrosion current density (about 38.6 µA cm−2).

Key words: TiO_2-ZnO nanocomposite, Adhesion strength, Thin film coatings, Tribology properties, Electrochemical behavior, Spray pyrolysis.

O4-H: Development and characterization of printable PLA/β- TCP modified with silane A-174 biocomposites

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The effect of silane A-174 (3-(trimethoxysilyl)-propyl methacrylate) modification on the structural and mechanical properties of PLA/β-TCP biocomposite systems was investigated. PLA, PLA/5β-TCP, and PLA/10β-TCP samples, along with their silane-modified counterparts (PLA/5β-TCP-s and PLA/10β-TCP-s), were fabricated using 3D printing technique. A comprehensive characterization of the biocomposites was carried out employing Fourier-transform infrared (FTIR) spectroscopy, scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), and differential scanning calorimetry (DSC). SEM, EDX, FTIR analyses and elemental mapping performed by EDX confirmed the successful incorporation of silane A-174 into the PLA/β-TCP composites. Thermal analysis revealed changes in melting, and cold crystallization temperatures due to the addition of β-TCP and silane treatment. The mechanical performance was evaluated through tensile, compression, and flexural strength tests. Mechanical tests demonstrated a reduction in strength with increasing β-TCP content. This study provides insights into optimizing the performance of silane-treated PLA/β-TCP biocomposites for potential use in 3D printing and biomedical applications.

Keywords: PLA, β-tricalcium phosphate, silane A-174, compressive strength, 3D Printing.

O5-H: Fabrication and Structural Characterisation of ZrC-W Cermet by Spark Plasma Sintering: Application in Ballistic Protection

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Zirconium carbide (ZrC) is a ceramic material known for its high melting point, hardness, and strength, making it an attractive candidate for advanced structural applications, including aerospace and defense. However, like most ceramics, ZrC suffers from low fracture toughness, limiting its broader use in harsh environments. To address this limitation, the addition of tungsten (W) to ZrC composites has been proposed as a means of enhancing both fracture toughness and hardness. This paper investigates the effect of tungsten (W) addition on ZrC composites to enhance their fracture toughness (KIC) and hardness (Hv) [1]. ZrC and ZrC with 20% tungsten (ZrC-W) were prepared using FAST-SPS-FCT technology at 1700–1800 °C under 50 MPa pressure [2]. Microstructural analysis through X-ray diffraction and scanning electron microscopy revealed phase separation into ZrC and W, indicating decomposition into ZrC, W2C, and WC. The relative density increased with W reinforcement, achieving over 98.8% density in ZrC-W composites [3]. Future work will include Vickers hardness, fracture toughness, and ballistic performance assessments. Finite element simulations will optimize W addition for better mechanical and ballistic properties, alongside dynamic behavior evaluations for body armor applications [4].

Keywords: FAST-SPS-FCT technology; Ceramic Metal-Composite (Cermet); Functionally Graded Materials (FGMs); Microstructure and Mechanical properties; Ballistic performance.

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POSTER-H

P1-H: Development of a new TiO_2 membrane based on flat ceramic supports made from natural clay, calcite, dolomite, and organic waste

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Preparing various membranes and evaluating the impact of inorganic precursor types on the stability, morphology, and porous texture of the inorganic matrix were the primary focuses of this study. Due to their high chemical, mechanical, and thermal stability and facile surface functionalization, ceramic materials have inspired scientists to design innovative low-cost ceramic-based membrane supports **[1, 2]**.

The production of low ceramic flat membranes by dry pressing and extrusion using low-cost materials, such as waste collected from the seawater station is of a power generation center as a pore-forming agent, calcite, dolomite, and natural illite from Tataouine (South Tunisia). To determine the ideal conditions for the membrane preparation, this effort started with the characterization of the raw material. The ceramic supports were sintered for two hours at 1000°C and 1050°C after the raw material characterization. A layer was deposited on the supports using the spin coating method. The layer of titanium (TiO_2) was sintered at 700 °C. To determine the porosity, density, mechanical strength, and morphological properties of these membranes, many characterizations were performed.

Keywords: Ceramic Membrane, TiO2 layer, spin-coating, porosity.

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P2-H: Effect of synthesized organic copolymers containing both carboxylate and hydroxyl groups on aqueous alumina dispersion

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Copolymers containing both carboxylate and hydroxyl groups noted PV2A have been synthesized in order to act simultaneously as dispersant and binder for spray drying alumina suspension. The quantity of the added copolymer was optimized to achieve adequate dispersion and stabilization of the suspension. Such investigation was done through a systematic analysis of the electrokinetic and rheological properties, from which the copolymer /alumina interactions during the powder dispersion can be evaluated. The addition of 1.2wt % of the PV2A copolymer in the formulation of an alumina suspension provides good stability, with a quasi-Newtonian rheological behavior and a minimum viscosity of 25 mPa.s.

Adsorption isotherm provided an electrosteric stabilization of alumina suspension, promoted by the adsorption of carboxylic groups onto the alumina surface and a loop-like conformation of hydroxyl groups.

The effect of polymeric chain length on the dispersion was studied using three copolymers $PV2A_L$, $PV2A_M$, $PV2A_H$ having respectively low, medium and high molecular weights estimated to 11,000, 19,000 and 47,000 Da. The strong attraction between dispersant and binding groups in the polymeric chains of PV2A prevents the competitive adsorption onto the alumina surface, usually obtained with commercial organic additives. As a result, the phenomenon of binder migration was prevented during the spray-drying, leading to a homogenous microstructure of atomized alumina powder.

KeyWords: Copolymer, aqueous alumina, electrosteric stabilization, adsorption, polymer molecular weight

P3-H: Spinel synthesis from waste aluminum dross and dolomite ore

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Aluminum melting industries generate large quantities of aluminum dross that are mainly composed of alumina (Al_2O_3). They can also contain other chemical compounds such as: $MgAl_2O_4$, AlN, $NaAlCl_4$, $Al(OH)_3$, Al_2S_3, NaCl, KCl, $FeSO_3$... Some chemicals such as: AlN, Al_4C_3, Al_2S are very dangerous and harmful to the environment and humans because they can react with the surrounding humidity and generate dangerous and toxic gases (H_2, CH_4, NH_3, H_2S…). Over the last few decades, several research studies have been conducted on the recovery of aluminum dross. It was demonstrated the possibility of their use to synthesize high purity γ-alumina, aluminum sulfate, calcium aluminates, and to manufacture refractory materials and active catalyst. Aluminum dross are also used to make spinel composites, and little research works were devoted to the synthesis of spinel.

Spinel ($MgAl_2O_4$) or magnesium aluminate is a very interesting ceramic due to its important physical, chemical and mechanical properties that make it a material of choice in various applications in advanced technology. The classical method for synthesizing spinel consists in the solid phase reaction, using magnesium oxide (MgO) and alumina (Al_2O_3) as starting materials. Unfortunately, the involved costs are high due to the price of the raw materials and the very high temperature required for the achievement of the reaction.

In this work, we were interested in the study of powders synthesized from aluminum dross and dolomite by dissolution-precipitation-calcination process. Local aluminum dross from the company AMR (El-Eulma, ,Setif (Algeria) was used as alumina (Al_2O_3) source and dolomite from Teioualt djebel as MgO source to promote the formation of spinel.

In first stage, the starting materials were characterized. According to the chemical analysis, a mixture (Al dross/dolomite) which theoretically gives an equimolarAl_2O_3/MgO final composition was optimised. The starting materials were subjected to the adopted synthesizing protocol comprising: dissolution of each material independently, precipitation and calcination. The obtained powder was characterized by several physicochemical methods (XRD, FTIR, SEM, EDX, laser granulometry). It was found that obtained powder was composed of spinel (Mg0.4A2.4O4) as a major phase associated to alumina (Al2O3) with traces of some impurities (CaO, SiO2...). The particles of the obtained grain powder are in agglomerated state and have a micronic size (5.6 μ m- 8.71 μ m).

Keywords: Aluminum dross, alumina, dissolution, precipitation, spinel

P4-H: The impact of MnO addition on the structural investigations and thermochemical behavior of M2O-MnO-P2O5 (M ≡ Na or Li) phosphate glasses

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Recently, phosphate glasses have attracted much attention due to their interesting properties which makes them suitable for various domains such as: medecine, optic, elctronic, environment…

In order to study the influence of MnO addition on the structural, physical properties and calorimetric dissolution of sodium and lithium based phosphate glasses.

Series of glasses with a general formula: (100-x)MPO_3-xMnO ($0 \leq x \leq 25$mol%) (M ≡ Na or Li) have been prepared using the conventional melt-quenching technique.

Samples were investigated by means of X ray diffraction, density measurements, differential scanning calorimetry (DSC), ^{31}P NMR-MAS and Raman spectroscopy.

The variations of density and molar volume of glasses were attributed to the structural changes of the glass network which induced the formation of P-O-Mn ionic bonds.

The increase of the glass transition temperature (T_g) values reflects an increase of the rigidity of the structure when MnO oxide is gradually incorporated.

Thermochemical study of the glass series shows that the dissolution phenomenon is endothermic for lower MnO content and becomes exothermic when MnO oxide is progressively added. The change in thermal sign can be explained by the depolymerization of metaphosphate chains (Q^2) which suggests the formation of diphosphate groups (Q^1). These results were correlated to the spectroscopic investigations which revealed the disruption of P-O-P bridges.

Keywords: Phosphate glasses, ^{31}P NMR-MAS spectroscopy, depolymerization, thermochemical study.

P5-H: The utilization of pistachio shell powder as a cellulose producer and its impact on the development of a bio composite

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"Natural Fiber Reinforced Polymer Composites" has been used in a wide variety of applications in the automotive components, construction sectors and packaging. The present study investigated the effect of chemical treatment of natural fibers on the development of a bio composite. In this project, the pistachio shell powder was chemically treated and the polylactic acid were used for the production of a green composite (i.e. bio composite). The aim of our study was to perform the scientific technics of extraction of cellulosic fibers from the pistachio shell powder and to study its impact on the development of a bio composite.

Keywords: Pistachio shell powder, Cellulose, Bio composite, Natural fibers.

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I. Mineral materials and applications

ORAL-I

O1-I: Effect of Sm3+ activation on the optical properties and antibacterial activity of TiO2 nanoparticles

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The remarkable photocatalytic activity of nanometric metal oxide semiconductors has attracted considerable interest in recent years. They are a valuable and promising material for the medical and environmental sciences as well as for industry [1-3]. This study investigates the effects of Sm^{3+} functionalization on the structural, morphological, optical, and antibacterial properties of TiO_2 nanoparticles (NPs). Photoluminescence spectroscopy was employed to examine the recombination and transfer dynamics of photoexcited electron-hole pairs within the semiconductors, and how these dynamics influence the antibacterial activity of Sm^{3+}-activated TiO_2. The results reveal that activation with 1% Sm^{3+} can enhance the antibacterial efficiency of TiO_2 NPs to 95% under sunlight irradiation, against a range of bacterial strains. A correlation between the optical properties of TiO_2-Sm NPs and their antibacterial activity is demonstrated. The study also discusses the proposed mechanism of the antibacterial process, considering illumination conditions and their impact on the interaction between pathogenic organisms and TiO_2-Sm NPs, with respect to their morphological properties. This research highlights the potential of TiO_2-Sm^{3+} nanoparticles for controlling bacterial pathogens.

Key words: Nanomaterials, Samarium, TiO_2, Photoluminescence, Antibacterial activity

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O2-I: Development of Novel Small Helicenes and Investigation of Their Photophysical and Electrochemical Properties

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Helicenes possess highly contorted electron systems that exhibit remarkable self-assembly capabilities and charge transfer complexation, along with unique optoelectronic properties and exceptional chemical and thermal stability.[1] These characteristics render them highly promising for various applications, particularly in organic electronics.[2] By incorporating electron-withdrawing and donor groups into their carbon framework, we can promote strong electron delocalization, which not only extends and stabilizes the triplet state but also significantly enhances their fluorescence and emission properties.[3]

In this study, we developed a series of cyano-functionalized [4]helicenes by incorporating electron-donating groups to create a *push-pull* system aimed at enhancing fluorescence for OLED applications. The novel tetracyclic compounds were synthesized with high yields using photochemical processes and were thoroughly characterized *via* NMR, mass spectrometry, and FT-IR spectroscopy. These compounds exhibited strong UV absorption and intense blue fluorescence. Cyclic voltammetry measurements indicated irreversible redox behavior, allowing for the determination of HOMO and LUMO energy levels. Overall, the results suggest that these materials have significant potential for use in OLEDs and electroluminescent devices.[4]

Key words: Helicenes, Photooxidation, Fluorophores, Electroluminescent devices.

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O3-I: Performance of natural clay material in synthetic wastewater Treatment

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The aim of this study is to investigate the application of a natural clay material in a synthetic wastewater solution containing essential heavy metals, specifically chromium ions. We focus on a continuous process, a high-technology method commonly used for wastewater purification in industrial applications.

The clay material was initially characterized using various techniques, including X-ray diffraction, Fourier transform infrared spectroscopy, and nitrogen physisorption. Column tests were conducted to evaluate the sorption capacity of the natural clay material in a continuous process. The adsorption conditions were examined by varying the initial chromium (Cr^{6+}) concentration, flow rate, and column height. Complete purification was achieved at a concentration of 100 mg/L, a flow rate of 5 mL/min, and a bed height of 25 cm.

The Thomas and Bohart-Adams models were employed to analyze the experimental data and predict breakthrough curves for continuous adsorption. Comparison of R^2 values indicated that the Thomas diffusion model effectively describes the experimental results.

The findings suggest a potential for expanding column adsorption systems for the treatment of heavy metals in industrial-scale wastewater. Furthermore, the natural clay material demonstrated remarkable reusability and exhibited promising characteristics for various environmental and industrial applications.

Keywords: Natural clay, characterization, heavy metal, retention, continuous adsorption, modeling

O4-I: Photocatalytic performances of ZnO/Clay-smectite nanocomposites for the diclofenac degradation under UV

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This work aims to study the photocatalytic performances of a new synthesized photocatalyst in order to purify water from pharmaceutical pollutants specially diclofenac (DCF), a nonsteroidal anti-inflammatory drug, and a contaminant of increasing concern which has been included in the monitoring list of the EU Water Framework Directive 2015/495. The ZnO/Clay-smectite nanocomposite photocatalyst was synthesized by sol-gel method and well prepared to be accessible to photocatalytic tests under UV irradiations. And in order to study its structural and morphological properties, the photocatalyst was characterized by different techniques (XRD, FTIR, SEM-EDX). Finally, the photodegradation of diclofenac under UV was evaluated under different conditions, including initial pollutant concentration, catalyst weight effect, and UV light exposure time. A 94% of pollutant was degraded during 90 minutes of UV irradiation and more then that the ZnO/clay-smectite nanocomposites can be used up to four times with a good degradation performance so it gives also amazing yield during the recycling tests.

Keywords: Photocatalytic, ZnO/Clay catalyst, Nanocomposites,

O5-I: REE in Tunisian phosphorite: A promising solution

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Rare earth elements (REEs) are essential components in many modern technologies. Their importance is only expected to grow in the future as new technologies emerge. However, there are concerns about the long-term availability and sustainability of these elements. Despite these challenges, the use of sedimentary phosphate deposits as a secondary resource of REEs is a promising solution to the REEs global crisis. For this purpose, six phosphate layers from two different phosphorite deposits from central Tunisia were geochemically investigated. Mineralogical characterizations of these samples were undertaken by X-Ray diffraction, revealed that the main mineral is the carbonate-fluorapatite (francolite), with dolomite, gypsum, and quartz as accessory minerals. The chemical analysis of the studied samples by ICP-MS demonstrates that they are significantly enriched in REEs with an average of 1464 ppm. Our data suggest that phosphorites currently mined in Tunisia, has a significant proportion that can be extracted to support the increasing demand for these elements in high technological applications.

Key words: REE, mineralogy, sedimentary phosphate, ICP-MS.

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O6-I: Antibacterial Properties of Moringa oleifera, Cynara scolymus, and Allium fistulosum Leaf Extracts: Molecular Docking Insights into Quercetin's Mechanism of Action

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This study investigates the antioxidant and antibacterial activities of leaf extracts from *Moringa oleifera*, *Cynara scolymus*, and *Allium fistulosum* and explores the role of quercetin, a bioactive compound found in these plants. Antioxidant efficacy was evaluated through DPPH, ABTS radical scavenging assays, and reducing power tests, confirming the potent antioxidant potential of these extracts.

The antibacterial activity was assessed against various Gram-positive and Gram-negative bacteria using disk diffusion and broth microdilution methods. *Moringa oleifera* extract showed significant inhibition zones against *Bacillus cereus* and *Escherichia coli*, while extracts from *Cynara scolymus* and *Allium fistulosum* demonstrated moderate antibacterial activity across all strains. To understand the molecular basis of these bioactivities, molecular docking studies were performed to evaluate the interactions of quercetin with bacterial proteins 1JIJ, 2XCT, and 5BNR, involved in essential bacterial metabolic pathways, cell wall synthesis, and DNA replication. The results revealed that quercetin effectively binds to these target proteins, potentially disrupting their functions and contributing to the observed antibacterial effects. The findings suggest that the antibacterial activities of the leaf extracts may be partly due to quercetin and its capacity to interfere with key bacterial processes.

This study provides a mechanistic understanding of the bioactivities of these leaf extracts, highlighting their potential as natural sources of antioxidant and antibacterial agents. Further research is recommended to isolate and quantify quercetin and other active compounds to fully elucidate their roles in these bioactivities.

Keywords: Antioxidant, Antibacterial, Quercetin molecular docking, Bioactive compounds

POSTER-I

P1-I: Design, Synthesis, and Characterization of Novel Functionalized Helicenic Derivatives

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Pentahelicenes combine semiconductor and fluorescence properties with intrinsic chirality,[1] making them promising candidates for advanced technologies such as optical sensors and spintronic devices.[2] Nevertheless, their photochemical synthesis presents notable challenges, particularly as irradiation of their precursors in a photoreactor can directly produce benzo[*ghi*]perylene.[3]

In this work, we propose harnessing solar radiation as a green and renewable energy source to simultaneously synthesize both [5]helicenes, renowned for their inherent chirality, and high performance properties and benzo[*ghi*]perylene, efficient planar fluorescent molecules.[4] The structures of these derivatives were confirmed via X-ray diffraction analysis, while their photophysical and electrochemical properties were investigated through UV-visible absorption, photoluminescence, and cyclic voltammetry. These compounds exhibited broad UV absorption, strong blue emission, and large Stokes shifts. The unique combination of chirality and intense fluorescence in the visible spectrum, along with significant Stokes shifts, positions these novel molecules as promising candidates for optoelectronic applications.[5]

Key words: Helicenes, Benzo[*ghi*]perylenes, Heck coupling, Photooxidation, Fluorophores.

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P2-I: Optimization of a lithium assay method in oil fields brines by using experimental design methodology and its validation by the accuracy profile approach

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To cover the excessive demand of lithium compounds, especially for the manufacture of vehicle batteries, several extraction technologies from natural resources and mainly geothermal brines are applied. These brines are distinguished by the complexity of its chemical composition. So, the quantification of lithium amount by spectroscopic methods will be disturbed by some interferences due to the cohabitation of major cations and anions. The originality of this investigated work is to optimize, by using the response surface methodology, and to validate, by the application of the accuracy profile approach, the analytical method for lithium assay by flame emission spectroscopy. After identification of the major ions in the oilfield brine sample (Ca, Mg, Na, K and Cl), a specificity test is applied, which reveals the presence of chemical interferences. For this reason, a spiked synthetic solution by a lithium standard (20 mg/L) is prepared for each run of the Doehlert design. Four studied factors, which are the major cations ([$Ca^{2+]}$ (X_1), [Mg^{2+}] (X_2), [Na^+] (X_3) and [K^+] (X_4)), are used to build this design and to determine their effects on the lithium recovery yield response (Y(%)). As resulted outcomes, a polynomial valid and predictive model is statistically qualified and used to plot the iso-responses curves of the chosen response. Consequently, the optimal conditions are determined by: [Ca^{2+}] (X_1) = 1.7 mol/L, [Mg^{2+}] (X_2) = 0.02 mol/L, [Na^+] (X_3) = 0.36 mol/L and [K^+] (X_4) = 0.01 mol/L, which correspond to 64.128, 2.43, 60 and 2 g/L, respectively and the theoretical lithium recovery yield is nearby 98% in five-fold diluted composition. Moreover, the validation by the accuracy profile approach is performed after the robustness test. The resulted β-expectation tolerance interval is within the acceptability limits, which means that the analytical method, used for lithium assay by flame emission spectroscopy, is valid and the response variances are almost constant (homoscedasticity) over the predefined range concentration (8–50 mg/L) and it can be used for routine analysis.

Keywords: Lithium; Oil field brine; Optimization; Validation; Accuracy profile; Uncertainty.

P3-I: Anion Influence on Catalytic Efficiency of Ferrocene-Imidazolium Salts in Copper-Catalyzed Hydrosilylation: Propiophenone Reaction Insights

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This study investigates the synthesis and catalytic efficiency of ferrocene-imidazolium salts in copper-catalyzed hydrosilylation, emphasizing the role of anion selection. A range of imidazolium salts, including iodide, tetrafluoroborate, and copper iodide variants, were synthesized with different yields. Propiophenone was used as a substrate to evaluate catalytic performance, revealing that tetrafluoroborate salts (2d and 2e) were highly effective, achieving complete conversion in 2 and 1.5 hours, respectively. In contrast, iodide salts showed limited activity, highlighting the critical influence of anion choice on catalytic outcomes. Control experiments demonstrated that imidazolium salts were essential for hydrosilylation, offering valuable insights for designing more efficient catalytic systems for organic synthesis.

Key words: Imidazolium salts, hydrosilylation, propiophenone, copper catalysis, anion exchange, ferrocene.

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P4-I: Catalytic efficiency of a vermiculite/TiO2 nanocomposite on the removal of two dyes: methylene blue and crystal violet

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In this work, a nanocomposite based on vermiculite and titanium oxide nanoparticles (TiO_2/Vm) was synthesized. Vermiculite was first oxidized by nitric acid (HNO_3), followed by the addition of TiO_2 which led to the formation of the TiO_2/Vm composite. The various stages in the preparation of these composites were characterized using X-ray diffraction (XRD). The results confirm the successful synthesis and formation of vermiculite and TiO_2 in the TiO_2/Vm composite. Using both adsorption and photocatalysis processes, the catalytic efficiency of this nanocomposite was tested on two dyes: Crystal violet dye (CV) and Methylene blue (MB). The overall removal of MB by adsorption and photocatalysis has reached 98.44%. In the mixture (BM + CV) / Vm /TiO_2, the MB dye showed a strong decrease in absorbance compared to CV dye.

Key words: TiO_2, Vermiculite, Dye , photocatalysis, X-ray diffraction, adsorption.

J. Mechanical Engineering & Metallurgy for materials science

ORAL-J

O1-J: Numerical Study of the Free Surface Stability in an LNG Carrier's Tank

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Computers & Chemical Engineering Volume 160, April 2022, 107698. In this study, we perform a comparative analysis of the two-phase flow of LNG in the storage tanks of a LNG carrier. The goal is to determine the optimal porous plate configuration that results in a more stable free surface, and thus less boiling. The laminar two-phase flow induced by ship motion is governed by equations describing mass and momentum balances, coupled with the pure convection equation (VOF). The partial differential equations with initial and boundary conditions are solved using the finite element method in Comsol Multiphysics 5.6. A mesh convergence study is also conducted for the simulation, with improvements to both the global and local mesh. The parameters studied include various Darcy numbers ($10^{-7} \leq Da \leq 10^{-9}$) and different rolling angles ($10° \leq \gamma \leq 30°$).

Key words: LNG, Boil-off, Porous medium, Darcy number, VOF, Free surface.

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O2-J: Protecting Ductile Cast Iron Drinking Water Pipelines: Evaluating the Efficacy of Green Inhibitor Nanoparticles Against Corrosion

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This study evaluates the corrosion of drinking water pipelines made from ductile cast iron and explores protection strategies using nanoparticles of a green inhibitor. We investigated the corrosion mechanisms affecting these pipelines and conducted comparative analyses between treated and untreated samples. The results demonstrated that the presence of the green inhibitor significantly reduced corrosion rates, with treated samples exhibiting up to 75% less degradation compared to untreated ones.

Additionally, the application of nanoparticles not only enhanced the protective properties but also improved the inhibitor's adhesion to the metal surface, ensuring prolonged efficacy. These findings highlight the potential of using green inhibitors as sustainable alternatives to traditional methods, offering significant improvements in the durability and safety of drinking water infrastructure.

Key words: Corrosion protection, Ductile cast iron, Drinking water pipelines, Nanoparticles, Green inhibitor, Infrastructure safety

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O3-J: the influence of filler metal on the welding characteristics of dissimilar joints comprising 316L and ferritic AISI 430 stainless steels

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Welding, a critical technique for the joining of metals across nummrous disciplines, can be classified into three primary categories: homogeneous welding, heterogeneous welding, and autogenous welding. Each industrial domain elects the most appropriate methodology contingent upon its unique requirements and limitations. Heterogeneous welding introduces a heightened level of complexity when juxtaposed with homogeneous welding. This intricacy stems from the possible incompatibility of the materials intended for fusion and the imperative for meticulous calibration of welding parameters.

This dissertation concentrates on the heterogeneous welding of two variants of stainless steel: ferritic 316L stainless steel and austenitic 316L stainless steel. We investigated the effects of four distinct filler metals (316, 309, 308, and 22.09) on the integrity of the welded joint. This welding technique is extensively employed in critical sectors such as the chemical and petroleum industries, as well as in shipbuilding, among others. The predominant challenges faced during heterogeneous welding include the occurrence of cracking, porosity, and the degradation of corrosion resistance attributable to precipitation.

Our research aims to fulfill a dual purpose: to ascertain the most effective filler metal for this particular heterogeneous welding process, and subsequently, to optimize the relevant welding parameters. The findings obtained illustrate the synergistic effect of welding parameters and the type of filler metal on the solidification microstructure and mechanical characteristics of the welded joints. Furthermore, the analysis indicates that filler metal 308 facilitates the attainment of enhanced mechanical properties.

Keywords: Ferritic and austenitic stainless steel, TIG welding, filler metals, chemical compositions (AISI 430, 316L).

O4-J: Inhibition of St37 carbon steel corrosion in 15 % H 2 SO4 by a newly synthesized Schiff Base

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The aim of this study was to evaluate a synthesized Schiff-based compound as a corrosion inhibitor for St37 steel in a 15% sulfuric acid solution. The corrosion rate was measured using weight loss, potentiodynamic polarization (PDP), and electrochemical impedance spectroscopy (EIS). Results indicated that the best protection was achieved with an average efficiency of 98% at a concentration of 1250 ppm of the tested compound, which acted as a mixed inhibitor with a predominantly cathodic effect. This protection was attributed to spontaneous adsorption at the steel/solution interface, in line with the Langmuir monolayer isotherm. Thermodynamic and kinetic parameters revealed that the adsorption process is endothermic, with the Schiff base molecules being more orderly arranged along the surface. Scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS) were carried out to characterize the protective layer. Furthermore, infrared spectroscopy (FTIR) and X-ray diffraction (XRD) analyses of the exposed metal specimen corroborated these findings by confirming that the inhibitor molecules bonded to the surface of the working electrode.

Keywords: corrosion, synthetic inhibitor, Schiff base, sulfuric acid, adsorption

POSTER-J

P1-J: The influence of varying percentage of copper on the structure and corrosion behavior of Zn-1Mg-XCu (X=0.6, 0.9wt%) alloys

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Biodegradable alloys based on zinc and magnesium Zn-Mg are being studied for their promising biomedical applications. These alloys combine the individual advantages of zinc and magnesium in terms of biodegradability and biocompatibility. In effect, their composition enables controlled degradation in biological environments, thus avoiding harmful effects on surrounding tissues. Moreover, the adjustable mechanical properties of these alloys make them suitable for a diverse range of medical applications, such as orthopedic implants and fixation devices. Continuing research in this field aims to optimize Zn-Mg alloy compositions to respond to the specific requirements of biomedical applications, while guaranteeing their security and efficacy. In the present work, the effect of copper at concentrations of 0.6 and 0.9% respectively on the structure and corrosion behavior of the Zn-1Mg alloy was investigated. The samples were subjected to homogenization treatment at 350°C for 24 hours in a muffle furnace. Techniques such as optical microscopy, scanning electron microscopy and XRD were used to highlight the effect of copper on the structure of the Zn-1Mg alloy. The electrochemical study was carried out using an AUTOLAB galvanostat potentiostat after one hour's immersion at a temperature of 27°C in physiological Hank's solution with a conventional three-electrode electrochemical cell: a working electrode, a platinum counter-electrode and a saturated calomel reference electrode. Potentiodynamic polarisation curves were plotted over a potential range from -600 to +1500 mV, with a 1mV/s scan rate. Electrochemical impedance curves were plotted over a frequency range from 100kHz to +10 mHz, with a signal amplitude of 10 mV. The results of the micrographic study using an optical microscope show that the three alloys have a granular structure. Copper generally has a biocidal effect and also acts as a grain refiner. Increasing the percentage of copper in the Zn-1Mg alloy refines the structure of the alloy. Its presence in the alloy causes the precipitation of intermetallics containing the three elements Zn, Mg and Cu.The results of electrochemical tests show that the three materials in Hank's solution after one hour's immersion. According to the shape of the curves Log i = f (E), the three materials present a substantially identical behaviour. With the addition of copper, we note that the corrosion potential tends towards positive values, moving from -1145 mV/ECS to -1110 mV/ECS. In parallel, we note a slight decrease in the corrosion current density in the case of the Zn-1Mg-0.9Cu alloy compared with Zn-1Mg. In the anodic branches, a significant passivation plateau is observed in all the alloys in the corrosive environment. This plateau is the result of the formation of a passive layer on the surface of each alloy.

Key words: biodegradable, alloys, corrosion, Zn-Mg, copper.

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P2-J: Glaucium Extract for the Inhibition of St37 steel corrosion in 15 % H 2 SO4

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The use of inhibitors to prevent metal degradation has gained significant attention. This study investigates the corrosion-inhibiting properties of Glaucium extract on St37 steel exposed to a 15% sulfuric acid solution. The extract demonstrated potential as an adsorbent on the steel surface, playing a protective role against corrosion. Corrosion inhibition efficiency was assessed using gravimetric analysis and electrochemical methods, showing an increase in efficiency with higher inhibitor concentrations, reaching up to 85%.

In addition to these methods, the morphological and compositional changes in the steel surface were analyzed using scanning electron microscopy (SEM), energy-dispersive spectroscopy (EDS), X-ray diffraction (XRD), and Fourier-transform infrared spectroscopy (FTIR). The results confirm the formation of a protective film on the steel surface, following the Langmuir adsorption model. The Glaucium extract functions as a mixed-type corrosion inhibitor, offering an effective, eco-friendly alternative for preserving steel in acidic environments.

Keywords: corrosion, green inhibitor, , sulfuric acid, adsorption

P3-J: Effect of laser Nd:yag on elasticity of aluminum alloys.

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Aluminum is an ideal product for many uses thanks to its properties (corrosion resistant, electrical conductor and particularly resistant).However aluminum alloys have weak mechanical properties (hardness, elasticity) that can be improved by different treatments. In this work we are interested to study effect of irradiation laser Nd:yag on elastic modulus and hardness by nano indentation measures of commercial aluminum alloys.

The objective of this study was to investigate the influence of number of shots of laser Nd:yag on elasticity and hardness of two kind of aluminum alloys (industrial and recycled). We used the Nd: Yag pulsed laser (with wavelength λ= 635nm) to irradiate the surface of the samples after the AFM microscope is used to show and analysis the surface irradiate . We found that the elasticity and hardness of the different irradiated zones increase with the increases in the number of laser shots and after a sufficient number of shots the different parts of the irradiated zone have the same nano indentation curves because of the various changes induced on the nanostructure at 120 shots.

Key words: Aluminum alloys, laser irradiation, nano indentation, elasticity and hardness.

P4-J: CHARACTERIZATION AND ADHESION EVALUATION OF BORIDED AND NITROCARBORIDED AISI 4130 STEEL

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The effects of single and combined surface treatments produced by boronizing and nitroboronizing processes on the formed layers and mechanical properties of the AISI 4130 steel were investigated. The complex surface treatments called nitroboronizing is composed by pack boriding at 950°C during 5h followed by salt bath nitrocarburizing at 580°C for 6h. Layers were characterized by means of optical and scanning electron microscopy, and X-ray diffraction. The mechanical properties were evaluated mainly by hardness, and weight loss. The adhesion of borided and nitroborided steels were evaluated by the Daimler Benz Rockwell C test. The damage of different layers was compared with the adhesion strength quality maps HF1-HF6. In general, the adhesion strength quality of single treatment is sufficient. The duplex treatment generated a delaminating and the formation of the ramified cracks around the indentation mark indicating brittleness and high residual tensile stresses obtained in the FeB phase and cannot give the best properties

Key words: Steel, Duplex treatment, Adhesion, Wear

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P5-J: Inhibition effect of myrtle oil on corrosion of API 5L X52 pipeline steel in a 3.5% NaCl solution

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In the hydrocarbon industry, particularly in oil and gas production, internal corrosion of pipelines is a phenomenon that poses a serious problem. The aqueous solutions containing salts that accompany the production of hydrocarbons such as oil, condensate and gases, often loaded with CO2, H2S and NaCl, make these environments corrosive for the materials used in the manufacture of production equipment. The use of corrosion inhibitors offers flexible and effective solutions for optimising pipeline performance by precisely controlling reactions according to specific requirements. In addition, their use can often reduce production costs and improve the quality of final products, which makes them indispensable tools in many industrial fields. Our study focuses on the use of a vegetable oil-based corrosion inhibitor such as myrtle oil at different concentrations (0.2, 0.4, 0.6 and 0.8ml) on the corrosion behavior of API 5L X52-pipeline steel.Electrochemical measurements were carried out in an aerated aqueous solution containing 3% NaCl using an AUTOLAB potentiostat-galvanostat. Polarisation curves were plotted over a range of potentials (from -1 to 1.2 V /SCE) with a scan speed 1mV/s. Electrochemical impedance spectroscopy (EIS) measurements were also carried out over a frequency range from 100 kHz to 10 mHz with a signal amplitude of 10 mV. The addition of the inhibitor shifts the corrosion potentials towards electronegative values up to -626 mV. We note that the addition of myrtle oil influences the anodic and cathodic slopes by decreasing the anodic and cathodic current densities, which indicates that myrtle oil acts as a mixed inhibitor. All the potentiodynamic polarisation curves show a passivation plateau in the anodic region. This plateau is attributed to the formation of a passive layer on the surface of the X52 steel. The various electrochemical parameters deduced from the polarisation curves are shown in Table 1.From the results, it can be seen that the highest efficiency (97%) is observed for a concentration of 0.4ml, where the corrosion current density has a low value of around 1.017µA.cm-2.

Electrochemical impedance measurements show that the addition of myrtle oil inhibitor induces the presence of two capacitive loops in the impedance diagrams. The high-frequency loops correspond to the phenomenon of charge transfer, while the low-frequency loops are attributed to the adsorption of the complex formed between the inhibitor molecules and the ferrous ions dissolved in the solution.

Key words: corrosion, inhibitor, myrtle, impedance, API 5L X52-pipeline.

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P6-J: The study of intergranular and pitting corrosion in welded joints

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The purpose of this work lies in understanding the corrosion phenomena that affect welded joints. Welding has a negative effect on the corrosion resistance of materials and can lead to premature product failure due to corrosion damage in the weld zone **[1].** Such incidents are frequent and require analysis to determine the exact causes of the damage and to prevent them in the future. The damage is concentrated in the weld zone**.** Intergranular corrosion and pitting corrosion are forms of localized corrosion that often occur in welded joints of austenitic stainless steels and aluminum alloy as well **[2]**. In this work, we will address the use of applied electrochemical study methods to evaluate the corrosion properties of different parts of their welded joints (open circuit voltage, electrodynamic bias curves and electrochemical impedance spectroscopy), electron microscopy examination and AFM used to analyze the corrosion mechanism SEM. As well as non-destructive methods NDT.

Keywords: corrosion, welding, Metal assemblies, NDT, AFM characterization, Protection.

K. Artificial Intelligence & Industry 4.0 in materials science

POSTER-K

P1-K: organic inhibitors for corrosion protection of metals

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The study of the inhibition of carbon steel corrosion in acidic media by organic inhibitors is one of the most important topics of current research in various fields, mainly for reasons of ecotoxicity. Schiff-base organic compounds can be used as promising corrosion inhibitors due to their easy process, their production with good yields, their high thermal stability, their high coordination ability, and also, they are inexpensive and biodegradable.it can be used also as anti-inflammatory, anti-microbial, and antioxidants. In this work a new Schiff base was synthesized and used as a corrosion inhibitor. And was investigated against carbon steel dissolution in acid by Gravimetric method, Impedance measurements.

P2-K: Real-Time Implementation of an Intelligent Vision System for Object Detection and Recognition

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Recently, Convolutional Neural Networks (CNN) has revolutionized various fields by providing effective solutions for complex tasks such as object detection. Despite their remarkable performance, deploying these models on embedded platforms poses challenges due to their significant size and computational requirements. Thus, this research focuses on compressing and optimizing CNN models to facilitate their integration into real-time applications on resource-constrained devices. After exploring the state-of-the-art in object detection and CNN architectures, an approach based on the YOLOv5 model is proposed. Additionally, a quantification methodology is suggested to accelerate the inference process on embedded devices. Experimental results confirm that this method reduces model complexity while maintaining acceptable performance.

Keywords: Deep Learning, Convolutional Neural Networks (CNNs), Object Detection, YOLOv5, Quantification, Embedded Platforms.

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P3-K: Predicting the storage duration of frozen meat through artificial neural network modeling utilizing color values.

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Among the different approaches to assess the storage duration of frozen meat, sensory analysis, particularly regarding color variations, stands out as a significant factor influencing consumer acceptability, alongside physical and chemical property analyses. This research utilized an artificial neural network (ANN) to forecast the meat's storage time by employing the CIELAB color space, indicated by the Lab* (L*), (a*), and (b*) values captured via a computer vision system at two-month intervals for a duration of up to one year. The optimization of the ANN topology was achieved by analyzing shifts in correlation coefficients (R2) and mean square errors (MSE), culminating in a network featuring 60 neurons within a hidden layer (R2 = 0.9762 and MSE = 0.0047). The ANN model'sperformance was evaluated using criteria such as mean absolutedeviation (MAD), MSE, root mean square error (RMSE), R2, and meanabsolute error (MAE), which were found to be 0.0344, 0.0047, 0.0687,0.9762, and 0.0078, respectively. Overall, these results suggest thatusing a computer vision–based system combined with artificialintelligence could be a reliable and nondestructive technique forevaluating meat quality throughout its storage time. These findings indicate that a system integrating computer vision with artificial intelligence may serve as a dependable and non-invasive method for assessing meat quality during its storage period.

Keywords: Beef meat; ANN modeling; color parameters; storage time

P4-K: The impact of Human-AI Conflicts in Process Systems Engineering

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As we delve into Industry 4.0 and beyond, the integration of artificial intelligence (AI) in process systems engineering has led to significant advancements in efficiency and predictive capabilities. However, this progress brings forth a crucial challenge: the potential for conflicts between human intelligence (HI) and AI, particularly in observation, interpretation, and control actions.In the transition toward intelligent augmentation—where AI is designed to support rather than replace human operators—addressing these conflicts becomes essential for maintaining safety in industrial processes. The presentation will explore the intricate dynamics of human-AI interaction, emphasizing the often-overlooked discrepancies in interpretation. Such conflicts can arise when humans and AI interpret data differently, posing risks to the safety of operations. Additionally, we will examine the broader implications of these human-AI conflicts, particularly within AI-driven systems, where disagreements in observation and control actions add complexity to the safe operation of process plants. By addressing these challenges, this presentation aims to provide insights into effective strategies for managing and mitigating human-AI conflicts, ensuring that their collaboration enhances, rather than compromises, safety in contemporary industrial environments.

Key words: artificial intelligence, intelligence augmentation, process safety, Strategy.

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