كلية العلوم التطبيقية - أيت ملول
FACULTE DES SCIENCES APPLIQUEES – AIT MELLOUL

3rd Edition

INTERNATIONAL CONFERENCE ON WATER DEPOLLUTION AND GREEN ENERGY - CIDEEV2024

May 8-9, 2024 – FSA, Ait Melloul, Morocco

Theme:

Innovating for Sustainable Development: The Energy-Water-Agriculture Nexus

Book of abstracts

About CIDEEV 2024

In its third version, CIDEEV 2024 gathers multiple researchers, engineers, scientists, and industry experts, all driven by a common purpose: advancing sustainable solutions for water depollution and the progression of green energy technologies. This conference serves as an indispensable platform for the exchange of knowledge, the cultivation of innovation, and the promotion of interdisciplinary collaboration.

CIDEEV offers a unique opportunity to engage with the latest research, innovations, and industry trends in the fields of water depollution and green energy. Attendees can connect with like-minded professionals, collaborate on sustainable solutions, and contribute to a greener and cleaner future. Join us in the quest for a more sustainable and environmentally friendly world.

The first two editions were held at The Higher School of Technology of Casablanca, successively in 2019 and 2022. These events were a great success, resulting in several high-quality publications in indexed journals.

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CIDEEV Speakers

Prof. Thierry Boulard

Conference title: Protected Cultivations of Horticultural Products: A Review of their Environmental Footprint.
Keywords: Life Cycle Assessment, LCA, protected cultivations, greenhouses, environmental impact.
Affiliation: Retired from INRAe

Prof. Ahmed Ihlal

Conference title: Atmospheric water harvesting: potential and challenges.
Keywords: Atmospheric water, harvesting, solar energy.
Affiliation: LMER, Ibn Zohr University

Prof. Charafeddine Jama

Conference title: Corrosion protection of carbon steel using cold plasma technologies
Keywords: Cold plasma; Surface modification; Corrosion protection, Electrochemical impedance spectroscopy.
Affiliation: Centrale Lille.

Prof. Ahmed Ennaoui

Conference title: Energy Transition: Water and Energy, Research & Development, Innovation and Governance (R&DIG).
Keywords: PV technology in desert environment , governance and management, energy, water, food Nexus.
Affiliation: Research Institute for Solar Energy and New Energies (IRESEN).
Founder of Virtual Learning Uniersity.

Dr. Saad Y. Jasim

Conference title: **Ozone & Advanced Oxidation Processes to address Water Scarcity and Sustainability.**
Keywords: **Sustainability, Climate Change, Ozone, Advanced Oxidation Processes.**
Affiliation: **President, SJ Environmental Consultants (Windsor) Inc.**

Dr. Hicham Fatnassi

Conference title: **Agrivoltaic Systems: Exploring Realities, Addressing Challenges and Unlocking Potential**
Keywords: **Agrivoltaics, Photovoltaic Greenhouse, PV open field shelter, Photovoltaic Energy, PV Panels, Crop.**
Affiliation: **INRAE, l'Institut national de recherche pour l'agriculture, l'alimentation et l'environnement, France.**

Prof. Mohamed TAHIRI

Conference title: **Water and Energy: Solutions for Low and Middle-Income Countries Facing a Global Crisis in the Third Millennium**
Keywords: **Acute Drought, Water Shortage, Climate Change Impacts, Reuse of Purified Water, Energy Crisis, Renewable Energies, Energy Mix, Innovative Solutions, Green Transition, Morocco**
Affiliation: **International Academy of Scientific Francophonie , Francophone University Association (IASF – FRA).**

Program of CIDEEV 2024

PROGRAM CIDEEV 2024

WEDNESDAY MAY 08, 2024

08h30 – 09h00	Registration	
09h00 – 09h30	Opening Words	Prof. Abdelaziz BENDOU, President of Ibn Zohr University - Agadir Prof. Ali RACHIDI, Dean of the Faculty of Applied Sciences, Aït Melloul Prof. Abderrahman NAIT ALLA, Chair of CIDEEV2024 Prof. Mohammed CHAFI, Co-chair of CIDEEV2024
09h30 – 10 h15	Conference 1: Conference title: Corrosion protection of carbon steel using cold plasma technologies. *By Prof. Charafeddine Jama.* Moderators: Prof. Mohammed CHAFI and Prof. Abdelaziz El AMRANI.	
10h15 – 10h45	Coffee Break / Poster Session	
10h45 – 11h30	Conference 2: Conference title: Agrivoltaic Systems: Exploring Realities, Addressing Challenges and Unlocking. Potential. *By Dr. Hicham Fatnassi.* Moderators: Prof. M'barek FEDDAOUI and Prof. Lahcen BAMMOU.	
11h30 – 12h15	Conference 3: Protected Cultivations of Horticultural Products: A Review of their Environmental Footprint. *By Prof. Thierry Boulard.* Moderators: Prof. Hassan DEMRATI and Prof. Abdeslam TIZLIOUINE.	
12h15 – 15h00	Lunch Break	
15h00 – 15h45	Conference 4: Conference title: Ozone & Advanced Oxidation Processes to address Water Scarcity and Sustainability. *By Dr. Saad Y. Jasim.* Moderators: Prof. Noureddine KAMIL and Prof. Monssif NAJIM.	
15h45 –	Oral Session 1	
16h45 – 17h15	Coffee Break / Poster Session	
17h15 –	Oral Session 2	

END OF THE 1st DAY

THURSDAY MAY 9, 2024

09h00 – 09 h45	Conference 5: Energy Transition: Water and Energy, Research & Development, Innovation and Governance (R&DIG). *By Prof. Ahmed Ennaoui.* Moderators: Prof. Saloua JEMJAMI and Prof. Alaâeddine ELHALIL.
09h45 – 10 h30	Conference 6: Conference title: Atmospheric water harvesting: potential and challenges. *By Prof. Ahmed Ihlal.* Moderators: Prof. Said BOUCHTA and Prof. Lhaj El Hachemi OMARI.
10h30 – 11h00	Coffee Break / Poster Session
11h00 – 13h00	Oral Session 3
13h00 – 15h00	Lunch Break
15h00 – 15h45	Conference 7: Water and Energy: Solutions for Low and Middle- Income Countries Facing a Global Crisis in the Third Millennium. *By Pr Mohamed TAHIRI.* Moderators: Prof. Mohamed CHIBAN and Prof. Charafeddine Jama.
15h45 – 17h00	Oral Session 4
17h00 – 18h30	Coffee Break / Poster Session

AWARD CEREMONY / CONGRESS CLOSING

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Biological and Ecological assessment of Freshwater Fish within the Zat Watershed (Morocco) across an altitudinal gradient

AHNICH *Abdelilah*[1], NAIMI *Mohamed*[1], AITBOUMALASSA *Fayçal*[1], KHALKI *Hanane*[1], HANFOURI *Souhaib*[2]

[1] Sultan Moulay Slimane University, Beni-mellal, Morocco
[2] Cadi Ayyad University, Marrakech, Morocco

Abstract: The phenotypic flexibility and adaptability of freshwater fish can lead to morphological and structural changes in response to variations in their environment. The study of these responses is of paramount importance in understanding the vulnerability of these species to environmental perturbations, whether of natural or anthropogenic origin.
In this research, we used an altitudinal gradient as an indicator of upstream and downstream environmental variations, and examined its impact on fish morphology and population structure. We chose the barbel, which occupies four different geographical stations, as a suitable biogeographical sample. We explored correlations between several variables using biological, ecological, morphological and environmental analyses. Analyses of water quality revealed a clear improvement upstream, favoring the isolation of *Luciobarbus ksibi* in terms of its adaptation to high altitudes, while downstream, the disappearance of *Luciobarbus magniatlantis* highlighted the sensitivity of these populations to variations in environmental quality. Along the altitudinal gradient, Ait Ourir barbels showed a reduction in the distance between their dorsal and pectoral fins as they moved upstream, while Tamgounnssi barbels showed an increased eye diameter and maximum body depth. In contrast, upstream barbel from Mriouate and Zerouane showed higher values for eye diameter, with Mriouate showing a longer pre-orbital distance and Zerouane a shorter pre-orbital distance. These observations suggest potential adaptations of fish to different environmental conditions along the altitudinal gradient, in response to thermal and hydrological variations. Other morphometric and functional characteristics were also influenced by selective environmental factors.
These results highlight the sensitivity of barbel to climate change, paving the way for future studies in the field of ecological conservation.

Keywords: Zat, Freshwater fish, geometric morphometry, population structure, biological index.

Contribution to the study of the inhibition of scaling in sewage pipes for transporting treated water

Mustapha Nassiri[1,*], *Ilham* Karmal[1], *Sara* Darbal[1], *Mohamed* El housse[1], *Said* Ben-aazza[1], *Abdallah* Hadfi[1], *M'Barek* Belattar[1] *and Ali* Driouiche[1]

[1]Team "Materials and Water Physico-Chemistry", Laboratory of Process Engineering, Faculty of Sciences, IBN ZOHR University, P.O. Box 8106, Agadir, Morocco

Abstract: Water scaling is a phenomenon that occurs when a surface comes into contact with water qualified as incrusting, i.e., liable to cause the formation of an adherent deposit. This phenomenon is observed and highly accentuated in the pipes used to transport purified water in the Greater Agadir region.

Generally, the solutions used to reduce scale deposits are either physical or chemical. Our understanding of the operation of physical methods is still partial, limiting their use. Due to their effectiveness and performance, chemical methods are the most widely used. Inhibitors, which are generally used, act by establishing a threshold effect. The aim of this study is to discover new ecological inhibitors from plants in the Greater Agadir region. These inhibitors must meet several criteria, including a high capacity to prevent scale formation, low toxicity, high biodegradability, minimal impact on water quality, and good value for money.

The Agadir region is characterized by an arid climate, limited water resources, and nutrient-poor soils, so the use of treated wastewater in agriculture and watering golf courses and green spaces can help preserve the region's water resources. These green spaces cover hundreds of hectares, requiring a substantial volume of irrigation water annually. Similarly, golf courses, spanning hundreds of hectares, demand a significant amount of water each year

Purified water from the L'Mzar wastewater treatment plant has the potential to meet this demand. However, the main obstacle to this project lies in the quality of the purified water, leading to the clogging of water transport pipes and the pores of sprinklers used to irrigate golf courses and green spaces, due to scale build-up. Our objective is to either minimize or completely inhibit scale formation in these irrigation systems.

A sustainable environmental solution focusing on the use of a plant extract from the Souss region as an environmentally friendly inhibitor was highlighted. My study is divided into two main parts. Firstly, I looked in detail at the process of extracting compounds from the plant, with particular emphasis on the precise identification and dosage of this extract. Understanding the chemical composition of the extract is crucial for assessing its inhibitory potential. Next, I characterized the inhibitory effect of this extract using the LCGE technique, which enabled us to rigorously assess the inhibitory efficacy of this plant extract.

Keywords: Water scaling, wastewater, plant extract, Inhibitors.

Study of the scaling of transport pipes by hot water: The case of water from the Ain Skhouna spring in the Agadir region

Sara Darbal [1,*], *Ilham* Karmal [1], *Mustapha* Nassiri [1], *M'barek* Belaatar [1], *Said* Ben-Aazza [1], *Abdellah* Hadfi [1], *Ali* driouiche[1]

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Abstract: The scaling of hot water pipes is a major problem, with harmful economic consequences. Scaling occurs when a surface comes into contact with water considered to be incrusting, i.e. likely to cause the formation of a crystalline deposit known as tartar. It is more pronounced in hot water.
As part of the drive to diversify tourist sites in the Agadir region, a project located 10 km from the city's tourist zone is currently underway. This is a thermal spa offering thermal baths, spa treatments, massages and other therapies to treat a variety of ailments. The project aims to harness the warm waters of the Ain Skhouna spring. The spring is located around 7 kilometres north of Agadir, in the commune of Drarga, more precisely in Douar Idoubella Tagadirt. The water from this spring is renowned for its therapeutic and curative properties.
At present, the pipes carrying hot water from the Ain Skhouna spring, either to the borehole or to a temporary reservoir, are clogged with scale after only a few weeks of operation. This clogging results in a reduction in flow and, consequently, the need for periodic replacement of these pipes.
The aim of our study is to find a solution to the scaling problem caused by water from the Ain Skhouna spring. This study involves identifying the scale deposits collected inside the pipe carrying these hot waters, which is the subject of this paper. The analytical techniques used for this identification are: X-ray diffraction (XRD), infrared spectroscopy (IR), X-ray fluorescence, scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), differential thermal analysis (DTA) and thermogravimetry (TGA). Analysis of the results obtained by these different techniques revealed that the scale studied is mainly composed of gypsum ($CaSO_4,2H_2O$).
Key words: Scaling, hot water, Ain Skhouna, characterization, scale, gypsum.

Hospital discharges: special emphasis on characterization, impact, and treatment of pollutants and antibiotic resistance

Fatimazahra Sayerh[1*], *Latifa Mouhir*[1], *Laila Safaadi*[1]

[1] Faculty of Science and Technology of Mohammedia, Hassan II University, Casablanca, Morocco

Abstract: Healthcare establishments generate large volumes of liquid effluents which are part of specific activities related to care, analysis and research. These effluents are characterized by a very high organic matter load in terms of biochemical oxygen demand, chemical oxygen demand, and suspended solids. In addition, a wide variety of products for medical use (antibiotics, solvents, heavy metals, radioelements, drugs) but also cleaning and disinfection products, likely to end up in the wastewater of these establishments. This chemical pollution is accompanied by biological pollution from the excreta of patients (fungi, bacteria sometimes resistant to antibiotics, viruses and parasites). However, hospital effluents are considered similar to domestic wastewater and they are generally discharged directly into the sewers without any prior treatment, thus joining the municipal wastewater treatment plant whose effectiveness of the processes on the degradation or retention of different products is changeable. However, a variety of products are still present in the water after treatment, thus creating a worrying risk for human health and the environment. In addition, hospital effluents, by conveying antibiotics, promote the emergence of antibiotic-resistant microorganisms in the environment. This resistance has become a global problem that manifests itself differently in different countries by causing the transmission of different infections. In this context, an effort is made to protect water resources through current treatment methods that involve physico-chemical processes such as adsorption and advanced oxidation processes, biological processes such as activated sludge and bioreactors at membranes and other hybrid techniques. Faced with all these risks, the regulatory framework governing hospital effluents remains insufficient in the majority of countries and absent in others. Hence the need for further scientific research, in order to develop effective treatment tools, making it possible to mitigate the emergence and spread of various contaminants in the environment and to remedy the phenomenon of antibiotic resistance.

Keywords: Hospital wastewater, Characterization, Pollutants, Impacts, Antibiotic resistance, Treatment

Strategic Ore Blending for Optimized Flotation Recovery in Mixed Copper Ore Deposit: A Mixture Process Design Approach to Mineralogical Variability

Rachid Faouzi[1], Hassan Oumesaoud[1], Khalid Naji[2], and Moulay Abdelazize Aboulhassan[1]*

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Abstract: The flotation recovery of copper from mixed ore deposits is significantly influenced by mineralogical variability, mainly due to oxide copper-bearing minerals, which often compromise recovery when processed with primary and secondary sulfide ores. This study proposes a strategic ore blending framework to counteract the negative impacts of such variability. An extensive experimental suite was conducted using a mixture process design, exploring the interplay of pH, collector dosages, solid percentages, particle sizes, and blending ratios underpinned by rigorous chemical and mineralogical feed analyses. The research identified a parabolic response of flotation recovery to pH, isolating an optimal range for maximized copper yield. Positive correlations were established between sulfide mineral prevalence and recovery, as well as with Potassium Amyl Xanthate dosages, while particle size and hydroxamate dosage were negligible. Critical to this study is the discovery of antagonistic interactions when blending malachite with chalcopyrite and chalcocite with chalcopyrite, contrasted by a synergistic relationship between chalcocite and malachite. The data suggest a prioritization of blending sequences to enhance flotation efficiency. The investigation advances our understanding of blending strategy optimization, emphasizing the dominance of mineralogical factors over processing parameters in dictating recovery outcomes. These insights hold substantial implications for the planning and forecasting of ore processing, with the potential for significant metallurgical performance enhancements in the flotation of mixed copper ores by adopting the adequate blending strategy.

Keywords: Copper ore flotation, Mineralogical variability, Ore blending, Mixture process design, Metallurgical recovery optimization

Soil fertility and agro-physiological responses of Basil (Ocimum basilicum L.) irrigated by treated domestic wastewater

Nadia Bougdour[1], Naoual Tajat[1] , Widad El Hayaoui[1] , Idriss Bakas[1] , Chafia Hajji[2] , Ali Assabbane[1]*

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[2] Faculty of Applied Sciences, CUAM, Ibn Zohr University, Morocc

Abstract: This work aimed to investigate the effect of treated sewage irrigation on the physiological and agronomic properties of basil. An experimental reuse study was performed using raw wastewater (RWW) and treated urban wastewater (TWW) by the Multi-Soil-Layering (MSL) process to irrigate Basil (Ocimum basilicum L.) in comparison to well water (WW) as a control over a period of 4 months. Based on the residual sodium carbonate (RSC), sodium percentage (Na%), and sodium adsorption ratio (SAR), the water quality was assessed for irrigation. These results showed that all treatments were suitable for irrigation. In this study, we also assessed the agro-physiological and biochemical proprieties of the crops. Hence, the highest productivity of basil and leaf area were achieved in reply to irrigation with RWW and TWW compared to WW; macro-elements (TP, TKN, and K) were also affected in basil irrigated with RWW in comparison with TWW and WW. However, the plants that receive well water accumulate higher Ca, Na, and Mg compared to those that receive RWW and TWW. All the crops irrigated with three water treatments showed a relatively similar concentration of micro-nutriments. The prevalence of total chlorophyll content in the plants has increased with WW irrigation. Nevertheless, RWW irrigation had a negative impact on biochemical parameters (protein and sugar content) compared to basil irrigated with TWW and WW. Additionally, the application of treated urban sewage increases crop productivity by improving soil fertility and physicochemical characteristics compared to WW.

Keywords: Basil; irrigation; TWW reuse; physiological proprieties; agronomic proprieties

Optimization of Waterworks Networks: Detection and Location of Problems

Oumaima El ghammad[1,*] and *Jamal Mabrouki*[2]

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Abstract: This chapter covers the detection of unknown closed valves and the location of leak hot spots in water systems. It highlights the importance of detecting unknown closed valves to avoid problems such as pressure drops and inconsistencies in the water system. Detection methods involve the use of real-time monitoring technologies and data analytics. Locating leak hot spots is based on optimization analyzes with complex mathematical models, taking into account pressure, flow and discharge from fire hydrants. The amplification of pressure drops when closing valves is also discussed, highlighting its impact on resistance to water flow. Obtaining additional hydrant flow data is suggested to improve model accuracy. The interdependence with past strategies and arguments for wider use of optimizations in water network modeling are also highlighted, highlighting the potential benefits of these approaches for effective water resources management.

***Keywords*:** Unknown closed valves; hot spots; optimization of water distribution networks

Paper ID: 13

Critical evaluation and thermodynamic CALPHAD reassessment of the Germanium-Antimony binary system

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[2]Laboratory of Energy Engineering, Materials and Systems, National School of Applied Sciences of Agadir, Ibn Zohr University, Agadir, Morocco

Abstract. Thermodynamic modelling of the Ge-Sb binary system was carried out with the help of the CALPHAD (CALculation of PHAse Diagram) method. The liquid, Rhombohedral (Sb) and Diamond (Ge) phases have been described with the sublattice formalism and the excess model with the Redlich–Kister equation by the linear model of temperature dependence. All of the experimental data (phase diagram and thermodynamics information) available in the literature were used for the optimization of the thermodynamic parameters. The calculated phase diagram and the thermodynamic properties of the system are in satisfactory agreement with the majority of the experimental data.

***Keywords*:** Reassessment, Ge-Sb system**,** Calphad method, phase diagram

Experimental study of the improvement of the electrical efficiency of a photovoltaic panel using a phase change material

M. Bouzelmad[1,*], Y. Belkassmi[1], A. Kotri[1], M. Gounzari[1], F. Amallal[1]

[1] Laboratory of Physics, Energy and Information Processing (Lab.PETI), Polydiciplinary Faculty of Ouarzazate, University Ibn Zohr, Agadir-Morocco.

Abstract. The present research examines how a phase change material (PCM) can enhance the performance of photovoltaic (PV) panels in terms of energy production. The aim of the study is to explore the effect of heat extraction on PV modules with and without PCM through an experimental approach. The PV modules, both with and without PCM, were compared based on their actual cell temperature records. The PCM was applied on the collector's backside. The results of the experiment indicate that, on July 10, 2023, the daily temperature of a PV/PCM module was 9°C lower compared to a standalone PV module. Furthermore, the PV/PCM module achieved a maximum energy output of 38.08 W, while the traditional PV module reached a maximum output of 35.36 W. Additionally; the PV/PCM panels demonstrated the highest electrical efficiency of 15.13%, compared to the traditional PV's efficiency of 14.97%.

***Keywords*:** *Photovoltaic panel, passive cooling, PCM*

Recent advances and modification strategies of semiconductors for the photocatalytic remediation of water containing organic pollutants

Safiya MALLAH [1,*], Wafaa BOUMYA [2], Aicha MACHROUHI [3], Rachid ELMOUBARKI [2], Noureddine BARKA [2], Alaâeddine ELHALIL [1,*]

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Abstract: Synthetic organic dyes used in many industries present a major source of water contamination. The presence of these pollutants in water will produce negative effects on the aquatic organisms and ecological environment due to their resistance to natural degradation. In this context, numerous water treatment techniques methods including degradation by coagulation, ozonation, electrodialysis, electrochemical degradation and adsorption have been treated. Heterogeneous photocatalysis, an advanced oxidation process, has garnered extensive attention in environmental remediation for several reasons, including its simplicity, low cost, reproducibility, manageability, and efficiency. Various metal oxide (TiO_2, WO_3, SnO_2, ZnO, Cu_2O, CeO_2 and Fe_2O_3)-based semiconductors have been explored as excellent photocatalysts to degrade organic pollutants in wastewater. However, their photocatalytic performance is limited due to their high band gap (UV range) and recombination time of photogenerated electron-hole pairs. Different strategies for improving the performance of these metal oxides in the fields of photocatalysis are discussed. To improve their photocatalytic activity, researchers have investigated the concept of doping, semiconductor combinations and the formation of nanocomposites.

Keywords: Synthetic dyes; Heterogeneous photocatalysis; Semiconductors; Doping; Nanocomposites.

Flood Hazard, Assessment and Mapping for the Bouselem Part of the Medjerda Wadi with TELEMAC-2D

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Abstract. The objective of this study is to conduct a thorough examination of flooding occurrences in the cross-sectional area of Boussalem city (North Tunisia) in relation to potential future scenarios across different return periods. To achieve this, we have developed a 2D hydrodynamic model using TELEMAC-2D to simulate floods, this model takes into consideration the dynamic nature of both flows and floodplains and is crafted through the analysis and processing of available topographic and hydrological data. A lidar survey and an orthophoto covering the project area, which includes wadi beds and floodplain, were scrutinized to identify specific land use components. These components were then converted to create a bathymetric mesh. The formulation of three flood hydrographs for return periods of 20, 50, and 100 years was accomplished through an analysis of historical flood records in Boussalem. Following model calibration and validation, the study's main findings are summarized in three maps depicting water depth and velocity distribution. The ultimate synthetic histogram illustrates the spatial distribution area of flood risk over the rural and urban zone, revealing that flooded areas in the city account for 30%, 50%, and 86% in events with return periods of 20, 50, and 100 years, indicating a significant flooding risk.

***Keywords*:** Environmental risk, bidimensional model, Medjerda river, TELEMAC-2D, Flooding

Study of the Destruction of Climatic Factors and Energy Conservation in the New Argon Double Glazing Greenhouse

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Abstract: The increasing importance of covered crops in recent decades has spurred the establishment of goals for greenhouse design and management, with a focus on achieving a harmonious balance between productivity and environmental sustainability [1,2]. Specifically, current initiatives concentrate on optimizing greenhouse design to improve solar radiation absorption and maintain a consistent temperature environment for crops throughout their growth cycle [3]. This study, presented in this paper, utilizes TRNSYS 18 simulation and experimental validation techniques to explore the impact of Argon Double Glazing (ADG) on the distribution and uniformity of climatic factors within the greenhouse [4]. Furthermore, an energy analysis was conducted, revealing that ADG positively affects the reduction of heating and cooling requirements compared to other covering materials. The findings showcase the high efficiency of ADG as a construction material for greenhouses, resulting in a decrease in greenhouse production costs.

Keywords: Covered crops, New greenhouse design, Environmental sustainability, Argon Double Glazing (ADG), Climatic factors, Greenhouse production cost.

Numerical study of the impact of nanoparticles on saltwater film evaporation

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Abstract: This work presents a computational investigation aimed at analyzing heat and mass exchanges in the evaporation of a binary liquid film along a vertical tube. The liquid film moves in co-current with the dry air, and the tube wall is exposed to a uniform heat flux. The analysis takes into account the impact of gas-liquid phase coupling, varying thermophysical properties, and film vaporization. The findings pertain to how the intensity of heat and mass transfer is influenced by the flow rate and the composition of the inlet liquid film.

Keywords: Binary liquid films, Evaporation, mixed convection, heat and mass transfer.

Reuse of treated slaughterhouse wastewater from Rabat in agriculture

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Abstract: The scarcity of water resources and the degradation of their quality is a major challenge for the 21st century. Water scarcity is a common concern in many arid and semi-arid regions of the world. In order to preserve the quality of water bodies and reduce withdrawals from the natural environment, alternative resources must be sought. The reuse of wastewater, after its treatment, is part of the strategy for mobilizing and developing the country's water resources. In irrigation and compared to conventional resources, the contribution of treated wastewater remains low, it concerns less than 1% of irrigated areas. The reuse of treated wastewater can constitute an important alternative to the use of clean and fresh water in the agricultural sector, particularly in a country like Morocco, where irrigation uses up to 90% of the water consumed.
This study aims to evaluate the impact of the reuse of treated wastewater in irrigation using two parameters, stem growth and the average number of leaves for two plants (bean, tomato). For this we studied irrigation with different types of water; raw slaughterhouse wastewater, biologically light-treated water, sand-filtered water and well water. These results will be the subject of comparison of their effects on the development and production of beans and tomatoes.

Keywords: *Resource, Wastewater, Slaughterhouse, Irrigation, Biologically treated water, Filtered water.*

Development and thermo-mechanical analysis of a new ecological material based on gypsum

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Abstract: Gypsum is a multi-purpose building material, its composition makes it interesting properties for construction, but its major disadvantage is its fragility. We proposed to study the feasibility of obtaining composites material based on gypsum using on the one side vegetable fibres from waste of date palm, in order to value a local resource and on the other side to use synthetic fibres of polyester to make a comparison. We proceeded to the development of four types of mixtures, the first is the plaster only which was considered as a control, the second is a mixture of plaster and fibres with mass percentages (0.25 % date palm + 0.25 % polyester), the third one is a mixture of plaster and 0.5 % date palm fibres and the last one is a mixture of plaster and 0.5 % polyester fibres. It was found that the mixture of plaster with low percentages of these two types of fibres at the same time can slightly reduce its thermal conductivity about 12.29 % and can increase its flexural strength about 45.07 %. However, it was observed a decrease in the transverse compressive strength of plaster reinforced with date palm fibres about 24.32 %.

Keywords: gypsum, mechanical properties, plaster, polyester fibres, thermal properties, date palm fibres

Investigation of a new gypsum-based composite reinforced with olive pomace waste

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Abstract: In this study, we sought to produce a building material with improved thermal and mechanical properties in order to make an environmentally friendly material. To this end, we examined the effect of adding olive pomace to the plaster matrix. Four proportions of this additive (4, 8, 12 and 16%) were used and the thermal and mechanical characterisation of the composites was carried out. The optimised composites showed an interesting thermal conductivity with a reduction rate of 18.41%, and mechanical properties lower than those of the reference but in compliance with the standard. We also tested water absorption by capillary action for each specimen, and found that this coefficient increased with the percentage of waste.

Keywords: Construction; Olive pomace; recycling; plaster; thermal properties; mechanical properties.

Paper ID: 25

Simulations for evaluating a bridge impact on water behaviour - Application to the Medjerda River

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Abstract: This work explores the complex dynamics of hydraulic engineering in the challenging context of the Medjerda River basin, in response to the global flood crisis. The varying speeds and heights of the water surface present a dynamic landscape, with particular emphasis on how existing bridge structures influence the water`s behaviour. The investigation aimed to uncover information about morphological changes, velocity fields and hydraulic properties under these conditions.
The main objective is to understand the behaviour of water in the river at different velocities and water surface heights and to evaluate the impact of existing bridge structures on the water properties. Simulation results provide an understanding of water behaviour in the Medjerda River, providing valuable information on the variation of concentration and velocity fields.

***Keywords*:** Water behavior, CFD, velocity, numerical simulation, Medjerda, Flood Response.

Shape Reversibility and Crystallographic Transformations in Shape Memory Alloys

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Abstracts: A series of alloy materials take place in a class of advanced smart materials with the stimulus response to external effect. Shape memory alloys take place in this class by exhibiting a peculiar property called shape memory effect, with the chemical compositions in the beta phase field in phase diagrams. This phenomenon is characterized by the recoverability of two certain shapes of material in reversible way at different conditions. This phenomenon is initiated on cooling and deformation and performed thermally in a temperature interval on heating and cooling, with which shape of materials cycles between original and deformed shapes in reversible way. Therefore, this behavior is called thermal memory or thermoelasticity. This is plastic deformation, due to the soft character of the material in low temperature condition, with which strain energy is stored in the material and releases upon heating, by recovering the original shape. This phenomenon is result of crystallographic transformations, thermal and stress induced martensitic transformations. Thermal induced martensitic transformation occurs on cooling with cooperative movements of atoms in <110 > -type directions on the {110} - type planes of austenite matrix, along with lattice twinning, and ordered parent phase structures turn into the twinned martensite structures. Twinned structures turn into the detwinned structures by means of stress induced martensitic transformation with deformation in the martensitic condition.

These alloys exhibit another property, called superelasticity, which is performed with stressing and releasing in elasticity limit at a constant temperature in parent phase region, and shape recovery is performed instantly and simultaneously upon releasing the applied stress, by exhibiting elastic material behavior. Stress-strain profile is nonlinear in stress-strain diagram, also stressing and releasing paths are different, and hysteresis loops refers to energy dissipation. Superelasticity is also result of stress induced martensitic transformation and ordered parent phase structures turn into detwinned martensite structure with stressing. However, lattice twinning and detwinning reactions are driven by lattice invariant shear.

Copper based alloys exhibit this property in metastable β-phase region, which has bcc-based structures at high temperature parent phase field. Lattice invariant shear and twinning is not uniform in these alloys and gives rise to the formation of complex layered structures. These structures can be described by different unit cells as 3R, 9R or 18R depending on the stacking sequences on the close-packed planes of the ordered lattice.

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

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

Paper ID: 27

Effect of cooling rate on magnetic properties and pinning force in deuterated κ-(BEDT-TTF)$_2$Cu[N(CN)$_2$]Br organic superconductor.

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Abstract: In this work we have studied the magnetic suceptibility, the hysteresis loop, the magnetization, the critical current density, and finally, the pining force in κ-(ET)$_2$Cu [N (CN)$_2$] Br organic superconductors at temperature T=2 K, both in rapid and slow cooling of the sample through the structural transformation that occurs near 80K. Our results show that the cooling rate near 80 K has a significant influence on the superconducting properties, particularly magnetization properties and the pining force. The magnetic phase can be improved, and superconductivity can be degraded by fast cooling.

Keywords: organic superconductor, magnetic suceptibility, hysterisis loop, critical current density, pining force, cooling rate.

Harnessing nanoscience and nanotechnology for the Sustainable Development Goals (SDGs): A Case Study of Morocco

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Abstract: Nanotechnology is one of the most promising key technologies of the 21st century, extends its influence across the spectrum of scientific and engineering domains, from materials science to medicine and agriculture. Its versatility positions it as a solution provider for pressing global challenges in health, energy, climate, and the environment. Aligned with the United Nations' Sustainable Development Goals (SDGs) established in 2017, nanotechnology emerges as a catalyst for addressing interconnected issues, acknowledging the symbiotic relationship between poverty alleviation, health improvement, environmental sustainability, and economic equality.
Nanotechnology can be harnessed to address some of these issues [1]. However, nanotechnology has already brought many benefits to society and many further opportunities exist to develop and implement new technologies, with countless more yet to be discovered [2].
This study will highlight the importance of integrating nanosciences and nanotechnologies into sustainable development efforts, focusing on the case of Morocco. then will examine the link between nanotechnology applications and sustainable development, highlighting the progress made in exploiting this technology for the furtherance of society.

Keywords: Environment, Nanotechnology, Sustainable Development, SDGs.

Title example: Thermophysical characterisation of ecological bricks based on clay stabilised with wood ash or crushed waste from traditional potteries

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Abstract: Clay is the oldest building material used by mankind, as demonstrated by the housing built in many parts of the world. But in recent decades, with urbanization and Westernization, they are increasingly built with cement materials, mainly imported. This has led to high construction costs and high energy consumption for thermal comfort in buildings.
Today, the energy challenges that accompany the global environmental crisis, which is of concern to more and more people, are helping to make more and more people aware of the ecological, but not only, advantages of eco-construction.
In Morocco, for example, in mountainous regions such as the village of "Tighmi", there are still craftsmen building with local materials. What's more, more and more people, generally the more affluent, are taking an interest in building with local materials such as clay, earth and wood.
Recycling waste in the construction industry also helps solve another environmental problem: waste management. One of the wastes we are studying is wood ash.
The aim of the study is to investigate the possibility of incorporating wood ash or shredded waste from traditional pottery into the formulation of environmentally-friendly bricks. Laboratory-scale experiments were carried out on different mixtures to determine the optimum dosage that would achieve optimal thermal characteristics for brick blocks. The percentage of wood ash and ground pottery waste varied from 0 to 50% of the total dry mix mass. Clay samples were used to create brick blocks and cylindrical specimens 5 cm in diameter and 10 cm high. The optimum dosage of wood ash was found to be 5% in combination with clay. The addition of ground pottery waste improved the absorption of these blocks, and the highest thermal resistance values were recorded with a dosage of 20% pottery waste. By replacing 5% of the clay with wood ash or 20% with crushed pottery waste, it was possible to produce ecological blocks with an increase in thermal resistance comparable to that of traditional building materials.

Keywords: Ecologic building material, Clay, Wood ash, Thermo-physical characterizations.

Paper ID: 30

Optimizing Photovoltaic Cell Parameters: Employing the Walrus Optimization Algorithm for Single and Dual Diode Models, Alongside Module Models

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Abstract. Obtaining precise and reliable parameters for photovoltaic models from measured current-voltage data is crucial for the assessment, control, and optimization of photovoltaic systems. Despite numerous techniques developed to address this issue, the accurate identification of model parameters remains a complex task. To enhance parameter identification for various photovoltaic models, this article introduces a novel algorithm, the Walrus Optimization Algorithm (WaOA), designed to strengthen the precision and reliability of this process. The foundational principles embedded in the WaOA's design are derived from natural behaviors, including feeding, migration, evasion, and predator confrontation. The implementation stages of the WaOA are mathematically conceptualized across three distinct phases: exploration, migration, and exploitation. The original WaOA is employed to solve parameter identification problems for various photovoltaic models, such as those with a single diode, double diode, and photovoltaic module. Comprehensive experimental results and statistical analyses demonstrate that the WaOA exhibits comparable, if not superior, performance compared to other state-of-the-art algorithms in terms of accuracy, reliability, and computational efficiency.

***Keywords*:** Walrus Optimization Algorithm, Single diode model, Double diode model, Optimal solution, Photovoltaic.

Implementation of integrated scenarios for sustainable management of irrigation water supply and demand in the Chtouka perimeter.

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Abstract: Due to climate change and the recurrence of drought periods, conventional water resources are experiencing increasing restrictions, insufficient to meet the water requirements of farmers. In response to this issue, authorities have established a desalination plant with the aim of preserving agricultural activity in Chtouka.

This work aims to examine various scenarios and formulate appropriate allocations for the three main resources (Youssef Ben Tachfine dam, Chtouka aquifer, and desalinated water) to ensure the sustainability of the aquifer while meeting the water needs of farmers. To achieve this, visits and surveys were conducted to gather necessary data for analysis. Subsequently, a detailed mapping of the study area was developed to provide better visualization and extract information regarding greenhouse areas.

The considered scenarios seek to evaluate options for optimizing the use of desalinated water while preserving the Chtouka aquifer, simulating results for each type of hydrological year (normal, average, dry). Four distinct scenarios were selected: the first describes the current situation of the desalination plant operation and analyzes the effects of maintaining withdrawals from the aquifer until 2040. The second considers the management of water resource allocations with the strengthening of desalination plant operation. The third examines the effects of the commitment of large farmers with the financial capacity to receive an increased allocation of desalinated water. Finally, the last highlights the crucial importance of the desalination plant during a dry year.

Following our analysis, which primarily focused on limiting withdrawals to the renewable volume, we concluded that the implementation of the desalination plant and the enforcement of the Chtouka safeguard decree could restore the balance of the aquifer. However, to build reserves in the aquifer, mobilizable during dry years, it would be conceivable to seek the participation of large farmers practicing high-value-added crops in receiving additional allocations of desalinated water.

Keywords: *Water resources, Desalination, Farmers, Management, Climate change.*

Matériaux éco-durables à base de déchets de construction renforcés de bâtonnets de plumes de volaille, Propriétés mécaniques et durabilité.

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Abstract : Etant des territoires urbanisés, les villes sont les lieux les plus favorable à la consommation de ressources (matières, énergies). La capitale économique Casablanca en fait partie avec ses 4 Millions d'habitants et ses 60% de part dans l'activité économique et industrielle du royaume. En l'absence d'un cadre juridique en vigueur, le développement urbanistique a favorisé la génération de millions de tonnes de déchets de BTP. Les déchets de démolition et des chantiers de construction éparpillés dans les espaces ouverts causent ainsi des nuisances importantes pour l'environnement et pour les citoyens. Leur évacuation vers les vieilles carrières ou vers les décharges publiques est restée tributaire de plusieurs facteurs dont la non attribution des sociétés de gestion déléguée des déchets ménagers et bien d'autres. Ce qui inflige des coûts supplémentaires très significatifs et une contribution non négligeable au réchauffement climatique planétaire. D'où l'objectif principal de notre travail. Celui-ci consiste à chercher plusieurs voies de recyclage et valorisation des déchets en béton. Les travaux réalisés comprennent : l'évaluation à travers un travail sur le terrain de la quantité de ces déchets contenue dans chaque site. Ensuite la collecte et la caractérisation de l'échantillon représentatif. En troisième lieu, il y a le tri, le concassage, le broyage et le tamisage des échantillons sélectionnés. La caractérisation physico-chimique des échantillons collectés ont permis l'investigation des voies d'exploitation pour chaque fraction extraite en vue d'une gestion intégrée.
Dans le présent travail, nous avons procédé à l'exploitation des fractions fines obtenus après tamisage des échantillons représentatifs pour formuler des matériaux écologiques « briques » en les mélangeant aux tiges de plumes de volailles préalablement lavés, séchés à 150°c et dépourvus de kératine. Ces formulations ont été testées et caractérisées : critères physiques (résistance à la flexion et à la compression, le temps de séchage, la durabilité et le cycle de vie, …) et d'aspects (Fissuration, déformation…). Nous présenterons en détail les principaux résultats de nos travaux de recherche et décrirons également les propriétés spécifiques de chaque matériau développé.

Keywords : Déchets de démolition et des chantiers de construction, Logiciels de combinaison SIG-Earth, Valorisation de déchets inertes, Eco-matériau, Briques, Plumes, Maroc

Toward the discovery of an effective method for treating industrial effluents: Application of adsorption on activated carbon based on argan kernels

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Abstract : Water pollution caused by industrial effluents is a pressing issue in many countries, posing a threat to the environment. To combat this problem, scientists employ various methods, including physico-chemical processes like adsorption, to purify effluents. The present study focuses on the application of a naturally biodegradable adsorbent derived from argan trees located in southern Morocco, aiming to reduce the harmful effects of pollutants through a physico-chemical adsorption process. To highlight the purification power of the investigated natural adsorbent, an aqueous solution of dye methylene blue was prepared and used as synthetic effluent. The conducted experiments showed a significant removal rate within the first 15 minutes. In addition, the influence of adsorbent mass and concentration on the purification rate were also explored, and the results highlight the effectiveness of argan powder in adsorbing MB. By promoting pollution reduction, waste recovery, and water recycling, this research underscores the potential of argan kernels to benefit local communities.

Keywords: *Wastewater; Carbon, Water Treatment; Argan, Adsorption; Coloured Discharge; Isotherms.*

Paper ID: 35

Device simulation of MAPbI3 /MASnI3 heterojunction solar cell perovskite by SCAPS-1D

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Abstract: In this study, we conducted an in-depth analysis of the FTO/TiO2/ZnO/MASNI3/MAPbI3/Au solar cell characteristics using SCAPS-1D modelling. Our investigation commenced with the device modelling of a single-layer CH3NH3PbI3, incorporating bilayer ETL and Spiro-OMETAD HTL in a conventional solar cell. The results demonstrated excellent agreement with experimental data, yielding a Power conversion efficiency (PCE) of approximately 17.17%, as reported in the literature. Subsequently, our focus shifted to the design and thorough analysis of the understudy structure using the SCAPS-1D simulator to assess its potential performance parameters. We explored crucial features such as thickness, doping concentration, and defect density for both MAPbI3 and MASnI3, systematically optimizing these parameters to enhance device efficiency without the inclusion of HTL. Remarkably, this approach resulted in a significant efficiency of 41.64%. The presented findings in this paper contribute a systematic methodology and approach for constructing heterojunction perovskite solar cells (PSCs) with compelling and high efficiencies.

Keywords: SCAPS-1D; MASNI3; MAPbI3; PCE > 41.63%.

Paper ID: 37

Impacts of climate change on surface runoff in the Bouregreg basin (Morocco) by integrating regional climate model output data in the GR2M hydrological model

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Abstract: Watershed hydrology is facing significant challenges due to climate change. This study aimed to evaluate the impact of future climate change on surface runoff in the Bouregreg catchment. The Rural Genius Model (GR2M), combined with the outputs from the CNRM-CM5 climate model, was used to project monthly streamflow in the 2040s (2031-2050), comparing it with the reference period of 1982-2001 under medium (RCP4.5) and high (RCP8.5) emission scenarios. The methodology encompassed three main steps: (1) projecting future trends of various climate parameters using the regional climate model; (2) calibrating and validating the hydrological model; and (3) predicting potential runoff in the 2040s. The results showed inevitable climatic changes in the Bouregreg catchment under the Representative Concentration Pathways (RCP). Mean temperatures were projected to increase by 1.32 °C and 1.69 °C, potential evapotranspiration (PET) to rise by 5.38 mm and 6.27 mm, and precipitation to decrease by 33.74% and 40.20% under RPC4.5 and RCP8.5, respectively. These changes would lead to an annual decrease in streamflow of 44.63% for RCP4.5 and 64.30% for RCP8.5 by the 2040s compared to 1982–2001. The study's insights can be invaluable for decision-makers in developing effective strategies to manage and safeguard water resources in the Bouregreg catchment.

Keywords: Bouregreg catchment. Climate change. RCP. CNRM-CM5. GR2M model. Surface runoff.

Which aquaculture for a contribution consistent with the sustainable aquaculture initiative?

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ABSTRACT: The increase in the world's population, as well as the increase in average fish consumption per capita, as a result of the improvement in the quality of life of people in developing countries, has led to an explosion in request in fish.

To meet this need, and to preserve marine resources, global aquaculture has experienced a strong development over the last 30 years. This farming of carnivorous and omnivorous fish requires the distribution of fish to fish whose composition is in line with their nutritional needs, an ideal diet from a nutritional point of view would be composed of small wild fish from the sea fishing, because of their availability, plants have become the main source of protein and oil for farmed carnivorous fish, and help ensure the development of sustainable aquaculture.

The development of continental and marine fish farms raises a number of questions concerning the impact of this type of production on the aquatic environment. It is recognized that a significant portion of this impact is nutritional in origin. Discharges that consist essentially of uneaten food, faces (non-digestible part of the food and endogenous losses) and excretion products enrich the aquatic environment.

The negative environmental impacts of aquaculture are very numerous, but the most worrying is the eutrophication of watercourses receiving effluents from aquaculture farms. The main pollutants involved in this phenomenon are phosphorus (P), nitrogen (N) and suspended matter(SM), these pollutants are primarily food-borne and environmental concerns about aquaculture are not new. They have led researchers and producers to explore ways and means to make aquaculture a viable and sustainable activity

To improve their tolerance, fish feed manufacturing has included plant processing processes by the extrusion system. This process makes it possible to concentrate the protein content of vegetable flours by eliminating the maximum amount of fibers, to reduce their content of antinutritional factors, to make their food compounds more digestible, especially carbohydrates in order to improve their palatability and to minimize the risk of deterioration of the environment.

Keywords: extrusion, fish feed, phosphorus, nitrogen, suspended matter, environment.

Paper ID: 39

Optimization Study of Methylene Blue Dye Adsorption by Chamaerops Humilis Fibers Biosorption Using a Central Composite Design Approach

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Abstract: In this study, we investigated the potential of Chamaerops humilis (CH) fibers as a biosorbent for the removal of Methylene Blue (MB) dye from aqueous solutions. The fibers were subjected to characterization using X-ray diffraction (DRX), Fourier-transform infrared spectroscopy (FTIR) and ultraviolet-visible (UV-Vis) spectrophotometry. To optimize the dye removal process, we employed a Design of Experiments approach, specifically Central Composite Design (CCD), by varying factors such as pH of the solution, mass of the adsorbent, contact time, and temperature. The results obtained from CCD revealed the optimal conditions for achieving the highest elimination efficiency of 99.87% for a 10 mg/L MB concentration: Chamaerops humilis fiber dosage of 1.06 g/L, solution pH of 9.6, and a process duration of 60 minutes. The adsorption process was well-fitted with a pseudo-second-order kinetic model. The maximum adsorption capacity of the Chamaerops humilis fiber-based biosorbent was determined to be 9.42 mg/g. Thermodynamic parameters, including the change in Gibbs free energy (ΔG°), enthalpy change (ΔH°) and entropy change (ΔS°) were also calculated. The thermodynamic analysis indicated that the MB adsorption onto Chamaerops humilis fibers is spontaneous and endothermic. The findings of this study demonstrate that Chamaerops humilis fibers serve as a suitable and efficient adsorbent for the removal of MB dye from synthetic solutions. This eco-friendly and cost-effective approach offers promising prospects for wastewater treatment applications, contributing to the development of sustainable strategies for dye removal from industrial effluents.

Keywords: Biosorption; Chamaerops Humilis; Methylene blue; RSM; CCD; Kinetics

Hydro-electromagnetic process for desalination and valorization of brine

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Abstract: Physical desalination consists of a combination of magnetic and electric fields to separate soluble salts from charged ions in seawater submitted to Lorentz forces [1]. The hydro-magneto dynamic, electromagnetic separation process is founded on two fundamental mechanisms: the transport and deformation of magnetic field lines by the flow in accordance with the Laplace force [2].

The procedure involves an iterative feedback process utilizing magnetic looping, employing a perturbative approach to the Magnetohydrodynamics (MHD) equations and considering the velocity field topology in the turbulent flow [3]. Initiating a magnetic field induces an electric current, accelerating ions present in the water. Once accelerated, these ions, following Faraday's law of induction, induce a current in a coil surrounding the setup [4].

The post-electrochemical separation phase entails the extraction of fresh water and the recovery of brines containing mineral salts and heavy metals [5]. This recovery process, for instance, targets lithium, bromine, phosphorus, arsenic, zinc, copper, lead, nickel, silver, iron, and manganese through a mechanism of concentration and precipitation in a solid state. This green technology is chemical-free and environmentally sustainable.

Keywords: Desalination, Hydrodynamics, Dynamo effect, Electromagnetic, heavy metals,

An ab-initio study of the adsorption of H_2O, NaCl, and salt water on graphene

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Abstract: In view of climate change, seawater desalination is of concern to mankind, as the most difficult step in water treatment is the isolation of NaCl from seawater. The methods currently used to disable seawater remain costly, so it is important to understand and improve other methods for reducing the cost of seawater filtration. We present an atomic-scale computational study of NaCl and H_2O adsorption on graphene, with the aim of estimating the ability of graphene to remove NaCl from seawater to obtain drinking water. The calculations are based on Density Functional Theory (DFT), using the Grid-based Projector-Augmented Wave (GPAW) approach and Atomistic Simulation Environment (ASE) methods. The main results of our work are the optimization of H_2O and NaCl molecule energies and densities of molecular states, and the calculation of the optimal adsorption distance of these molecules on the adsorbent(graphene). The observed changes in adsorption energies and density of state of the adsorbent could be exploited as an application for seawater filters. All results contribute to the optimization of potential seawater filter applications. Our work provides interesting information to the theoretical and experimental communities working in this field of research. It opens up the debate on the adsorption of H_2O and NaCl molecules on graphene.

Keywords: — GPAW and ASE, Density of state (DOS), adsorption NaCl and H_2O on graphene.

Paper ID: 43

Development of superhydrophobic concrete for preserving building facades

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Abstract: Concrete facades can deteriorate for a variety of reasons, and damages is often the result of a combination of several factors, such as ultraviolet radiation, temperature changes (thermal cracking), abrasion, erosion, fine dust pollution, and microbial adhesion, which increases their vulnerability to developing surface defects. The permeability and water penetration associated with the hydrophilic character of concrete allows water to quickly penetrate into its structure during rainy seasons. This penetration is the principal cause of all major physical and chemical degradation processes affecting concrete structure. Protecting the concrete surface with superhydrophobic coatings remains one of the best alternatives for overcoming water penetration. In this study, a fluorine-free water-repellent coating based on siloxane as low surface energy material was developed and successfully applied to concrete substrates using dip-coating technique. The prepared formulations have a high stability during storage in the bottle, and the coated concrete showed super-hydrophobicity with high water contact angle (WCA) over than 150°. Besides, the self-cleaning properties, mechanical robustness, stability under UV radiations, resistance to temperature and humidity were investigated. After 10 cycles of abrasion test and 720 hours at 45°C and 80% humidity, the coated concrete maintained its self-cleaning properties. Natural out-door aging tests have shown that the coating is weather resistant.

Keywords: *Superhydrophobic concrete / Self-cleaning / polydimethylsiloxane / out-door application / durability / Sol-Gel process*

Sustainable reuse of harbor dredged sediment in concrete maritime blocks

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Abstract. Maritime construction requires large quantities of concrete aggregates. Sustainable reuse of harbor-dredged sediment is a potential alternative to natural resources. It can address a dual challenge: the environmental impacts of dredging and the scarcity of non-renewable materials used in the construction industry. However, the literature has seldom focused on case studies of reusing dredged sediment as concrete aggregate in a marine environment. This paper addresses this gap by studying the feasibility of valorizing dredged sediment in maritime works, particularly as concrete blocks employed to protect harbor infrastructures. To this end, four concrete mixes were formulated, incorporating sand dredged from Safi port in Morocco as a partial substitute for conventional sand at varying rates (25%, 50%, 75%, and 100%). The properties of both fresh and hardened concretes were investigated and compared with those of the reference concrete. Furthermore, an in-situ application was conducted; grooved cubical blocks were manufactured and inspected. The results indicated that concretes containing dredged sand performed as well as the reference concrete, with the most favorable results observed at a substitution rate of 75%. Therefore, the feasibility of the sustainable reuse of harbor-dredged sediment in concrete maritime blocks is confirmed.

***Keywords*:** dredged sediment, valorization, construction material; marine environment.

Paper ID: 46

Effects of mineralogical, physicochemical characteristics, and durability on earthen mortars

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Abstract. This study showcases the experimental outcomes from employing the techniques for the mineralogical and chemical analysis of earthen mortar sourced from the soil of Rabat city. The findings from uni-axial compressive tests conducted on cylindrical specimens of this particular earth, combined with varying percentages of cement, are presented; enable the examination of how mineralogical and chemical elements affects the mechanical properties of the material. Nevertheless, our goal is to calculate the water absorption coefficient of the mortar across various cement concentrations, aiming to enhance the mortar's resilience against adverse weather conditions, rain, and particularly humid climates. In the earthen mortar sourced from Rabat city, one can identify the existence of calcite, quartz, kaolinite, and aluminum silicate. The performance of the material has been improved through the addition of cement, owing to the presence of these elements.

***Keywords*:** soil, mortar, mineralogy, durability, chemical, mechanical tests.

Paper ID: 48

Treatment of phosphoric acid production effluent

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Abstract: Phosphoric acid is an important chemical product with a wide range of applications, including fertilizers, industrial chemicals, food and beverages. Phosphoric acid production processes are constantly evolving to meet the growing demand for this product [1]. There are two types of production processes: furnace processes and wet processes are the most common. They are based on the reaction of phosphate rock with sulfuric acid or hydrochloric acid [2]. Phosphoric acid effluents are a worldwide problem. It contains high concentrations of acids and heavy metals that seriously contaminate the environment and groundwater. It also contains valuable elements like sulphuric acid, phosphoric acid, fluorine…etc that we have to care about [3]. For this purpose, modeling and simulation play an important role in the process treatment. The concept, is based on creating a mathematical model of the system and running it to get a vision of how changes in operating conditions will affect phosphoric acid production and to study the behavior of defferent effluents over time, which can help to develop a new process treatment.

Keywords: Modeling, simulation, effluent treatment, environment.

Effect of co-substitution in $SrTiO_3$ Perovskite in A and B sites on structural, optical and magnetic properties

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Abstract: The objective of this project is to investigate the impact of co-substitution involving A ions for Sr and B ions for Ti in the $SrTiO_3$-type perovskite. The study delves into the structural, optical, and magnetic properties of the substituted compounds at room temperature. Nanocrystalline materials with the composition $Sr_{1-x}A_xTi_{1-x}B_xO_3$ (x = 0, 0.6, 0.8, and 1) were synthesized through a solid-state reaction. The investigation included X-Ray diffraction, UV-Visible spectroscopy, and studies using a Superconducting Quantum Interface Device (SQUID) magnetometer MPMS (Magnetic Property Measurement System) for $Sr_{1-x}A_xTi_{1-x}B_xO_3$ with (x = 0, 0.6, 0.8, and 1) perovskite compounds.
Rietveld refinement revealed a phase transition from a cubic to orthorhombic structure with an increase in A and B contents. The band gap energy exhibited a decrease from 3.25 eV to 2 eV as the concentration of A and B ions increased. Notably, lattice distortion significantly influenced the magnetic properties, demonstrating a strong ferromagnetic behavior in $Sr_{1-x}A_xTi_{1-x}B_xO_3$ with (x = 0.6 and 0.8)

Keywords: $Sr_{1-x}A_xTi_{1-x}B_xO_3$ perovskite oxide; X-Ray Diffraction; Rietveld refinement; UV-Visible spectroscopy; solid state reaction; band gap Energy; Ferromagnetism

Paper ID: 50

Hydrogeochemical Characterization, Quality Assessment, And Vulnerability Mapping of the Tamouda Aquifer, Upstream of The Martil-Alila Plain (Internal Rif, Morocco)

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Abstract. The study of Tamouda aquifer's hydrogeochemistry involved collecting samples from ten sites. The results revealed high concentrations of bicarbonates, calcium, and magnesium in the aquifer, likely sourced from the local limestone ridge. A geochemical speciation analysis showed a notable oversaturation of carbonated minerals in Tamouda's water. The groundwater quality was evaluated using indices like WQI and PI, with most wells exhibiting excellent to good water quality, indicating low pollution levels in the aquifer during the study period. The vulnerability assessment using the SINTACS method highlighted a marginally higher vulnerability in the western part of the aquifer compared to the eastern part, correlating with increased nitrate concentrations found in the western area. Future projections using the SINTACS method suggest an escalating vulnerability in the aquifer, especially in the western region, due to the shallowness of the groundwater there.

***Keywords*:** Hydrogeochemistry, Groundwater quality, Tamouda aquifer, SINTACS method and Nitrate concentrations

Surface modification of Moroccan clay: Optimization of phenolic compound adsorption onto modified clay using full factorial design

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Abstract: The effectiveness of the organophilic clays produced by chemically altering sodium Ghassoul clay was examined in this work in relation to the adsorption of the phenolic compound. The clays were characterized by zeta potential, FTIR and SEM-EDX. The optimization of phenolic compound removal by clay adsorbents is achieved using the full factorial design and response surface methodology with a tree-factor, including Cation Exchange Capacity, Adsorbent dosage, initial concentration. The results proved the validity of the regression model, wherein the adsorption efficiency its maximum value of at 99.21%.

Keywords: surface modification, organophilic clay, optimization, adsorption

Paper ID: 53

Physical and Thermal performance of building materials based on *Washingtonia robusta* Fibers

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Abstract. This study stands out from conventional research focusing on the thermal implications of natural fibers in compressed earth bricks. For the first time, this paper breaks new ground by characterizing the thermal transport properties of materials composed of clay and waste fibers derived from *Washingtonia robusta* (*WRP*). The study focuses on the development of eco-composites incorporating variable proportions of *WRP* fibers (ranging from 0.5% to 4.5% by weight of the soil), with the aim of assessing their thermal performance and apparent density. The results reveal a positive influence of *WRP* fibers on the thermal properties of earth blocks, highlighting the potential of these environmentally-friendly composites for improving the thermal behaviour of building materials.

***Keywords*:** *Washingtonia robusta*, Density, Hot disk, Thermal insulation, earth block

Paper ID: 54

Performance analysis of MPPT strategies for PV systems under various climatic conditions

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Abstract: To improve the efficiency of photovoltaic systems and optimize their performance in diverse environmental conditions, the utilization of Maximum Power Point Tracking techniques (MPPT) is crucial [1]. Sever
al strategies will be presented, including conventional methods like P&O MPPT and incremental conductance MPPT, as well as artificial intelligence-based approaches such as fuzzy logic MPPT and neural network MPPT. Performance analysis will demonstrate that artificial intelligence-based methods, especially neural network-based MPPT, show superior efficiency with minimal response time, reduced oscillations, and enhanced performance compared to conventional techniques.

The proposed system illustrated in Figure 1 comprises the following components: a solar panel of 305.225 W rated power, a DC load, and a Boost converter. The output voltage of the boost converter is regulated by an MPPT controller using a PWM signal (Pulse Width Modulation).

For Neural Network MPPT, we propose using the feed-forward neural network method to generate the voltage's reference corresponding to the maximum power point under a specific value of temperature and irradiation. The proposed neural network structure consists of neurons organized in three layers. The input layer comprises 2 neurons receiving the input data: temperature and irradiation. The input neurons are connected to a hidden layer, composed of 10 neurons, through weighted connections and bias. The hidden layer combines the inputs and sends the result to the output layer through an activation function. A supervised training process based on the Levenberg–Marquardt back propagation method was used to adjust the parameters of the network.

For MPPT based on Fuzzy logic, we propose to use a nonlinear controller based on fuzzy logic type 2, due to its efficiency in a system with a high level of uncertainty [2]. The inputs of the proposed fuzzy logic controller are the Error *E* and the derivation of the Error *EC*, while the output is the duty cycle change *CD*. The fuzzy controller conception is built on the following processes: fuzzification, fuzzy inference generator, and output processing. First, the input and output variables are expressed in terms of linguistic variables to which three-dimensional membership functions are associated. Then, the rules are expressed in an inference processing unit. The fuzzy output is generated based on rules defined in the inference engine. A type reduction and defuzzification process is employed to acquire the exact value for the output variable ΔD.

The proposed system was implemented and simulated in MATLAB/SIMULINK. Different MPPT controllers were tested under different conditions of temperature and irradiation. Simulation results of the output power of the PV panel and boost converter using different controllers were compared, as shown in Figure 2. Performance analysis of PV and boost power showed that the controller using Neural Network and PI regulator demonstrated a reduced gap oscillation of 0.*2 W* around the maximum point**,** along with an enhanced rapidity characterized by a convergence time of *14 ms*.

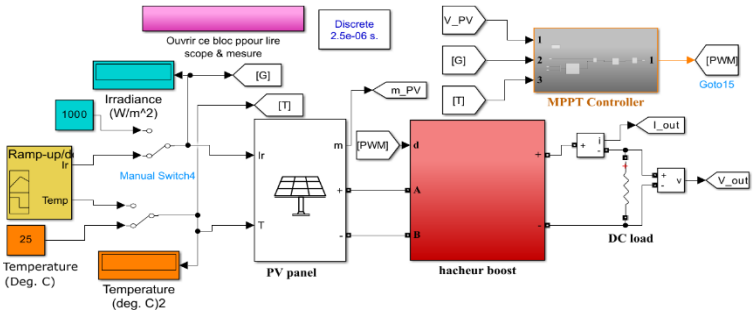

Figure 1: Proposed system model.

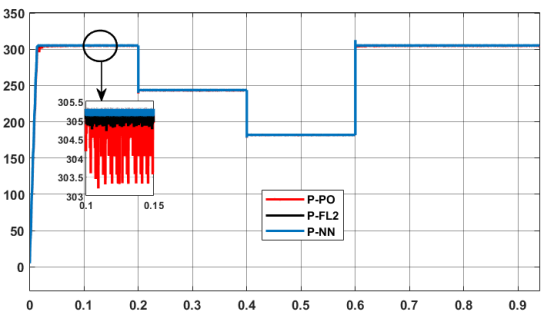

Figure 2: PV power for P&O, ANN, and FL.

Keywords: PV system, MPPT, ANN, fuzzy logic type 2.

Paper ID: 55

Optimization design of geothermal cooling based on CFD simulation for Agriculture greenhouse in semi-arid regions

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Abstract: This study presents an innovative approach to optimize geothermal cooling system in agricultural greenhouses in semi-arid regions as sustainable cooling system. Our findings indicate a notable improvement in the greenhouse environment, characterized by decreased temperatures, increased humidity levels, and enhanced airflow efficiency when utilizing the proposed system. The research aims to enhance the efficiency of geothermal cooling and address high temperatures in challenging environments through a meticulous optimization process. This process involves a comprehensive analysis of site-specific conditions, greenhouse geometry, and the integration of geothermal components. Using Computational Fluid Dynamics (CFD) simulations, the study delves into the airflow, temperature distribution, and humidity within the greenhouse, offering insights into the interaction between the geothermal cooling system and the environment. Key steps include systematically integrating geothermal components, particularly ground heat exchangers, into the CFD model, and evaluating various parameters for optimal cooling performance. Energy efficiency and cost-effectiveness are systematically addressed through thorough analyses. The outcomes contribute to advancing sustainable agricultural practices by presenting a customized geothermal cooling solution for semi-arid regions. The data-driven optimization process ensures effective temperature mitigation aligned with economic feasibility, offering valuable insights for greenhouse designers, agriculturists, and policymakers in regions with challenging climatic conditions.
Keywords: Geothermal Cooling Systems, Agriculture Greenhouses, Semi-Arid Regions, Computational Fluid Dynamics (CFD), Efficiency Optimization, Sustainable Solutions.

Experimental performance evaluation and analysis of water-based PVT solar collector in real operating conditions

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Abstract: Energy is a vital resource for human activities and lifestyle, powering important everyday infrastructures and services. Nowadays, a large part of the world's energy consumption is provided by fossil resources (oil, gas and coal). In order to deal with the rapid growth of energy demand and to prevent the destructive environmental problems caused by the use of fossil fuels, many efforts have been made to develop and promote the use of renewable energy [1]. The integration of renewable energy sources into our energy landscape makes the energy sector more eco-friendly, and sustainable.

Solar energy, as a clean and inexhaustible renewable energy, carries the tremendous potential to be the primary energy source in the future. It has gained significant attention in recent years, and its utilization technology is being rapidly developed [2]. Sophisticated utilization of solar energy is the main area of concern these days. Using hybrid Photovoltaic and thermal (PVT) collectors, the abundant solar energy available can be converted simultaneously into electricity and heat [3]. They achieve this by combining solar PV and thermal technologies in a single component, making them more efficient than conventional PV systems. The collected excess heat from the PV module can be useful for different purposes. It can be used for domestic water heating (water-based PVT) and space heating (air-based PVT). Literature review shows that the PVT system has been studied from various aspects, including system design [4], performance analysis [3], simulation models [5], and so on.

The present work deals with an experimental investigation of a water-based PVT hybrid solar collector. Both electrical and thermal performances of the proposed system are evaluated and analyzed in real field conditions. A comparative study of energy efficiency between PVT and conventional PV systems is presented and widely discussed in this study.

Keywords: Solar energy, PVT collector, Cell cooling, Electrical and Thermal performance, Experimental study.

Paper ID: 57

A comparative study of four methodologies (Analytical and numerical iterative) for parameter estimation in photovoltaic cells

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Abstract. To assess the energy efficiency of a photovoltaic device, a precise extraction of the electrical parameters from its equivalent circuit is essential to comprehensively describe the curve representing its current-voltage characteristic. In this context, the present study provides a comparative analysis of four widely employed methods in the literature for identifying the single diode model. Of these four methods, two are analytical, while the other two involve iterative approaches. The assessment of each method's performance relies on comparing its results with experimental data. Criteria such as mean square error and absolute error are also introduced to evaluate the inherent precision of each method.

***Keywords*:** Single diode model; photovoltaic; Solar cell; Analytical method; Iterative numerical method.

Modeling and simulation of the thermal and hydric behaviour of building materials based on rammed earth and concrete.

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Abstract: Nowadays, thermal and hydric comfort remain a necessary performance for the well-being of human in buildings, particularly in hot zones. The thermal and hydric effect can vary significantly depending on the materials used in the construction method, and the choice of an appropriate construction method depends on the thermal study of different construction materials, in particular rammed earth and concrete.

This research will be dedicated to the comparative study of a section of wall constructed with Rammed earth and concrete in terms of thermal and hydric performance. The first step was to establish the thermophysical properties of a part of the building enclosure. This thermal study is employed to regulate the selection of materials to be used in the building process with respect to energy efficiency. Modelling and simulation were conducted using Comsol Multiphysics software.

The results of this study are interesting in terms of the thermal and hydric performance of walls built with rammed earth and concrete.

Keywords: Rammed earth, concrete, thermo-physical characteristics, simulation.

Photovoltaic Performance Improvement of InGaN/GaN Quantum-well Solar Cells: Exploiting the Impact of External Stresses with Piezo-Phototronics

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Abstract: In recent years, quantum well solar cells (QWSCs) have appeared as a promising way to improve the efficiency of solar energy conversion. Our study focuses on the numerical simulation and modeling of a new approach to improve the performance of GaN/InGaN quantum well solar cells in the Ga polarity. The key innovation is to take advantage of the piezo-photonic effects induced by external stress, using the crucial role of piezoelectric charges at the GaN and InGaN interfaces to counterbalance the internal charges generated inside the InGaN wells due to lattice mismatch stresses. Our research shows a remarkable improvement in the short-circuit current, which rises from 3.49 mA/cm² to 3.71 mA/cm² under the influence of hydrostatic pressure (P = 30 GPa). This effect translates into a significant increase in efficiency of around 12.96%. These results underline the potential of piezo-photonic effects as a transformative mechanism for improving the performance of GaN/InGaN quantum-well solar cells, paving the way for advances in optoelectronic properties for photovoltaic and optoelectronic applications.

Keywords: MQW InGaN/GaN solar cells, Piezo-phototronic effects, Strain, In content, Hydrostatic pressure, Photovoltaic properties.

Paper ID: 59

Optimizing Photovoltaic Precision: A Meta-heuristic Approach with Particle Swarm Optimization for Accurate Single-Diode Model Parameter Determination

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Abstract. The effective implementation of photovoltaic (PV) systems heavily relies on accurate electrical modeling, where the single-diode model (SDM) has emerged as a prominent choice due to its capability to capture the intricate behavior of PV modules. The SDM involves five unknown parameters, presenting a challenge for precise determination. This study delves into the investigation and comparison of meta-heuristic methods in addressing this parameter determination challenge. Specifically, Particle Swarm Optimization (PSO) is employed using two distinct objective functions: Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE). The validation of these methods is conducted on a PV module provided by RTC FRANCE under standard test conditions (STC). The results from PSO demonstrate a realistic and accurate outcome in determining the unknown parameters and predicting the I-V curve of the PV module. This research contributes valuable insights into the application of meta-heuristic methods for enhancing the precision and reliability of electrical modeling in PV systems.

***Keywords*:** Photovoltaic Systems. Particle Swarm Optimization (PSO). Objective Functions. Single-Diode Model (SDM). Optimization.

Paper ID: 65

Optimizing Used Lubricating Oil Purification: A Surrogate Model Approach to Assess Natural and Activated Bleaching Clays

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Abstract: The disposal of substantial quantities of used lubricating oils presents a significant environmental challenge, necessitating the development of novel strategies for their reuse. The process of re-refining these oils is contingent upon the chemical composition of the base oil and the diverse array and concentration of contaminants accrued during operational use. Notably, while the molecular integrity of lubricating oils is preserved over time, the degradation or depletion of their additives necessitates restoration processes. Typically, waste lubricating oils are composed of hydrocarbons, polymer additives, carbon particles, water, and metallic elements. It is important to note that the metal content in these oils primarily originates not from the base lubricant but from the incorporation of additives, metallic contaminants from leaded petrol, airborne particulate matter, and the use of refrigerants and cooling water in machinery.

A critical phase in the treatment of these used oils is distillation, which aims to eradicate contaminants, thereby facilitating the recovery of base oils for further purification. In this context, adsorption using bleaching clays emerges as a key technique. The effectiveness of bleaching clays in impurity adsorption is attributable to both physical and chemical interactions. These clays are characterized by negatively charged particle surfaces, predominantly due to the presence of oxygen and hydroxide ions on the surfaces of the clay minerals.

Furthermore, the role of Van der Waals forces, arising from transient fluctuations in electronic charge distributions, is crucial in the adsorption process. These forces contribute significantly to the affinity between impurity molecules and the bleaching clay surface. This research aims to conduct a comparative analysis of natural versus activated clays to augment the bleaching efficacy in the purification of used lubricating oils. Employing surrogate models, the study seeks to ascertain the most effective clay type for optimal impurity adsorption, ultimately contributing to more effective and environmentally sustainable practices in lubricating oil recycling.

Keywords: Used lubricating oil, Bleaching clay, Adsorption, Surrogate models

Paper ID: 66

Suitability and Thermophysical performances of Local Materials for High Temperature Thermal Energy Storage

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Abstract: Due to the intermittent nature of solar energy, there is a need to store heat to meet the needs when solar light is not available. Rock bed using air as heat transfer fluid (HTF) is being now used for thermal energy storage (TES) in concentrated solar power (CSP) plants. It is considered as a cost effective storage system. However, no detailed works have been published on selection and identification of rocks for high temperature storage applications. The scope of the present study is to choose the most suitable materials for high temperature sensible heat storage (SHS) using a methodology based on laboratory measurements. Thus, experimental characterization of several rock types has been performed. The obtained results show that the gabbro rock is the best candidate material for CSP plants. Comparative study with some other conventional materials found in literature indicates that rock is an efficient filler material for high temperature TES.

Keywords : High temperature SHS, Rock bed, CSP plants, Experimental characterization, Selection methodology.

Effect of pesticides on primary metabolites *Phaseolus vulgaris*

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Abstract: The objective of this study is to investigate the toxic effects of two widely used pesticides in agriculture by assessing their impact on primary metabolites in green bean plants (*Phaseolus vulgaris* L.). The plants were divided into four groups, three of which were treated with the corresponding pesticides Turbo (Mancozeb), Proclaim (Emamectin Benzoate), and both simultaneously while the last group served as a control. Harvested fruit was used to determine primary metabolites.
The results revealed that lipid content was most affected by the pesticides, causing a significant decrease in lipid levels compared to the control in plants treated with Emamectin benzoate. Regarding proteins, the lowest concentration was observed in plants treated with both pesticides combined. Carbohydrate content, on the other hand, remained unaffected.
In light of the results obtained, a close relationship was observed between variations in metabolites and the types of pesticides used, highlighting the role of metabolites in plant growth and development.

Keywords: Primary metabolites, Pesticides, *Phaseolus vulgaris* L.

Paper ID: 69

Exploiting Almond Waste Powder (AWP) for Enhanced Thermal Insulation in Fired Clay Bricks (CIDEEV2024)

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Abstract: This study investigated the potential of AWP to improve the thermal insulation performance of fired clay bricks. Clay-AWP composites were prepared with AWP content ranging from 0 to 20 weight percent. The thermal conductivity of the composites was measured and compared to that of pure clay bricks. The results showed that the thermal conductivity of the composites decreased significantly with increasing AWP content, reaching a reduction of 25.77% for 20% AWP compared to pure clay. The firing process further enhanced the thermal insulation by densifying the clay matrix and optimizing the size and distribution of air pockets, leading to a decrease in thermal conductivity of up to 19% compared to unfired AWP-containing bricks of the same percentage. These findings suggest that AWP can be a promising sustainable and cost-effective solution for improving the thermal insulation of clay-based building materials. This sustainable approach leverages AWP's natural pore-forming properties to achieve improved insulation, further supporting environmentally friendly construction practices.

***Keywords*:** Almond waste powder, clay bricks, thermal insulation, pore-forming agent, sustainability.

Modelling and Optimization of CdTe/CdS Heterostructure Solar Cell Performance using SCAPS-1D

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Abstract. Numerical modelling is a crucial technique for optimizing photovoltaic cell architectures. Currently, there is a significant demand for system design and numerical simulation in the field of thin-film solar cells. This paper discusses the design of a device and the numerical modelling of a CdS/CdTe-based heterojunction cell with a glass/TCO/CdS/CdTe/Mo structure. The thickness of the CdTe absorber layer varies from 0.5 µm to 5 µm with a deviation of one unit, and the thickness of the buffer layer CdS varies from 10 nm to 100 nm with a deviation of 10 units. The study found that an absorber layer thickness of 2.5 µm to 3 µm resulted in better performance. This included a Voc of 859.79 mV, Jsc of 24.11 mA/cm^2, FF of 77.82%, and a power conversion efficiency of 16.13%. Additionally, a quantum efficiency of approximately 90% was achieved in the lowest wavelength range (330 nm to 830 nm) or energy range (3.8 eV to 1.48 eV) with the studied absorber thickness. Specifically, an increase in window layer thickness is directly proportional to a decrease in Voc, Jsc, and η%, For our work, the best results for CdS thickness were achieved with η=16.29% for 20nm. Additionally, the operating temperature of solar panels should be carefully controlled to ensure optimal performance. The efficiency of solar panels can decrease with an increase in temperature of 27°C. This decrease affects the FF, Voc, and Jsc parameters. Our research has found that the optimal temperature for achieving the best results is 300 K.

***Keywords*:** Solar cell, PCE, heterostructure, SCAPS, window layer, quantum efficiency (QE) .

Paper ID:72

Numerical study of the natural convection of the ionanofluid ([C4mim][NTf2]-Cu) in an inclined square cavity

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Abstract: This work consists in numerically studying heat transfer by natural laminar convection in an inclined square cavity filled with ionanofluid. The equations of de Navier Stocks and energy governing the problem are solved numerically by the finite volume method, and with the Simple algorithm for pressure correction. The objective is to compare the effect of the addition of copper nanoparticles in the ionic fluid as well as the effect of the angle of the inclination of the cavity on heat exchange by natural convection. At the end of this simulation, several results are given in the form of streamlines, isotherms, and variations in the Nusselt number. These results are obtained by analyzing the effect of a set of factors such as the Rayleigh number, the volume fraction of the particles, the angle of inclination on the dynamic and thermal fields, and the heat transfer. It has been shown that the nanoparticle fraction, high Rayleigh numbers have a positive effect on improving heat transfer by ionanofluid. Two comparisons have been made, between ionic fluid and ionanofluid at isotherms and streamlines, and between nanofluid and ionanofluid at the Nusselt number, which show the advantage of using ionanofluid in heat transfer.

Keywords: *Ionanofluid, natural convection, finite volume*.

Paper ID: 73

Comparative Study of Adsorption of Two Cationic Dyes by Organic Matter Modified Lamellar Double Hydroxide Synthetic Clay: Unveiling the Adsorption Potential

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Abstract: This study presents a comparative analysis of the adsorption behavior of two cationic dyes, Rhodamine B (RhB) and Crystal Violet (CV), onto Layered Double Hydroxides MgZnAl-LDHs modified with dextrose (M@LDHs). The LDHs were synthesized using the co-precipitation method, and their structural properties were characterized using X-ray diffraction (XRD), infrared spectroscopy (IR), and scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDX).

To evaluate the adsorption performance of the (M@LDHs) towards RhB and CV, batch adsorption experiments were conducted. The study aimed to understand the effects of various parameters, such as initial dye concentration, pH, contact time, and temperature. Additionally, the adsorption isotherms and kinetics were analyzed to compare the equilibrium and rate of RhB and CV uptake by the (M@LDHs).

In terms of the adsorption behavior, both RhB and CV exhibit similar characteristics when adsorbed on (M@LDHs) surfaces. The experimental data for both dyes align well with the Langmuir isotherm model, indicating the formation of monolayers on the (M@LDHs) surfaces. Moreover, the adsorption kinetics follow a pseudo-second-order model, suggesting that chemisorption is the primary mechanism for both dyes. Furthermore, thermodynamic analysis reveals that the adsorption process for RhB is exothermic, while for CV, it is observed to be endothermic.

This comparative study highlights the potential of (M@LDHs) as efficient adsorbents for the removal of cationic dyes from aqueous solutions. The findings contribute to the understanding of the adsorption behavior of RhB and CV on the same type of (M@LDHs), paving the way for the development of sustainable solutions for water treatment and environmental remediation.

Keywords: Layered Double Hydroxides, Adsorption, Pollutants, Organic Matter, Cationic Dye.

Influence of Heat Treatments and Hole Density on the Physical Properties of $LnSrBaCu_3O_{6+z}$

Mohamed Id Elamel, Mohammed Bellioua, Fatima Bouzit, Mohammed Khenfouch, Issam Mouhti

Abstract: This study thoroughly explores the impact of heat treatments and hole count (p) on $LnSrBaCu_3O_{6+z}$ compounds (Ln=Eu, Sm, Nd). We focused on preparation, X-ray diffraction with Rietveld refinement, AC susceptibility, DC resistivity measurements, and the effects of two heat treatments: oxygen annealing [O] and argon annealing followed by oxygen annealing [AO]. With an increase in the rare earth Ln's ionic radius, notable changes occurred—specifically, the c parameter, surface area (S), and volume (V) increased, while critical temperature (Tc) and holes (p) in the CuO_2 plane decreased. The evolution of these parameters in [AO] heat treatment exhibited a linear trend. The structure varied with Ln, being orthorhombic for Ln=Eu, tetragonal for Ln=Nd, orthorhombic for Ln=Sm [AO], and pseudo-tetragonal for Sm [O]. The highest Tc was observed with Ln=Eu (Tc[AO]=87.1 K), where Tc[AO] consistently surpassed Tc[O] for each sample.
The observed data originates from various factors, including the ionic size of rare earth elements, enhanced cationic and oxygen chain order, hole density (p) in $Cu(2)O_2$ planes, and the in-phase purity of [AO] samples. Our research aims to unequivocally illustrate that the density of holes (p) within the copper plane plays a decisive role in influencing the structural, electrical, and superconducting properties of these samples. Simultaneously, the other parameters mentioned contribute to shaping this hole density (p).

Keywords: *—High-Tc superconductors, Heat treatments, holes density (p), Tc, parameter c, surface ab, electrical resistance, X- ray diffraction*.

The influence of internal and external operating parameters on a PV/T sensor

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Abstract: The present work actually shows that a dynamic model, as well as the use of real weather and DHW demand data, are necessary to accurately estimate the energy production of the PVT system.
Furthermore, the influence of external and internal parameters on the system performance will be discussed in detail. We will highlight how factors such as the number of layers of glass coating, glass cover material used, tube spacing, fluid flow rate, inlet fluid temperature, as well as External environmental parameters, can significantly influence energy production. It will also be demonstrated that the use of time-averaged input data leads to an overestimation of the energy generated,

Keywords : PVT hybrid sensor, Energy, Exergy, Thermal, Electrical, Nanofluid.

Paper ID: 78

Performances study of wastewater treatment plant using two systems: Activated Sludge (AS) and Sequencing Batch Reactor (SBR) (CI-DEEV2024)

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Abstract. Worldwide reuse of wastewater has become a necessity to overcome water scarcity problems. Morocco is one of the countries that have adopted this strategy, through the establishment of a national wastewater treatment program. The Ibn Tofail University in Morocco has embarked on this strategy of reusing wastewater by setting up a treatment plant for its rejections a capacity of 400 m^3/d. This work was focused on the performance and the efficiency comparison removal of organic matter of wastewater treatment using two systems: Sequenced Batch Reactor (SBR) and Activated Sludge (AS) technology. These systems will allow the University to be completely autonomous in terms of processing these wastes and the reuse in the irrigation of green spaces. The results obtained in this work show that the optimization of the operational parameters such as pH, temperature and the hydraulic retention time was higher in (SBR) than in (AS) which is represented by the removal rates of organic matter of: 114.15 O_2 mg/L, 23.88 O_2 mg/L, 74.66 mg/L respectively for chemical oxygen demand (COD), biological oxygen demand (BOD_5) and suspended solids (TSS), recorded in the SBR system. But the elimination of organic matter is lower of the second one. These results show that SBR significantly improved efficiency for an 80% reduction of pollution load.

***Keywords*:** Wastewater, Performances, Organic matter, Sequencing Batch Reactor, Activated Sludge.

Recycling of biocomposite waste for construction applications

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Abstract: Due to rapid urbanization, national energy consumption in the building sector is set to increase, accounting for around 25% of annual energy consumption. Electricity is the main source of energy in this sector, particularly for air-conditioning systems. The demand for energy to meet comfort needs in a building depends on many parameters, such as the shape, orientation and type of building, energy capture and recovery systems, building-ground interaction and the nature of the building materials used. In this context, my doctoral thesis aims to find relevant solutions that can minimize the consumption load in buildings, as well as finding ecological solutions that will help reduce CO2 emissions. The aim of our work is to develop a new energy-efficient argan-based eco-construction material that can meet the requirements of thermal insulation, mechanical strength, environmental concerns, economy and sustainable development. four load contents are tested; 2, 5 ,10 and 20% Measurements include MEB , DRX , conductivity and thermal resistance ,

Keywords: insulation building, eco-construction, biocomposite, conductivity

Investigating the Influence of Heat Treatment on Crystalline Parameters in $(Y_{1-x}Sm_x)_{1-y}Nd_yBaSrCu_3O_{6+z}$

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Abstract: This study explores the preparation, X-ray diffraction with Rietveld refinement, and the impact of heat treatments on $(Y_{1-x}Sm_x)_{1-y}Nd_yBaSrCu_3O_{6+z}$ (y=0 with x=0, 0.2, 1 and y=1). Each sample underwent two heat treatments: oxygen [O] annealing and argon annealing followed by oxygen [AO] annealing. For y=1, heat treatment [AO] led to an increase in parameter b and a decrease in parameter a, except in the case of $YBaSrCu_3O_{6+z}$ where both parameters a and b increased, intensifying the orthorhombicity (ε=b-a/b+a), with this increase being mitigated in the case of $YBaSrCu_3O_{6+z}$ (y=0, x=0).
For y=0 and x varying from 0 to 1, the orthorhombic structure persisted irrespective of the heat treatment, except in the case of $SmBaSrCu_3O_{6+z}$ [O] (x=1 and y=0) where the structure became pseudo-tetragonal. For y=1 ($NBaSrCu_3O_{6+z}$), the structure was tetragonal regardless of heat treatment. Heat treatment [AO] consistently increased the critical temperature, except for $YBaSrCu_3O_{6+z}$ where it decreased from 83K to 81.7K. Our research delves into the impact of crystalline parameters and the order/disorder of oxygen in the Cu(1)O base plane on the critical temperature (Tc) and, consequently, on the hole density (p) in the copper plane $Cu(2)O_2$ of our samples, taking into account the effect of heat treatment on these parameters.
Keywords: Heat treatments, orthorhombicity (ε), ***holes density (p), Tc, parameter c, surface ab, electrical resistance, X- ray diffraction*.**

Paper ID: 82

Utilizing Modified LDH for the Removal of the Herbicide via Adsorption Process

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Abstract: The presence of herbicide in aquatic environments is common, and its limited biodegradability poses a significant environmental concern. Therefore, finding an effective method to reduce the presence of this toxic contaminant in aqueous solutions has become an urgent priority. In this study, a layered double hydroxide (LDH) material was synthesized through a coprecipitation procedure. The synthesized material underwent characterization using X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Energy Dispersive X-ray Spectroscopy (EDS). The focus of this work was to investigate the adsorption of herbicide from water using LDH modified. Various factors such as contact time, pH, temperature and initial concentration of herbicide were examined to understand their influence on the sorption capacity of the material.

Keywords: Herbicide, adsorption mechanism, Ternary double lamellar hydroxide LDH.

Enhancing Mobile Edge Computing with EDCO: An Efficient Dynamic Computation Offloading Strategy for Energy-Harvesting Devices

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Abstract: In the realm of increasingly intricate intelligent services, the limitations posed by the resources of mobile devices demand innovative solutions. A significant advancement in this field is the integration of mobile edge computing (MEC) systems with devices capable of energy harvesting. This technology enables users to offload computational tasks to nearby MEC servers, markedly reducing latency. Moreover, the incorporation of energy harvesting mechanisms alleviates the issue of high energy consumption inherent to intelligent services, which often strains the limited battery capacities of mobile devices. Nevertheless, the application of computation offloading strategies in environments characterized by multiple users and servers, as well as the potential for random mobility of devices, presents new challenges. These challenges stem primarily from the competition for resources and the complexity of server selection. This paper introduces an innovative approach to computation offloading, articulated through the development of an online algorithm known as the Efficient Dynamic Computation Offloading (EDCO) algorithm. The EDCO algorithm, drawing upon the principles of Lyapunov Optimization, strategically determines the optimal execution mode for each mobile device, choosing between local execution, offloading to MEC servers, or dropping tasks. This approach ensures that the system as a whole approaches optimal performance levels. The EDCO algorithm not only retains the advantages of its predecessor but also exhibits enhanced adaptability to more complex environments. Our simulation results affirm that the EDCO algorithm significantly enhances the ratio of successfully offloaded computation tasks by over 10%, all while maintaining a high Quality of Experience (QoE) for users.

K*eywords:* Intelligent Services, Mobile Edge Computing, Energy Harvesting, Computation Offloading, Dynamic Algorithm, and Resource Management.

Paper ID: 84

Influence of Hole Density (Psh) and Heat Treatments on Critical Temperature (Tc) in High-Tc Superconductors

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Abstract. This study presents the preparation, X-ray diffraction with Rietveld refinement, and the impact of heat treatments on Y1-xSmxBaSrCu3O6+z. Two heat treatment types, oxygen annealing [O] and argon annealing followed by oxygen annealing [AO], were applied to each sample. As x increases from 0 to 1, the a/b ratio increases, and Tc[O] decreases. However, Tc[AO] decreases until x=0.2 and then increases with a/b by 5.3 K to 84.6 K for x=1 [AO]. Notably, the crystalline parameter b remains constant, while a (and c) increases, indicating a rise in the number of oxygen atoms by chain (NOC) along a, leading to a decrease of a/b(Tc)[O] towards a tetragonal structure. For each x, the [AO] heat treatment decreases a/b (for 0≤ x ≤1) and Tc (for x>0.4). Interestingly, for x=0.4, the surface of the sample s[O]=s[AO] with Tc[O]≈Tc[AO]=81,4 K. Remarkable correlations were observed, involving factors such as the decrease in d[Cu(2)-Cu (1)], the increase in cationic and oxygen chain order, the effect of the number of holes psh in the Cu(2)O2 planes, and in-phase purity for the [AO] samples, which may collectively explain the observed data.

***Keywords*:** High-Tc superconductors, Heat treatments, holes psh, Tc,surface, a/b ratio, X- ray diffraction.

Reuse of activated sludge effluent from a ballast water depollution station

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Abstract: Morocco is facing major water stress due to climate change, low precipitation, exploding demand and the uneven distribution of water resources across the country. To alleviate this situation, Morocco has committed to an integrated water resources management policy based on the concept of reuse of treated wastewater in watering green spaces and in agriculture which already consume 74% of pumped water. However, the reuse of treated effluent often comes up against a certain number of obstacles, particularly health ones. Indeed, activated sludge plants are generally designed to provide effluents containing less than 90 or 125 mg/L of COD and a reduction of approximately 80 to 100% of hydrocarbons contained in ballast water. This work addresses the problem of reuse of wastewater in the port area, which contains large industrial units whose water, needs are greater in the face of environmental degradation of water resources. The objective of this study is to characterize the ballast water from the depollution station of the port of Agadir, treated by an activated sludge process with a view to its reuse for the irrigation of the green spaces of the port. This study shows that the treatment of these effluents works correctly and meets MARPOL recommendations with a reduction in COD, BOD_5 and TSS of approximately 73, 62 and 95% and a pH varying between 6.2 and 7.8. In addition, the average conductivity of the effluent is 17.5 ms/cm with an average sodium absorption rate (DAS) of 62.8. Consequently, the treated effluent did not meet the health requirements and salinity of irrigation water and was therefore not suitable for watering parks. Additional water purification could reduce health risks and those linked to salinity will allow the reuse of effluent for watering. A second phase of work will reveal the behavior of plants in relation to this water and research suitable treatment methods.

Keywords: Ballast water, port reception facility, reuse, activated sludge, MARPOL convention

Valorisation and physicochemical study of fly ash from an ultra-super-critical thermal power plant. (CIDEEV2024)

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Abstract: Fly ash is a thermal process residue; more precisely, it is the product of coal combustion in thermal power plant. Fly ash has remarkable properties and could be used effectively in the manufacture of new materials for a wide variety of applications. Research for the valorization of fly ash, combined with a reduction in landfill opportunities, has led to many programs in this direction, with some promising results.

In this study, the challenges of fly ash treatment were examined. For physicochemical characterization, X-ray diffractometry (XRD), infrared spectroscopy (ATR), ATG / ATD thermo gravimetric analysis, Scanning Electron Microscopy (SEM), H: Humidity Rate, GI: Swelling Index, P: Porosity, have been used.

The study highlights the need to better characterize ashes and better identify them, in particular by drawing up a more detailed typology of ashes to make better use of qualitative and quantitative data, and finally to change the regulatory framework and aim for greater harmonization of reassuring the producers.

Keywords: Waste recovery, Fly ash ultra-supercritical power plant, Physicochemical Characterization.

A combined molecular dynamic simulation, DFT calculations, and experimental study of methyl orange and methylene blue adsorption onto activated carbon in aqueous solutions

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Abstract: This study aims to evaluate and understand the adsorption of methyl orange (MO) and methylene bleu (MB) by activated carbon from thapsia transtagana stems (ACTTS) under different experimental conditions. Textural and structural properties of ACTTS adsorbent were observed by FTIR, XRD, SEM-EDX, potentiometric titrations and point of zero charge. Various initial values of the solution pH, adsorbent dose, temperature, reaction duration, and initial dye concentration were used in experiment series. The Langmuir and Freundlich models were used to assess the equilibrium isotherm data. Kinetic data were analyzed using pseudo-first order and pseudo-second order kinetic models. In order to obtain information regarding the electronic properties of dyes and its adsorption mechanism that has not been experimentally seen, we also used molecular dynamic (MD) simulation and DFT-based computational approaches. According to experimental findings, the pseudo-second order kinetic model and Langmuir model accurately describe the adsorption phenomenon. Maximum adsorption occurred at neutral to basic pH values for MB and neutral to acid pH for MO. The process was exothermic in nature and accompanied by a decrease in entropy. The Gaussian 09W program was used to assess the MO and MB structure at the B3LYP/LANL2DZ level. The analyzed quantum descriptors provided support for the study's experimental findings.

Keywords: Thapsia Transtagana Stems, Activated carbon, Synthetic dyes, thermodynamics, molecular dynamic, DFT calculations.

Preparation and characterisation of TiO2 thin films for solar cells

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Abstract: Titanium dioxide TiO2 was extensively studied because of its interesting chemical, electrical and optical properties (high band-gap, transparent in the visible range, high refractive index, high dielectric constant, and ability to be easily doped with active ions) which are considered for various optical applications. Furthermore, TiO2 can be prepared using a variety of methods. In this study, TiO2 thin films are prepared by the sol–gel spin-coating technique using titanium tetraisopropoxide (TTIP) as a precursor. The films were coated on FTO and glass substrates. The influence of heat treatments for different annealing temperatures (400°C, 450°C and 500°C) and the nature of substrate, on the structural, morphological and optical properties of the films were investigated using X-ray diffraction (XRD), scanning electron microscopy (SEM) and UV-Vis-NIR spectrophotometry. The obtained films were nanocrystalline and exhibit a refractive index of about 2.4 and a band gap value as high as 3.2 eV.

Keywords: TiO2 thin films, Sol gel, Anatase, Refractive index, band gap

Paper ID: 90

Heat Treatment-Induced Changes in Crystalline Parameters of $(Y_{1-x}Sm_x)_{1-y}Eu_yBaSrCu_3O_{6+z}$ Compound

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Abstract: This study details the preparation, X-ray diffraction with Rietveld refinement, and the effects of heat treatments on (Y1-xSmx)1-yEuyBaSrCu3O6+z (y=0 with x=0, 0.8, 1 and y=1). Each sample underwent two distinct heat treatments: oxygen [O] annealing and argon annealing followed by oxygen [AO] annealing. The [AO] treatment leads to an increase in the parameter b and a decrease in the parameter a, except for YBaSrCu3O6+z, where both parameters increase, accentuating orthorhombicity (ε=b-a/b+a). This increase is attenuated in the case of YBaSrCu3O6+z. For y=0 and as x varies from 0 to 1, the orthorhombic structure remains unchanged, irrespective of the heat treatment applied, except for SmBaSrCu3O6+z [O] (x=1 and y=1), where the structure becomes pseudo-tetragonal. Notably, heat treatment [AO] enhances the critical temperature in all cases except YBaSrCu3O6+z, where it decreases from 83K to 81.7K. Our investigation is centered on comprehending how crystalline parameters and the order/disorder of oxygen in the Cu(1)O base plane affect the critical temperature (Tc), subsequently influencing the hole density (p) within the copper plane Cu(2)O2 of our samples. Additionally, we take into account the impact of heat treatment on these parameters.

Keywords: High-Tc superconductors, Heat treatments, holes p, Tc,surface ab, orthorhombicity (ε), X- ray diffraction.

Adsorption And inhibition mechanism of novel pyrazole derivatives for carbon steel C48 in 1.0 M hydrochloric acid medium

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Abstract: In the present work, we examined the adsorption and inhibitory performance of newly synthesized pyrazole-derived ligands on C48 carbon steel in 1.0 M hydrochloric acid solution, over a temperature range from 298 K to 318 K. This evaluation was carried out using a variety of chemical, electrochemical and surface characterization techniques, this includes techniques such as potentiodynamic polarization (PDP), the use of electrochemical impedance spectroscopy (EIS), weight loss (WL) assessment as well as the application of scanning electron microscopy (SEM). Inhibition efficiencies reached 97 %, at an optimal concentration of 10^{-3} M. Electrochemical impedance analysis (EIS) data reveal an increase in polarization resistance, and a significant decrease in double-layer capacitance (C_{dl}) values. which can be attributed to the adsorption of inhibitors at the metal/solution interface. Potentiodynamic polarization curves show that pyrazole-derived act as mixed-type corrosion inhibitor. Furthermore, inhibitor adsorption obeys the Langmuir adsorption isotherm, and the influence of temperature and activation parameters suggest that pyrazole-based inhibitor are mixed-type adsorption (both chemical and physical adsorption) on the C48 surface. Scanning electron microscopy (SEM) images and UV-visible adsorption analysis confirmed that the effectiveness of the inhibitor can be associated with the development of a protective layer on the metal's surface.
Keywords: pyrazole-derived, electrochemical impedance spectroscopy, SEM technique.

Paper ID: 92

Synthesis and study of, Sr-doped CuO Thin Films

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Abstract: This work reports the effect of Sr doping on structural and optical properties of CuO thin films prepared by the ultrasonic Spray technique using copper (II) chloride dehydrate and strontium nitrate as precursors. The structural and optical properties of these CuO films were investigated using X-ray diffraction patterns (XRD), Scanning electron microscopy (SEM) , Raman diffusion and UV-vis transmittance. X-ray analysis reveals the monoclinic phase (space group C2/c), with no other secondary phase. This is confirmed by the Raman spectra, performed for displaying various vibrational modes. The maximum crystallinity is shown to be achieved by doping with 4% Sr. Scanning Electron Microscopy shows the effect of strontium on the morphological shape, whereas the UV-Vis transmittance data show an optical band gap ranging around the optimum value for photovoltaic applications, with no significant change.

Keywords: Thin film CuO, Sr doping, Ultrasonic Spray.

Simulation of the effect of partial shading on a PV system

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Abstract. In recent years, solar photovoltaic (PV) systems have been expanding rapidly. However, this growing technology still faces challenges regarding its efficiency, which is hugely affected by various factors such as the changing weather and partial shading conditions. Notably, partial shading stands out as a critical operational challenge, not only diminishing module efficiency but also posing a risk of hot spots that can result in substantial damage to solar cells/modules. To prevent this bypass diodes are used. In general, under partial shading conditions, the PV characteristics get more complex with multiple peaks. Our study specifically delves into the impact of shading on PV modules. The occurrence of multiple maximum peaks in the power output due to shading of PV cells is analysed in this paper using MATLAB/Simulink software. The maximum power degradation resulting from partial shading was depicted in Simulink and then compared to experimental data and simulation results from certain previous studies in the literature. Through this paper, we present an illustrative exploration of the partial shading concept.

***Keywords*:** Photovoltaic system, Partial shading, Matlab/Simulink .

Electrochemical investigation of the inhibition effect of calcon on carbon steel corrosion in the aqueous solution of 1.0 M hydrochloric acid

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Abstract: The increasing need for effective, high-performance compounds to safeguard metals and their alloys from corrosion has arisen due to widespread corrosion damage on a global scale. The inhibition effect of calcon (CLN) on the corrosion of carbon steel (CS) in 1M HCl solution was investigated using electrochemical techniques such as electrochemical impedance spectroscopy (EIS), potentiodynamic polarization (PDP), the gravimetric method, SEM analysis, to determine the inhibition performance of CLN. EIS studies indicated the construction of the protective film adsorbed on the steel/electrolyte interface by the molecule tested, its existence confirmed by SEM analysis. Polarization studies have shown that CLN acts as a mixed-type corrosion inhibitor, affecting both anodic and cathodic corrosion currents. Adsorption of this compound on the surface of carbon steel follows Langmuir's adsorption isotherm model. Electrochemical results showed that the compound tested behaves as an effective inhibitor of CS corrosion in 1M HCl at all concentrations, with best efficiency at an optimum concentration of 5×10^{-3} M achieving an inhibitory efficiency of 88%. On the other hand, corrosion inhibition decreased slightly with increasing temperature. Scanning electron microscopy (SEM) reveals an improvement in the surface morphology of carbon steel after the addition of calcon to the electrolyte.

Keywords: Calcon, Anti-corrosive, SEM technique, carbon steel.

Spatial patterns of abundance and biodiversity in a demersal community of the Moroccan Mediterranean Sea

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Abstract: Information on the spatial patterns and habitat preferences of marine species is key to understand the functioning of marine ecosystem and to manage and protect marine resources efficiently. However, the study of spatial patterns of marine ecosystems is challenging because there are dynamic environments that can influence the spatial distribution of marine communities.
We modelled the spatial patterns of abundance and biodiversity in a demersal community of the Moroccan Mediterranean Sea by season using hierarchical Bayesian spatial models and environmental factors. Overall, our findings revealed the importance of two mean variables in the spatial patterns of the demersal community, which were mainly driven by depth and temperature. Results also underlined important patterns of movements of demersal organisms : fishes, cephalopods, and crustaceans showed high densities in the area surrounding Cape of Three Forks, particularly in the Bay of Betoya and the central part of the region in both seasons, areas well-known for their upwelling, mainly driven by species-specific behaviour. Our research findings hold significant relevance as they provide valuable insights to guide and shape future management strategies within the study area. These insights can inform a range of potential actions, from the implementation of spatial fishing restrictions designed to sustain and balance marine ecosystems, to the dynamic adaptation of local marine protected areas, allowing them to effectively respond to and fit the natural fluctuations associated with seasonal processes. This study provides evidence of the need to expand current monitoring schemes to capture the spatial pattern of marine demersal communities for a more comprehensive marine spatial planning framework.

Keywords: Mediterranean Sea, spatial ecology, species distribution models, depth, demersal communities

The use of mussel *Mytilus galloprovincialis* and gooseneck barnacle *Pollicipes pollicipes* to biomonitor the coastal pollution by trace metals: a comparative analysis from Safi shores, Morocco

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Abstract: The present study aims to assess the spatial and temporal pollution status related to metal contamination in coastal waters at two specified points along the Safi areas situated on the Moroccan northwestern Atlantic coast. These sites include a presumed clean site and a contaminated metal site. The main objectives are to assess the level of contamination of the environment and the deterioration of costal water at these sites. The Water Pollution Index highlighted concerning degradation levels of seawater quality, classifying the study sites as 'strongly to seriously affected'. Moreover, the investigation delved into a comparative analysis of trace metal accumulation capacities between two biofilterer invertebrates, the gooseneck barnacle *Pollicipes pollicipes* and the Mediterranean mussel *Mytilus galloprovincialis*. In overall, the mussel tended to accumulate higher metal concentrations compared to the barnacle. The metal content analyses showed average annual means of ~ 19, 30, 14, 434, and 334 µg g^{-1} dry weight for *M. galloprovincialis* and ~ 17, 3, 8, 548, and 431 µg g^{-1} dry weight for *P. pollicipes*, for Cd, Cr, Cu, Fe and Zn, respectively. In addition, average concentrations of trace metals exhibited distinct patterns among soft tissues between species: Fe > Zn > Cd > Cu > Cr for *P. pollicipes* and Fe > Zn > Cr > Cd > Cu for *M. galloprovincialis*. Seasonal variations were observed, with higher trace metal concentrations during wet seasons and lower levels during summers for both species. Significant spatiotemporal variations ($p < 0.05$) in trace elements concentrations were noted, except for Cu levels in *P. pollicipes*, which displayed no spatial variability. Strong positive correlations ($p < 0.05$) were found between Cd, Fe, and Zn concentrations in soft tissues of *M. galloprovincialis* and *P. pollicipes* and those and their concentrations in seawaters. Conversely, Cu and Cr values in *P. pollicipes* soft tissues did not exhibit such correlations ($p > 0.05$). Bioaccumulation potential, assessed via Bioaccumulation Factor (BWAF), followed distinct orders for each species, with higher Cd values recorded at the polluted site during Summer for both species. The Trace Element Pollution Index (TEPI) and the Trace Element Spatial Variation Index (TESVI) were also calculated for species and sites. Both sites were categorized as highly contaminated based on the assessment of *M. galloprovincialis* and *P. pollicipes* during spring, with TEPI values of 0.95 and 1.20, respectively. Throughout the four-season study period and across sites, TESVI exhibited significant differences among trace metals. The highest spatial variability was observed for Cd in *M. galloprovincialis* and *P. pollicipes*, with TESVI values of 0.35 and 0.56, respectively.

Keywords: Bioaccumulation, Coastal waters, Mediterranean mussel, Gooseneck barnacle, metal contamination, pollution indices.

Inhibition of inorganic scaling by green inhibitor in reverse osmosis plant treating brackish water

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Abstract: Water, an indispensable resource for human activities and a vital element for ecosystems, holds paramount importance. In Morocco, the southern regions grapple with a growing concern over water scarcity, driven by persistent droughts, uneven rainfall distribution, and limitations in the available water resources. This challenge underscores the need for sustainable water management practices and solutions to ensure the well-being of both communities and the environment in these regions.

To surmount these challenges, it becomes imperative to tap into alternative water resources and implement advanced production techniques, especially with the surging water demand accompanying a growing population. In this context, the demineralization of brackish water emerges as a vital solution to meet the drinking water requirements of the TAN-TAN city. The demineralization station at Khang Lahmam, employing state-of-the-art reverse osmosis technology, stands as a key player in this endeavor. Located 80 km away from the town, the station draws brackish water from boreholes, producing a daily flow of 1700 m^3 of drinking water. However, a notable issue arises with the scaling of filtration membranes within this desalination unit, primarily attributed to the presence of calcium carbonate in the analyzed scale. This highlights the necessity for effective scaling mitigation measures to ensure optimal functionality of the demineralization unit.

This study delves into the potential of green inhibitors as effective agents for inhibiting $CaCO_3$ scale formation, exploring their performance in relation to both pH variations and inhibitor concentrations. Using the LCGE method, we scrutinized the interplay between pH levels and the parameters influencing the formation of calcium carbonate in pure Calco-carbonic water. The results revealed that the green inhibitor exhibited exceptional efficacy in preventing the deposition of $CaCO_3$. Even at very low concentrations, the inhibitor demonstrated a noteworthy capability to impede the formation of calcite, evident through the observation of deformed structures in Scanning Electron Microscopy images. These findings underscore the promising role of green inhibitors as efficient solutions for mitigating the formation of $CaCO_3$ scale.

Keywords: Brackish water, Demineralization, Reverse osmosis, Green inhibitors, Calcium carbonate, LCGE method.

Bioaccumulation of heavy metals in Sardina pilchardus muscle caught in the Moroccan Mediterranean coast

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Abstract: In Morocco, maritime fishing is a main component of the national economy given its geographical position, its double Atlantic and Mediterranean façade and a coastline that reaches up to 3500 km. The total Moroccan production of fishery products is around 1376420 tons with a contribution of 2.5% of the national GDP. Heavy metals are a severe threat because of their toxicity, long persistence, bioaccumulation, and biomagnification in the food chain. This investigation deals with human health risk assessment of metal contamination through the consumption of *Sardina pilchardus* (Walbaum, 1792) as one of the most consumed fish species in Morocco. The aim of this study is to assess the health risks associated with the consumption of sardine by assessing the contamination level of Hg, Pb, As, and Cd in the muscle of this species. Three hundred sixty (n=360) specimens of sardine were sampled between December 2020 and October 2021 at 3 Mediterranean coast sites: Beni Ensar, Ras El Ma and Al-Hoceïma in the northern region of Morocco. The results show that the arsenic (As) and mercury (Hg) were influenced by geographical area and season (p<0.05), while the lead and cadmium were not affected (p>0.05). The highest values were recorded in the winter season (p<0.05). The lowest contamination level was found in the spring season. For the geographical area, the Al-Houceima specimens present the highest heavy metals content (p<0.05). According to the standard set by the World Health Organization, the consumption of S. pilchardus from the Moroccan Mediterranean coast was not likely to have an adverse effect on human health.

Keywords: Heavy metals, Moroccan coast, *Sardina pilchardus*, Toxicity***.***

Paper ID: 99

Investigation of Electronic properties and Sodium ion diffusion in polyanionic compound

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Abstract: Sodium-ion batteries (SIBs) have emerged as an appealing and promising alternative within the realm of energy storage applications, primarily due to their advantages stemming from abundant resources, cost-effectiveness, and relatively high safety measures. Using first principles Density Functional Theory (DFT), the electronic properties of sodiated NNPO and desodiated NPO materials have been investigated using a generalized gradient approximation in combination to the onsite Hubbard correction (GGA+U). The Linear Synchronous Transit maximum (LST maximum) algorithm was considered to investigate the migration of the Na-ion in NNPO. The calculations of Na-ion diffusion barrier, ionic conductivity and the diffusion coefficient were also carried out. As main results, the NNPO reveals a semiconductor state with a band gap of 3.02 eV. In contrast, the NPO exhibit a metallic behavior. The barrier for sodium transport is estimated to be 0.97 eV and a high open circuit voltage is found equal to 4,4 V.

Keywords: DFT, Na ion, Energy Storage, Phosphates.

Evaluation of Culture Conditions for Carotenoid Production in Saline Microalgae Isolated from Saltworks in Southern Morocco

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Abstract: *Dunaliella salina* is a biflagellate green microalgae that can live in hypersaline ecosystems**.** These qualities therefore make *Dunaliella salina* good candidates for successful culture in open ponds to production of carotenoid such as β–carotene. Also, it could be used to provide a rich source of such antioxidant for health foods. This research focuses on the marine microalgae *Dunaliella salina* isolated from the Akhfennir saltworks in the Laayoune region of southern Morocco for the potential of microalgal biomass production and pigment production under stress conditions for better carotenogenesis.
Dunaliella salina was cultivated in an f/2 culture medium using natural seawater at under stress conditions: different salinities (2M NaCl, 3M NaCl,4M NaCl and 5M NaCl) at five different light intensities (1000, 2000, 3000, 4000 and 5000 lux). Carotenoid-accumulating cells were cultivated in a medium with a wide range of NaNO3 from the f/2 medium. The cultures were incubated at 20 °C, 25 °C and 30 °C. Maximum cell density and pigment production were observed under low temperature 20°C and high concentration of sodium nitrate during the last days of culture. The highest cell density in the microalga Dunaliella salina was 0.9 with carotenoid production reaching up to 18.42 µg/mL

Keywords : Stress conditions, Carotenoids, Dunaliella salina, Microalgae.

Engineering the hydrogen storage properties of the perovskite hydride $KMgH_3$ through First-principles method

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Abstract: The increase in current energy requires finding an alternative to fossil fuels. Hydrogen appears to be an innovative solution for the production and storage of energy. Indeed, scientific and technological obstacles have prevented the development of a method or a material allowing to store a large quantity of hydrogen at pressure and ambient temperature in a given volume. Our goal is to find a suitable material for hydrogen storage, and to use theoretical structural research techniques to explore the possibilities of storing hydrogen by metal adsorption. From a theoretical point of view, simulation studies using first principles based on Density Functional Theory (DFT) will allow to model the structure of the synthesized and predict or confirm the experimental results.
. **Keywords** : Adsorption , DFT, Energy Storage, Hydrogen , materials,

Valorization of insect breeding rejects by Chitins production. Preparation of Chitosans with controlled characteristics.

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Abstract: The breeding of the Black Soldier Fly intended to produce proteins is accompanied by rejections during the development of the insect. This work is a study of the valorization of these wastes through the production of chitins and chitosans with controlled characteristics. An extraction process is developed with an order of treatments and reaction conditions that provide chitins with high contents. All these chitins have an α structure. N-deacetylation of chitins makes possible the valorization of all rejects by the production of pure chitosans with high yields which retain a porous and fibrous structure which allow complementary applications. The obtained polymers are characterized by different analytical methods (Acid-base titration, Viscometry, ^{1}H NMR Spectroscopy Infra-red spectroscopy, X-ray diffraction, Thermogravimetric analysis TGA, Scanning electron microscopy (SEM), Energy dispersive X-ray spectroscopy (EDX). These chitosans are highly to completely deacetylated and their molar masses can vary depending on the process and life stage.

Keywords: rejects, valorization, chitin, chitosan, degree of deacetylation, molar mass

Electrochemical study of a material based on iron and phosphate dedicated to lithium-ion and sodium-ion batteries.

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Abstract: With continuing demographic growth and increasing energy demand, the problem of pollution is taking on considerable proportions. This situation is exacerbated by the significant increase in the use of smartphones and informatics tools, as well as by the worldwide transition towards the growing use of electric vehicles. Against this backdrop, the need for clean energy sources and efficient storage methods is becoming more pressing than ever.

To maximise the use of renewable energy resources, it is essential to develop ways of storing the surplus energy generated during periods of peak production. Batteries play a key role in the development of energy storage solutions, and advances in improved materials, combined with in-depth electrochemical studies, are essential catalysts for increasing the capacity and efficiency of these technologies.

The in-depth study of certain electrochemical parameters is of crucial importance, enabling us to understand in detail how the intercalation and de-intercalation of lithium or sodium takes place. In addition, the way in which materials are synthesised and the judicious choice of doped elements are of considerable importance in improving electrochemical performance.

As part of these advances, electrochemical studies in aqueous media are emerging as a significant dimension. This exploration paves the way for durable aqueous lithium-ion or sodium-ion batteries, offering promising prospects for more economical energy storage solutions. The application of these advances to the design of sustainable aqueous batteries represents a crucial development, opening opportunities for more environmentally friendly energy storage devices suitable for a variety of applications. Together, these developments strengthen our ability to shape the future of sustainable, efficient, and cost-effective energy solutions.

Keywords: materials- energy - energy storage- lithium-ion batteries – performance

Paper ID: 104

Integrating Advanced Biorefinery Approaches for Enhanced Bioethanol Production from *Opuntia ficus-indica* Wastes: A Circular Economy Perspective

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Abstract. This research explores the viability of producing bioethanol from *Opuntia ficus-indica* (OFI), commonly known as prickly pear, from a circular economy perspective. OFI, thriving in arid and semi-arid regions, offers a sustainable biomass feedstock for bioethanol due to its minimal water and maintenance needs. The study conducts a thorough literature review, tracing the progression of bioethanol production methods from OFI. It highlights the plant's potential in generating varying ethanol concentrations from different parts, such as cladodes and fruits. Emphasizing a circular economy, the research assesses the conversion of OFI waste into bioethanol, aiming at waste reduction and resource optimization. The study also covers the economic aspects and environmental benefits of OFI, including its efficiency as a forage crop and its lower environmental impact compared to other fruits. Key challenges identified include scalability, technological hurdles in biomass processing, and market acceptance. The paper concludes with the need for further research and development to improve the process's efficiency and sustainability. This study provides a comprehensive understanding of OFI's role in sustainable bioenergy, highlighting its potential in the context of advanced biorefinery approaches and circular economy principles.

***Keywords*:** *Opuntia ficus-indica*, Bioethanol Production, Circular Economy, Biorefinery Approaches, Sustainable Biomass, Renewable Energy.

Paper ID: 105

First principle investigation on hydrogen solid storage in NaBeH3

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Abstract: We investigate the hydrogen storage characteristics of alkali metal-substituted NaBeH3 using first-principles calculations based on density functional theory (DFT). Our calculations use the Full Potential Linearized Augmented Plane Wave (FP-LAPW) method implemented in the WIEN2K code. The aim of this study is to explore the heat of formation as a measure of material stability and desorption temperature. Our results indicate that transition metal substitution leads to a significant improvement in thermodynamic properties, accompanied by a decrease in volumetric and gravimetric hydrogen storage capacities. Furthermore, the calculated values for heat of formation and temperature of desorption comply with the criteria set by the US Department of Energy (DOE) for stability and volumetric capacity.

Keywords: hydrogen storage, Density functional theory, First-principles calculations, Perovskites, Thermodynamic properties, $NabeH_3$

Paper ID: 106

Simultaneous removal of anionic and cationic dyes from aqueous solutions using nickel–iron layered double hydroxide nanosheets

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Abstract: The removal of multiple organic dyes contained in industrial wastewater poses a significant challenge, and the underlying mechanisms involved in their simultaneous removal are still not fully understood. In this work, Nickel–Iron layered double hydroxides nanosheets were successfully synthesized by coprecipitation method at constant pH and were characterized by powder x-ray diffraction, Fourier Transform Infrared Spectroscopy, Scanning Electron Microscopy, Energy Dispersive Spectroscopy, and their effectiveness in removing anionic dyes Remazol Red 23, and Indigo Carmine was investigated by studying several parameters such as initial solution pH, adsorbent dose, dye concentration, and temperature effect. The as-prepared nanocomposite exhibited excellent removal efficiency for Remazol Red 23 and Indigo Carmine reaching the maximum adsorption capacities of 133.04 $mg.g^{-1}$ and 115.59 $mg.g^{-1}$, respectively. The simultaneous removal of binary anionic dye mixture was studied and proved the high performance of the synthesized material due to the electrostatic attraction. Also, a cationic dye Basic Yellow 28 was successfully removed when it was added to the binary anionic dyes' mixture, and this was explained by two proposed mechanisms: surface charge modification and the synergetic effect of dyes molecules.

Keywords: Adsorption, Anionic dyes, Binary system, Cationic dye, Layered double hydroxide

Paper ID: 107

A high and efficient advanced Cuttlebone Nanobiocomposite (Al_2O_3@CB) for cationic dye removal.

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Abstract: Population growth and industrial development lead to a significant increase in the production of waste and wastewater (Zhang et al., 2022). These discharges are polluting and have a negative impact on the environment and on the health (Farzana & Meenakshi, 2014). Pollutants are diverse like organic substances (such as dyes, pesticides, drugs, additives and surfactants) and inorganic substances (such as heavy metals, nitrate ions, phosphates and other industrial use products).

The aim of this study is, on the one hand, the depollution of industrial wastewater by the elimination of dyes using the adsorption technique and on the other hand, to valorize co-products from the fish and mollusks processing industries, specifically sepia waste (Bone of *Sepia. Officinalis)* for the implementation of bio-sourced materials for adsorption.

We have prepared a nanobiocomposite based on aluminum oxide and cuttlefish bone to eliminate Crystal Violet (cationic dye). The biomaterial was characterized by X-ray fluorescence and XRD. The adsorption yield reached 97.9% with a quantity of around 883.35 mg/g of of Al_2O_3@CB. The Zero Charge Point of this nanobiocomposite is of the order of pH = 8.8.

Keywords: Nanobiocomposites, adsorption, cationic dye, experimental design.

Paper ID: 108

Synthesis and Characterization of CuAl LDH and its Application for Effective Removal of Eriochrome Black T from Aqueous Solutions

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Abstract: This study focuses on the synthesis of CuAl LDH material through the coprecipitation method at constant pH and its subsequent application as an efficient adsorbent for the removal of Eriochrome Black T (EBT) dye from aqueous solutions. The synthesized LDH was systematically characterized using X-ray diffraction (XRD), scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDX). The XRD analysis revealed a well-defined layered double hydroxide structure and SEM images further illustrated the nanolayered morphology of the LDH confirming the successful synthesis of the material. The EDX analysis confirmed the presence of the essential elements constituting the LDH, validating its elemental composition and the molar ratio 2 used during the synthesis. The adsorption efficiency of the LDH for EBT dye removal was investigated by studying the pH, initial concentration and adsorbent dose effects. Significant removal efficiencies were achieved. This enhanced performance was attributed to the LDH's high ability to effectively adsorb dyes due to the electrostatic attraction between the positively charged surface of the material and the anionic dye. The results showed the promising potential of LDH for the environmentally friendly and efficient removal of dye pollutants from aqueous environments.

Keywords: Layered double hydroxide; Adsorption; EBT; Electrostatic attraction.

First-principles calculations to investigate structural, electronic and optical properties of undoped and Ag doped Sb_2S_3

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Abstract: Energy is generated from environmentally friendly sources sash as Wind Power, Hydropower, solar energy, Biomass and Bioenergy. Cost-effective solar cell is one of the most critical aspects of the developing field of clean-renewable energy economy and one of the paramount topics in the materials science community. Antimony sulfide (Sb_2S_3) a chalcogenide binary material, is a potential candidate as sustainable sources of renewable energy, less toxic, stable, efficient and Earth-abundant materials with suitable proprieties for photovoltaic application, to replace certain toxic materials such as CdTe, which contains heavy metals, raising environmental concerns.

In the present work, we have investigated the structural, electronic, and optical properties of both undoped Sb_2S_3 and Ag doped Sb_2S_3. In this study we used the Density Functional Theory implemented in the Wien2k code with Full Potential-Linearized Augmented Plane Wave (FP-LAPW) [1] and the Local Orbital (LO) Method. The structural properties were computed using the Perdew–Burke–Ernzerhof generalized gradient approximation for solids and surfaces (PBEsol-GGA). For electronic and optical properties, the Trans-Blaha approximation of the modified Becke–Johnson (TB-mBJ) potential was used, to guarantee more reliable results for the fundamental bandgap energy and optical coefficients.

The optical characteristics of Ag-doped Sb_2S_3, including the dielectric function, extinction coefficient, refractive index, energy loss function, absorption coefficient, reflectivity, and transmittance, are presented. We note that our results indicate that in the visible range and UV, Ag-doped Sb_2S_3 exhibits a higher optical absorption coefficient compared to the undoped Sb_2S_3. All our obtained results are in good agreement with experimental values and confirm that Ag-doped Sb_2S_3 can be considered as a candidate absorber material in solar cells.

Keywords: DFT, Antimony sulphide, chalcogenide, structural properties, electronic properties, Optical properties

DFT study of the structural, electronic and optical properties of binary compounds based on InX (X=P, As, Sb)

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Abstract: Binary compounds based on InX (X=P, As, Sb) crystallizing in the zinc blende structure, are attractive for their fundamental research interest and technological applications in the field of optoelectronics and fast microelectronics. They are used in the manufacturing of devices such as diodes (laser, LED, light-emitting), transistors (FET and field effect, WT) and optical amplifiers. Indeed, the production of bipolar heterojunction transistors by the binary compound InP constitutes an important issue in the development of high speed optical fiber communication systems (20 to 40 Gbit/s).

In our work, we studied, the physical properties of binary compounds based on InX (X=P, As, Sb). The calculations have been performed based on the density functional theory (DFT) using linear augmented plane waves at full potential (FP-LAPW) implemented on the Win2k code where exchange-correlation potentials such as the local density approximation (LDA) and the generalized Perdew-Burke-Ernzerhof gradient (pBEsol-GGA) are used to calculate the structural properties. The gap energy values currently calculated with the modified Beck Johnson approximation (mBJ+GGA) are respectively 1.48eV, 0.55eV and 0.32eV for InP, InAs and InSb. The optical quantities are also calculated by mBJ+GGA. InP, InAs and InSb have a strong absorption of around 106cm-1 at wavelengths 250nm, 273nm and 312nm. These values belong to the ultraviolet (UV) range. Also, the maximum reflection coefficient in the UV is 30% for InP, 35% for InAs and 40% for InSb in the visible range. The transmittance coefficient in the visible range is between [42%-56%] for InP, [42%-48%] for InAs and [37%-39%] for InSb. All the values obtained by our calculations are in good agreement with the experimental data

Keywords: DFT study, Binary compounds, Structural properties, Electronic properties, Optical properties.

Paper ID : 112

Structural, morphological, optical study of $Cu_2Fe_{0.75}Co_{0.25}SnS_4$ thin film synthesized by the sol-gel method

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Abstract. The compound copper iron cobalt tin sulfide $Cu_2Fe_{0.75}Co_{0.25}SnS_4$ (CFCTS) is a potential absorber thin film candidate for solar cells. In the present work, CFCTS thin film was deposited on soda lime glass substrates, using sol-gel spin coating technique without a sulfurization step. X-ray diffraction, Raman spectroscopy, scanning electron microscopy, energy dispersive analysis and UV-Vis-NIR spectrometry were used to investigate the effect of annealing temperature and time in a nitrogen atmosphere on the structural, morphological, compositional and optical properties of the deposited thin films. The optimal annealing temperature of the pure, uniform, dense and stoichiometric CFCTS thin film is found to be 400°C for 20 min. Energy dispersive X-ray analysis and scanning electron microscopy revealed that the nearly stoichiometric composition and homogeneous surfaces. In addition, UV-Vis analysis confirms the optical band gap of 1.55 eV in the visible region which is the optimal value for converting amount of energy from solar spectrum into electricity. Moreover, the films exhibited a p-conductivity with a sheet carrier concentration of 1.4 10^{19} cm^{-3}, a low resistivity 4.29 Ω.cm and an electrical mobility of 1.12 10^{-1} $cm^2/V.s$.

Keywords**:** $Cu_2Fe_{1-x}Co_xSnS_4$, Sol-gel, annealing, Structural, Morphological, Optical properties.

Paper ID: 113

Comparative Analysis of Low-Cost Smart Irrigation Tools in African Contexts: Opportunities, Challenges, and Social Impact

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Abstract: This study addresses the pressing need for sustainable water management in agriculture, focusing on the use of low-cost smart irrigation tools, particularly in the Moroccan context. With growing concerns about water scarcity and climate change, exploring practical and affordable solutions for optimizing irrigation is crucial. While past research has touched on smart irrigation, our study contributes by providing a comparative analysis across African countries, offering insights into the opportunities and challenges specific to the region. We employed a mixed-methods approach, combining field studies and data collection through low-cost sensor technologies. Field studies were conducted in Morocco, and data, including soil moisture levels and crop performance, were collected using affordable sensor devices. The data were processed using statistical analysis to assess the effectiveness of smart irrigation tools in optimizing water usage for agricultural practices. Our findings indicate that the implementation of low-cost smart irrigation tools, particularly via sensors, led to a significant improvement in water use efficiency across diverse agricultural landscapes. Comparative analysis across multiple African countries unveiled variations in the adaptability and limitations of these tools, providing a nuanced understanding of their practical implications. The results suggest that the affordability and adaptability of smart irrigation tools hold promising potential for sustainable agriculture. Furthermore, the study delves into the social implications, highlighting the potential for socio-economic empowerment of local communities through improved agricultural practices. Challenges hindering widespread adoption are discussed, offering valuable insights for policymakers and researchers interested in sustainable water resources management. In conclusion, our research underscores the significance of low-cost smart irrigation tools in addressing water management challenges in agriculture. The comparative analysis contributes novel insights, guiding future research and policy initiatives for the implementation of integrated water resources management, ultimately promoting sustainable agricultural practices in the face of climate change and resource scarcity.
Keywords: Smart Irrigation, Water Resources Management, Low-Cost Tools , Comparative Analysis, Sustainable Agriculture.

Paper ID: 114

Pt/α-Fe_2O_3@RGO nanocomposites as electrocatalyst for selective detection of the drug ornidazole (ORD) in environmental samples

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Abstract: The widespread use of antibiotics for human and animal leads to the contamination of the water environments. Thus, several studies have been developed to monitor the contamination of environmental samples with pharmaceutical products. The electrochemical performance of the constructed sensor was examined by electrochemical impedance spectroscopy (EIS), cyclic voltammetry (CV) and square wave voltammetry (SWV). The obtained results indicate that the sensor achieves excellent electrocatalytic conductivity and rapid electron transfer for the detection of ORD, good reproducibility, storage stability and reliable selectivity. Additionally, the detection limit of the developed sensor was 15 nM with a sensitivity of 0.277 µA μM^{-1} cm^{-2}.

Keywords: RGO, Nanocomposite, Ornidazole, Electrochemical, Detection.

Physicochemical Water Quality Assessment of Lake Dayet Erroumi (Khemisset, Morocco)

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Abstract: The Dayet Erroumi lake is a site of biological and ecological interest. The objective of this research is the hydrochemical study of Dayet Erroumi lake. Three sampling campaigns were carried out in April, July and November 2019. Twelve physicochemical parameters were analyzed: temperature, electrical conductivity, pH, calcium magnesium, sodium, potassium, chlorides, nitrates, sulfates, carbonates and bicarbonates. The physico-chemical analysis of the water shows that the pH of the water is basic. The nitrate and sulfate content shows that the water is of good quality according to Moroccan surface water quality standards. The hydrochemical facies of the water according to the Piper diagram is chloride-sodium. The electrical conductivity value indicates that the lake water is characterized by high salinity, due mainly to the high concentration of chlorides and sodium. The high mineralization of the water is explained by the leaching of evaporitic rocks in the region. Evaporation plays a crucial role in the seasonal variation of water chemistry.

Keywords: Dayet Erroumi lake, water quality, salinity, evaporation.

Paper ID: 116

Biological Methods for Post-Harvest Control of R. stolonifera Rot in Peaches and Nectarines

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Abstract: Peaches (Prunus persica) are highly susceptible to Rot, primarily caused by opportunistic fungi during storage, such as Rhizopus stolonifer. This fungal infection can lead to significant economic, environmental, and health consequences. To address thèse issues, the study evaluated the effectiveness of various treatments for the preservation of the ORION nectarine variety and the Bénédicte peach variety, both with a fruit caliber of 26.

Fruits were inoculated with a spore solution of 1 × 10^6 spores/ml of R. Stolonifer, either before or after treatment with various products. These products included Bacillus amyloliquefaciens, Bacillus Subtilis, Aureobasidium pullulans, Bacillus amyloliquefaciens combined with Aureobasidium pullulans, sodium bicarbonate in combination with Bacillus amyloliquefaciens, and finally, fludioxonil as a référence product.

The treated fruit was subsequently stored at a temperature of 25°C and monitored daily for an 18-day period. The results indicated that the combination of Bacillus subtilis and Aureobasidium pullulans yielded the best outcomes in terms of preserving fruit quality. This combination significantly reduced quality losses, achieving success rates of 55% for nectarines inoculated before treatment, 35% for nectarines inoculated after treatment, 42.5% for peaches inoculated before treatment, and 20% for peaches inoculated after treatment.

Fruits treated with the combination of Bacillus subtilis and Aureobasidium pullulans before inoculation by the pathogen showed the best results for protection against R. Stolonifer. Furthermore, this study paves the way for more sustainable conservation practices for these fruits, while mitigating the economic and environmental impacts associated with post-harvest fruit deterioration.

Keywords: Prunus persica, R.Stolonifer, Bacillus Subtilis, Aureobasidium pullulans, Bacillus amyloliquefaciens, sodium bicarbonate.

Paper ID: 117

Realisation of a boost converter to control a PV generator

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Abstracts: The conception of an electrical model of a photovoltaic generator is based on the characteristic current-voltage of the solar panel. Many electrical models have been proposed in the literature to simulate PV cells operating under various conditions, for example single diode, dual diode and Bishop models[1,2]. The complexity of the models depends on the number of parameters to be identified (series resistance RS, parallel resistance RSh, diode current, photocurrent...). Each model is essentially an approximation of the ideal model which contains a current source representing the incident sun power and a diode representing the PN junction.
The single diode model is the most used model. This model is applied to PV cells and and PV modules for its simplicity and good precision in the power generation quadrant of energy production. The direct connection of the PV panel to load does not allow the extraction of maximum power from the panel, therefore the interconnection of a boost chopper by regulating the duty cycle is the objective. This work consists in the electrical characterization of a photovoltaic generator based on the single diode model using MATLAB Simulink. The realization of a boost converter to continuously adjust the load, to keep the PV generator operating at, or close to, the peak power point of the PV panel under varying conditions, like changing solar irradiance, temperature, and load. The results of this work validate simulation results established in Matlab Simulink.

Key words: modeling, Matlab simulink, photovoltaic generator, boost converter

Impact des rejets des eaux usées sur la qualité physicochimique de L'Oued Sebou en aval de la ville de Fès (Maroc)

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RESUME : L'étude porte sur l'analyse des paramètres physico-chimiques (T°, pH, CE, MES, O2, DBO5, DCO, Cl-, PO43-, NH4+ et NO3-) des eaux de l'Oued Sebou de en aval de la ville de Fès afin d'établir un diagnostic de l'état de pollution des eaux superficielles de cette partie du fleuve. Des échantillons d'eau ont été effectués à quatre stations d'étude pendant les périodes humides et pendant les périodes sèches.

A la lumière des résultats obtenus sur les eaux de surface de la rivière Sebou, il est conclu à une dégradation importante de la qualité de l'eau aussi bien en période hivernale qu'en été. Notamment, une augmentation des valeurs de l'ammonium, de la DCO et de la DBO5 outre un pH acide dû aux rejets des eaux usées des villes de Fès, aux rejets marginaux et aux lessivages des engrais.

Efficient removal of levofloxacin from aqueous solutions using avocado seeds treated: kinetics and isotherms modelling

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Abstract: The main objective is to optimize a new composite for the depollution of contaminated water. The avocado seeds treated (AST) were first prepared, characterized, and applied for efficient removal of antibiotic levofloxacin (LEVO) in wastewater. In addition, the adsorption in a batch system of LEVO on the AST material was studied (1-2). Therefore, we accomplished a parametric study of the adsorption by studying the effect of several important parameters on the adsorption power of the used material, namely, initial pH, contact time, initial antibiotic concentration, temperature, and the ionic strength effect on the antibiotic adsorption process were systematically assessed. The highest adsorption efficiency of LEVO (83.87%). The pseudo-second-order kinetic model gave the best description of the adsorption kinetic of antibiotics on the AST adsorbent. In addition, the mass transfer of LEVO molecules from the solution to the adsorbent surface occurred in three sequential stages (boundary layer diffusion, intraparticle diffusion, and adsorption equilibrium). The adsorption isotherm data were best fitted with the Dubinin-Radushkevich model. The adsorption capacity of AST is 29.82 mg/g. The thermodynamic study showed that antibiotic adsorption onto AST was an exothermic and feasible process. Therefore, we can state that the AST material has a potential application prospect as an efficient adsorbent for CV dye from wastewater.

Keywords: adsorption, avocado seeds treated, levofloxacin, adsorption isotherms, kinetics

Evaluation of Single Slope Solar Still Integrated with Flat Plate Collector

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Abstract. Freshwater scarcity and reliance on conventional energy sources were among the significant challenges faced by the population last year. Consequently, the implementation of solar desalination systems stands as a promising solution to mitigate dependence on non-renewable energy sources and address water shortages. The present work presents a numerical investigation of conventional solar still (CSS) coupled with flat plate collectors (FPC). A thermal analysis investigates the impact of integrating flat plate collectors (FPC) on the CSS system's productivity and energy efficiency. The modified solar still (SSP) indicates a significant improvement in the daily productivity of the CSS by about 66.58%. The average energy efficiency of CSS and SSP is 47.65 % and 54.19 % respectively.

***Keywords*:** Solar Still, active solar still, flat plate collector

Paper ID: 121

First principles investigation of the substitutional doping of iron in Mg_2Ni phase

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Abstract: Because of its small weight, inexpensive cost, and high theoretical gravimetric hydrogen storage capacity (3.6 mass%, assuming the production of Mg_2NiH_4), Mg_2Ni is regarded as one of the most promising alloys for hydrogen storage. Moreover, it has the ability to both absorb and desorb hydrogen at moderate pressures and temperatures. Nonetheless, Mg2NiH4's strong thermal stability and poor hydriding/dehydriding kinetics (requiring 280 °C for 1 bar hydrogen) [1] become the obstacle for the practical use for hydrogen storage. Fe, as a transition metal, has been experimentally added into Mg_2Ni for improving its hydrogen storage properties. Different literatures reported diffferent substitution methods. Some authors used Fe to substitute Ni[2], while others used Fe to substitute Mg in Mg_2Ni[3].
In this work, we use first principles density functional theory calculations to explore the substitutional doping of Fe in the Mg2Ni phase. By employing the method of elemental substitution to enhance the hydrogen storage capabilities of the Mg2Ni intermetallic complex, the preferred site of substitution of Fe in the Mg2Ni lattice has been identified through total energy calculation.

Keywords: First principles calculation, Fe-doped Mg2Ni, Enthalpy of formation, electronic structure

Effect of hydrodynamic parameter on the rate of Zinc removal from wastewater by ion flotation

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Abstract: Heavy metal ions must be eliminated from industrial effluents because of their negative effects on the environment. The production of wastewater is increasing as a result of the growth in industrial production linked to the increase in the world's population.
Because of its efficiency, the ionic flotation technique offers great potential in the field of wastewater treatment. (Rubio et al., 2002).
The simplicity of the method, its low energy requirements, its low cost compared with other separation techniques, its speed of execution, its low concentration of residual metals, its small footprint, its ability to adapt to a range of metals at different levels and the production of a low volume of sludge are all advantages of this method. (Salmani et al., 2013).
This study investigated the effect of a hydrodynamic parameter on zinc ion removal in a column.Zinc ion was removed at four surfactant concentrations (SDS / Zinc (II) ratio from 2 to 5) and three air flow rates (0.5-1 L/min) in an acidic medium . The results indicated that the SDS / Zinc (II) ratio and the air flow rate had a significant effect on flotation kinetics and ion recovery. Increasing the ratio resulted in an increase in the zinc removal rate. Increasing the air flow rate generally leads to an increase in the zinc removal rate of about 67% (4-fold).

Key words : Ion flotation, Experimental design, Zn(II) ions, Wastewater, Anionic surfactant, Sodium dodecyl sulfate

Paper ID: 123

Investigating the Effectiveness and Parameters of an Experimental Physico-Chemical Approach for Wastewater Treatment: Coagulation/Flocculation Perspective

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Abstract: The purpose of this study was to investigate the application of experimental physicochemical treatment methods (particularly coagulation/flocculation) in the treatment of wastewaters from various chemical analyses, including GLP dosing and silica dosing. The focus is on studying and evaluating key parameters related to this treatment process, including the duration and intensity of agitation, settling time, the amount of coagulant (lime CaO), the effect of pH and the amount of flocculant (cactus). To evaluate the effectiveness of the physicochemical treatment, an extensive analysis was performed focusing on the above parameters and their interaction in the system. We performed various experiments, systematically varying the values of these parameters, and carefully measured the results obtained. The results of this study demonstrate the significant effectiveness of coagulation/flocculation technology in treating wastewater samples. By carefully controlling the parameters, we found that certain combinations produced better results in terms of wastewater treatment efficiency. The effects of agitation time and speed, settling time, coagulant dosage, pH adjustment, and flocculant dosage were analyzed, providing valuable insights into their individual and collective effects on the entire treatment process.

Keywords: Wastewater treatment, experimental, physico-chemical, coagulation/flocculation, chemical analyses

Paper ID: 124

Thin-layer drying characteristics of two Moroccan apricot varieties in a forced convection solar process

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Abstract: Numerous countries have a significant agricultural sector that contributes significantly to employment, both directly and indirectly through its connections to food processing and distribution (1). The agricultural industry in Morocco is the main focus of this paper. This work focuses on the influence of different controllable and uncontrollable aero-thermal parameters (air temperature and airflow rate) on water loss of fresh two Apricot varieties commonly named Carmen and Aurora using solar energy as a green energy. The kinetics of drying is studied for four temperatures (50, 60, 70 and 80 °C) in an air flow drying 300m^3/h, the ambient temperature ranged from 26 to 37 °C and external relative humidity between 13 and 39%. The established results show a significant reduction in moisture content for Aurora and Carmen apricot varieties, from initial values of 86.38% and 82.75%, respectively to 26.78 ± 3% (w.b).An analysis of the drying kinetics of apricot slices was conducted to determine the diffusion coefficient during the phase of consistent drying rate. The diffusion coefficient exhibited variability ranging from 4.65 10^{-10} to 24.40 10^{-10} m^2/s for Carmen and from 3.24 10^{-10} to 14.16 10^{-10} m^2/s for Aurora, as temperature increased. The influence of temperature on the diffusion coefficient was effectively described by the Arrhenius relation, where the activation energy was determined to be 5434.87kJ/kg (2). Notably, the Midilli-Kucuk model was identified as suitable for effectively characterizing the conductive drying kinetics of apricot slices

Keywords: Apricot varieties; Convective solar drying; Drying kinetics; Modelling Activation energy

Removal of phosphate ion by adsorption onto treated biomass

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Abstract: This study aimed to analyze the impact of basic pretreatment of the Carpobrutus edulis (C. edulis) plant on its phosphate ion adsorption capacity. The biomaterial used was characterized using techniques such as scanning electron microscopy with dispersive energy spectrometry (SEM-EDX), Fourier transform infrared spectroscopy (FT-IR), thermogravimetry and differential thermal analysis (DTA/TGA), as well as pH measurement (pHz). A comprehensive study of phosphate ion removal by this biomaterial was carried out, examining physicochemical factors such as initial pollutant concentration, adsorbent quantity, contact time, pH, and temperature. After the treatment of biomaterial, kinetic and equilibrium studies of phosphate ion adsorption were fitted to the pseudo-second-order kinetic model and the Langmuir model, respectively. The thermodynamic parameters indicate that the adsorption process is feasible and spontaneous. The mechanism of phosphate ion adsorption by the biomaterial surface was attributed to electrostatic interaction and H-bonding. The prepared biomaterial was easily regenerated with an aqueous solution of HNO3, resulting in a slight decrease in its adsorption capacity.

Keywords: *Carpobrotus edulis* plant · Adsorption · phosphate ion removal · Chemical treatment.

Paper ID: 126

Design of novel small molecule inhibitors of TRKs using a computer-aided drug design approach

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Abstract: In this work, a data site of small-molecule indolin-2-one derivatives showed remarkable biological activity against TRKs enzymatic activity, these small molecules could have an excellent profile for pharmaceutical application in the treatment of cancers caused by TRKs activity. The aim of this study is to modify the structure of these molecules to obtain new molecules with improved TRK inhibitory activity and pharmacokinetic properties favorable to the design of new drugs. Based on this series, we carried out a 3D-QSAR study. As a result, robust and reliable CoMFA and CoMSIA models are developed and applied to the design of 11 new molecules. with biological activity superior to that of the most active molecule in the starting series. The eleven designed molecules are screened using drug-likeness, ADMET proprieties, and molecular docking. The results of this screening identified the T1, T3, and T4 molecules as the best candidates for strong inhibition of TRKs enzymatic activity. In addition, MD simulations are performed for TRK free and complexed with ligands T1, T3, and T4 to evaluate the stability of ligand-protein complexes over the simulation time. On the other hand, we proposed experimental synthesis routes for these newly designed molecules. Finally, the designed molecules T1, T2, and T3 have great potential to become reliable candidates for the conception of new drug inhibitors of TRKs.

Keywords: TRKs; 3D-QSAR; ADMET; molecular docking; molecular dynamics.

Numerical Survey of Contaminant Transport and Self-Cleansing of Water in Nador Lagoon, Morocco

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Abstract: Numerical simulations are presented of the flow hydrodynamics and hypothetical contaminant dispersion patterns in Nador Lagoon, a shallow lagoon with a barrier island situated on the coast of Morocco. It is found that the natural circulation forced by the tidal flow in the lagoon is greatly affected by the development of an artificial inlet in the barrier island. The case study demonstrates the potential use of modern computational hydraulics as a tool integrated in the decision support system designed to manage a lagoon ecosystem.

Keywords: Shallow water equations; Contaminant transport; finite volume method; unstructured mesh; Nador lagoon.

Numerical Investigation of MHD Natural Convection Using a Non-Homogeneous Dynamic Mathematical Model inside a Cubical Cavity Loaded with Al_2O_3-Water Nanofluid.

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Abstract: The study utilized a non-homogeneous dynamic model to investigate free convective flow in a cubical cavity filled with Al_2O_3-water nanofluid. This model is more accurate in terms of physical representation of nanofluids than homogenous ones. The left sidewall created a horizontal magnetic field that entered the cavity. The vertical left and right sidewalls of the enclosure are both maintained at an isothermal cold temperature (T_c). Within the cavity, two isothermal heating blocks are located in the center of the upper and lower walls. It is assumed that the other cavity walls are adiabatic. The solid volume percentage ranged from $0 \leq \phi \leq 0.06$ throughout the simulations, the Rayleigh number varied from $10^3 \leq Ra \leq 10^5$, the Hartmann number varied from $0 \leq Ha \leq 40$, and the nanoparticle diameter varied from 15 nm ≤ dp ≤ 120 nm. It was discovered that the average Nusselt number grows as (Ra) and (ϕ) increase, but it decreases as Ha increases at (dp = 15 nm). Additionally, at all values of (ϕ), the rising influence of the magnetic field on the average Nusselt number is absent ($Ra = 10^3$). Nonetheless, the average Nusselt number was inversely related to (dp) and directly proportional to (Ra) and (ϕ) when (dp) was taken into account as a variable.

Keywords: *Natural Convection; Al_2O_3-water Nanofluid; Magnetic field; Non-homogeneous Dynamic Mathematical Model*

Paper ID: 131

Development of Novel Non-Bioaccumulative Fluoropolymer Materials Used as Coating Materials for Granulated Fertilizers

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Abstract: Until today, several coating materials have been proposed to encapsulate conventional fertilizers in order to regulate water penetration and rate of nutrient dissolution, allowing the release of available nutrient in synchronization with the requirements of the plants. Many researchers are focused on the development of coating materials based on vegetable oils [1], some are more interested in biopolymers coatings [2], and others are attracted to acrylic coatings [3]. The current study was devoted to design and characterize a new coating materials for conventional granular fertilizers produced by OCP group. We will, in what follows, focus on various fluorinated formulations having a less bio accumulation effects [4]. Each presented formulation has its particular properties and its advantages which make each proposed formulation an attractive candidate to encapsulate granular fertilizers. Based on the obtained results, it can be concluded that due to their specific properties, fluorinated materials have several advantages making them the most attractive candidate to cover conventional water-soluble quick-release fertilizers.

***Keywords**:* Fluoropolymers, Fertilizers, Coating Process and Slow Release.

Paper ID: 133

Removal of Cu(II) ions by ceramic membrane modified by using micro-particles of dried plants

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Abstract. This research focuses on enhancing the selectivity of ceramic membranes through surface modifications utilizing inert solid biomaterials as adsorbents. Filtration experiments were conducted using a ceramic tubular membrane composed of cordierite/ZrO2 (pore size 0.2µm). The membrane underwent modification through the formation of a dynamic layer on the microfiltration membrane's surface during the circulation of the vegetal suspension. The study presents the results of metal cation retention by this novel membrane system, comparing these results with those of the unmodified membrane (cordierite/ZrO2). The influence of concentration on the retention process was also investigated. Scanning electron microscopy (SEM) images of the surface and transverse section of the modified membrane are provided and discussed. The obtained results are encouraging, demonstrating the potential applicability of this process for the purification of water polluted with ions such as heavy metals.

Keywords: *Heavy metals, Cordierite/ZrO2/membrane, Incorporation, Microfiltration, Ultrafiltration, Water depollution*

Inhibition of biofilm formation in Pseudomonas aeruginosa: Molecular docking and ADMET properties

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Abstract: The focus of this study is to explore the molecular docking and ADMET properties investigations of triazol derivatives to specific biological target. Through molecular docking, the study examined the potential interactions between the triazol derivatives and the active site of the lasR protein of P. aeruginosa 3JPU. Additionally, a comprehensive ADMET assessment was conducted to predict the pharmacokinetic and toxicological profiles of potent compounds.
The results indicated that several compounds exhibited favourable binding energies and interactions with 3JPU protein especially **G**, **N** and **U** using Auto-dock vina. Moreover, the ADMET evaluation highlighted derivatives with promising pharmacokinetic properties, including optimal absorption, distribution, and metabolism, coupled with minimal toxicity concerns. Hence, compound N is identified as valid reference for design new drugs antibacterial.
Finally, this integrated approach of molecular docking and ADMET profiling offers a systematic strategy for identifying compound with desirable biological activities and pharmacokinetic characteristics, thus contributing to the development of novel therapeutic drugs.

Keywords: Molecular docking, ADMET, P.aeruginosa, lasR protein, 3JPU.

Preparation and investigation of structural and photocatalytic properties of doped titanium dioxide nanotubes

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Abstract: In this study, copper and silver doped TiO_2 nanotubes were fabricated by in situ anodization method to improve their photocatalytic performance. The resulting nanotubes (NTs) were characterized by scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD), Raman spectroscopy, and Mott-Schottky analysis. The SEM study shows the formation of NTs structure and reveals that the doping does not affect the surface morphology. The XPS analysis proves that a mixture of Ag^0/Ag^+ and Cu^+ / Cu^{2+} exist simultaneously on the surface of the Ag and Cu doped TiO_2 NTs, respectively. XRD and Raman spectroscopy analysis shows that the doping shifted the anatase and rutile phase transformation and has a stabilization effect on the anatase phase. The Mott-Schottky analysis demonstrates that the potential of the flat band shifted to negative values by doping. The prepared NTs were evaluated in the photodegradation of methylene blue (MB) under UV. The results reveal that the doped TiO_2 NTs were found to be more efficient than pure TiO_2 NTs in degradation of MB. The Cu-doped TiO_2 NTs exhibited excellent degradation efficiency.

Keywords: Electrochemical anodization, Photocatalysis, Photodegradation, Nanotubes TiO_2, XPS · Methylene blue.

Paper ID: 137

Electrochemical Detection of Nitrate Ions Using a Sensor Based on Poly 1,8-Diaminonaphthalene and Copper Particles Film

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Abstract: The contamination of groundwater, rivers, and lakes by nitrates has become a big issue, coming mainly from agricultural activities such as the use of chemical fertilizers. In some regions of Morocco, nitrate concentrations in groundwater and drinking water exceed 50 mg/L^{-1} of NO_3^-. The World Health Organization (WHO) requires a maximum level of 50 mg/L of NO_3^- in water, which is often exceeded, rendering drinking water unfit for consumption.

Designing new electrochemical sensors for detection of nitrates require new electroactive materials, among these conducting polymers offers a great opportunity to develop new materials. In this work, we successfully synthetized the poly (1,8-Diaminonaphthene) onto the surface of carbon paste electrode by using galvanostatic mode at a positive current. The electrodeposition of copper was then conducted by potentiostatic mode at negative potential. The polymer obtained by facile polymerization allows a uniform dispersion of copper particles and improves the mechanical stability of the sensors leading to a low detection limit.

The Cu /Poly 1,8-DAN /CPE exhibit a very impressive electrochemical performance towards nitrates ions. The electrode was stable over a week with a very good linear range between 2 µM and 200 µM, a good stability, high reproducibility and a very low detection limit at 0.5 µM. This work revealed that the deposition of polymer and metal particles can be applied as promising material in new application such as water denitrification.

Keywords: Sensor, electrochemical detection, Nitrate, Copper, Polymer.

Paper ID: 138

Creating a novel polyaniline@oak acorn biocomposite for effective chromium ion removal from water

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Abstract: A novel composite material called polyaniline@oak acorn (PANI@OA) was created through a straightforward in situ chemical polymerization process. The resulting adsorbent underwent thorough analysis using various techniques including Fourier transform infrared spectroscopy (FTIR), energy dispersive X-ray spectroscopy (EDS), scanning electron microscopy (SEM), thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), and specific surface area measurement (BET). In a controlled batch adsorption setup, the synthesized material's effectiveness in removing Cr(VI) ions from water was investigated. The findings highlighted a strong reliance on the physicochemical properties during the adsorption process. The behavior of Cr(VI) adsorption onto PANI@OA aligns best with the pseudo-second-order kinetic model and adheres to the Langmuir isothermal model. The maximum adsorption capacity of this composite material was precisely determined as 249.09 mg/g. Additionally, we discovered that PANI@OA can be easily regenerated using a NaOH solution, making it highly reusable for removing Cr(VI) from water sources. These outcomes strongly suggest the practical feasibility of employing PANI@OA in wastewater treatment applications.

Keywords: Adsorption. Isotherm. Kinetics. Cr(VI) ions. Polyaniline. Biocomposite.

Heterostructures of plasmonic metal nanoparticles/LDH for p-nitrophenol degradation

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Abstract. Solar-to-chemical energy conversion by plasmon-driven photocatalysis is one of the sustainable approaches to counteract the negative impacts of pollutants on the environment and human health. In this study, we report the design, synthesis and photocatalytic applications of metal plasmon-layered double hydroxides hybrids obtained by the close junction of plasmonic metal nanoparticles (PNPs) and 2D layered double hydroxides (LDH) for p-nitrophenol degradation. The effect of PNPs particles (Ag, Cu and Co) on the photocatalysis performance have been investigated. The structural, morphological and optical properties of heterostructured plasmonic photocatalysts were studied using XRD, XPS, MEB, EDS and UV-Vis-DR spectroscopy analysis. The photocatalysis results showed that 90%, 46% and 35% of p-nitrophenol has been degraded within 60 min of irradiation time using AgZnAl, CoZnAl and CuZnAl catalysts respectively. These results should be inspiring for engineering heterostructures of plasmonic metal nanoparticles/LDH materials for environmental remediation applications.

***Keywords*:** Layered double hydroxide, photocatalysis, plasmonic metal nanoparticles, p-nitrophenol

Numerical analysis of thermocline thermal energy storage system

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Abstract: Packed bed of rocks represents a good alternative to two-tank molten-salt thermal energy storage system. The packed bed thermal energy storage system is a porous medium composed of a storage material traversed by the heat transfer fluid. It is ecofriendly, thanks to the use of air and natural rocks, and it is usable at high temperature. In addition, heat transfer between air and rocks is direct which eliminates the use of the heat exchanger. This work is devoted to study the thermal storage of solar energy in a packed bed of rocks ventilated by air. A two-phase transient numerical model has been developed and validated by experimental data taken from the literature. A good agreement is obtained between the numerical and experimental results. The numerical model is used to characterize and evaluate the themal behavior and the performance of rock bed thermal energy storage system.

Keywords: Solar energy, thermal energy storage, heat accumulator, thermal discharge, charge/discharge thermal cycles, thermal storage material, rocks, stored energy.

Comparing the evolution of ABS damage between the operational zone and the thermoforming zone

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Abstract: In this paper, our focus lies in examining the impact of temperature on the mechanical behaviour of ABS. This study is based on a series of uniaxial tensile tests conducted at various temperature levels using smooth test specimens.
In the literature, the behaviour of polymers is significantly influenced by temperature. It is crucial not to overlook its impact on the physical characteristics, especially when studying polymer behaviour, particularly in the examination of shaping processes that involve substantial heat input and mechanical effort. Therefore, the current study aims to compare the temperature effects on the thermo mechanical properties of ABS in two key zones: the operational zone and the thermoforming zone. This comparison is undertaken to predict the evolution of damage to ABS.

Keywords: ABS; Damage; Temperature; Thermo mechanical behaviour; tensile testing.

Politiques énergétiques dans le secteur agricole au Maroc et les opportunités d'efficacité énergétique.

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Introduction : Les politiques énergétiques au Maroc se focalisent plus précisément sur l'industrie, le transport et le résidentiel puisqu'ils sont les secteurs les plus énergivores avec 80% de la consommation totale au Maroc (AIE, 2019). Mais le secteur agricole présente un réel potentiel de l'amélioration de l'efficacité énergétique, d'après l'agence internationale de l'énergie, la consommation d'énergie finale du secteur agricole est de 53 PJ, soit 7.6% de la consommation d'énergie totale, et une variation de 375% depuis 1990. Un chiffre a augmenté avec les projets entrepris dans le cadre de « Génération Green ». Cette consommation finale ne prend pas en considération les pertes en amont de la transformation et de la distribution, d'où l'essor important de la demande en énergie du secteur.

D'autre part la mécanisation agricole a connu une réelle évolution avec le lancement de la stratégie du Plan Maroc Vert (PMV), en effet il a été recensé 5 tracteurs/ 1000 ha en 2009 contre 10 tracteurs/1000 ha en 2018 et ceux grâce aux subventions misent en œuvre pour l'acquisition du matériel agricole et qui s'élèvent à 4,5 milliards dh, soit 16% des aides cumulées du Fond de Développement Agricole (FDA) (MAPMDREF, 2018). La stratégie de la mécanisation a fixé l'indice de mécanisation agricole de 0,5 CV/ha à 1CV/ha à moyen terme et ce conformément aux standards internationaux (MAPMDREF). Toutes ces données constituent un surplus sur la demande énergétique agricole.

L'efficacité énergétique est un domaine qui a pris de l'importance au Maroc ces dernières années en raison de la croissance de la demande en énergie et de la nécessité de réduire la dépendance du pays aux énergies fossiles importées. Selon les estimations, l'efficacité énergétique pourrait représenter jusqu'à 30% des besoins en énergie du Maroc à l'horizon 2030 (MTEDD,2019).

Notre propos dans cet article est de capitaliser sur les efforts déployer en matière de l'efficacité énergétique dans le domaine agricole, et d'analyser les différentes politiques énergétiques afin de saisir les réelles opportunités d'économie d'énergie.

Cette analyse bibliographique va présenter une lecture critique des politiques et programmes étatiques marocains relatifs à l'efficacité énergétique dans le secteur agricole et ce à partir d'un inventaire du cadre législatif et organisationnel relatifs à l'efficacité énergétique au Maroc et ses programmes liés à l'agriculture, ensuite identifier les points de faiblesses et les critiques de la stratégie énergétique. Postérieurement caractériser le potentiel marocain en matière de l'efficacité énergétique pour finalement capitaliser les expériences enrichissantes de la France et de la Russie s'agissant de l'économie d'énergie.

Mots clés : Efficacité énergétique, politique énergétique, consommation énergétique, analyse critique.

Paper ID: 143

Comparative Analysis of TSR and Back stepping MPPT Methods in DFIG Wind Turbines: Efficiency and Dynamic Response Assessment.

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Abstract. This study presents a comprehensive analysis of two distinct Maximum Power Point Tracking (MPPT) methods–the Tip Speed Ratio and back stepping applied to a 7.5 kW Doubly Fed Induction Generator (DFIG)-based variable step wind turbine. Using MATLAB Simulink, the performance of each method is rigorously evaluated under varying wind conditions, with the aim of identifying the most efficient approach for optimal power extraction. The conventional TSR method, known for its simplicity and reliance on wind speed measurements, was compared with the Back stepping MPPT technique. The last approach, which integrates adaptive nonlinear control strategies, promises enhanced robustness against parameter variations and uncertainties inherent in wind power systems. The focus of this study is to assess the efficiency, response time, and stability of each method, as well as their adaptability to fluctuating wind profiles. By analysing and contrasting the simulation results with the existing literature, this study aims to provide valuable insights into the effectiveness of each MPPT technique, contributing to the optimization of energy extraction in wind power generation and aiding the selection of suitable MPPT methods for various operational conditions.

***Keywords*:** WECS, DFIG, MPPT, Adaptive Control.

Preparation and characterisation of a ceramic microfiltration membrane based on natural clay: Application to the pre-treatment of raw seawater for desalination by the reverse osmosis process

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Abstract: A low-cost porous ceramic membrane was developed by the spin coating method using raw clay. The corresponding support was prepared by the tape casting method using a mixture of raw clay and corn starch powder followed by sintering at 1050°C in a muffle furnace for 2 hours. The raw clay was characterised by a series of analytical and instrumental characterisation techniques (SEM-EDX, FTIR, DTA-TGA). In particular, the influence of the added starch content on support properties such as mass loss, shrinkage, porosity, mechanical strength, water absorption and density was examined. The ceramic membrane prepared has a homogeneous structure and improved pore distribution. The prepared membrane was applied to the pre-treatment of raw seawater for desalination, and demonstrated high retention of turbidity, suspended solids and total dissolved solids. The manufacturing cost of the developed membrane was estimated and analysed.

Keywords: Clay, Starch; Microfiltration membrane; Desalination.

Aide a la réhabilitation des sols via la symbiose

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Abstract: La gestion durable des sols fait partie des thématiques actuelles qui sont très importante à tenir en compte dans les stratégies de développement d'un environnement favorable pour une agriculture durable à faible intrants. Dans cette thématique s'inscrit notre projet de recherche et qui a pour finalité d'évaluer la fraction des symbiontes dans des sols marginaux tout en faisant face au problème de la pénurie de l'eau.
Une prospection de terrains dans la zone du Grand Agadir a été réalisée. Différents sites ont été ciblés et des analyses in-situ ont été effectuées (10 sites ont été retenus). Des échantillons de sols ont été ramenés au laboratoire pour subir des analyses détaillées concernant les caractéristiques structurales, physico-chimiques ainsi que la fraction biologique.
Les résultats indiquent une légèreté marquante du sol avec une texture généralement sableuse, la profondeur ne présente pas de grande variation. Le pH s'affiche entre neutre (7,5) à alcalin (8,1). La fraction minérale présente quelques variations et la teneur en matière organique est généralement faible.
La détermination des symbiontes a été évalué via l'utilisation de différentes plantes tests appartenant au genre : *Medicago sp.* (Communément connue sous le nom luzerne) et *Lupinus sp*. La première espèce a été prise comme témoin puisqu'elle est la plante la plus utilisée dans la région. La deuxième pour sa capacité à abriter un grand nombre de symbiontes déviant ainsi la spécificité plante-microorganisme rapporté en littérature. De plus, des tests de germination et des analyses microbiologiques des différentes semences ont été réalisées afin de garantir leur salubrité.
Les tests de germination réalisés en semi-direct dans une station expérimentale nous ont permis d'écarter une espèce de *Lupinus sp*. puisque la levée de dormance s'est avérée nulle. Les tests ont été reconduits au laboratoire pour la confirmation : 10% de germination, ce résultat a été le même pour les semences de deux années successives. Les analyses microbiologiques des autres plantes choisies n'ont indiqué la présence d'aucun agent pathogène (*Listeria*, *Salmonella*, *E-coli O157 :H7*) mais un nombre élevé de staphylocoques.
Le piégeage des symbiontes a été conduit en pots contenant les sols échantillonnés des différents sites amendés de 10% de tourbe avec quatre plantules par pot. Trois répétitions ont été réalisées pour chaque site. Les pots ont été ensuite placés sous les conditions de lumière et de température environnantes.
Vu la crise de l'eau que vit le pays, l'arrosage a été effectué avec de l'eau usée épurée provenant de la grande steppe d'Agadir. Cette eau a été préalablement analysée selon les exigences de la norme marocaine pour les eaux d'irrigation, et ce sur trois mois (qui coïncident avec la période de culture) et pendant deux années successives par des tests microbiologique et physico-chimiques dont principalement les nitrites, les nitrates et l'ion ammonium selon les normes NF T90-013, NF T90-012 et NF T90-015 respectivement.
Les analyses effectuées ont révélé qu'elles respectaient les seuils établis par la norme pour le contenu microbien ; les valeurs en matières azotés ont révélés des valeurs moyenne à élevés avec des variations.
Le piégeage a révélé des résultats positifs allant jusqu'à 73 % pour certains sites. Toutefois les nodules étaient très dispersés. Ce résultat indique la présence d'un potentiel de diversification en symbiontes assez important dans les sites ayant donné des résultats positifs de point de vue résistance et adaptation aux conditions environnementales.
Différents symbiontes ont été obtenus des extraits nodulaires, puis cultivés et purifiés. Ils doivent encore être testés pour évaluer leur capacité à croître sous différents stress abiotiques pris séparément pour pouvoir sélectionner les plus performants.
Mots-clés : Réhabilitation ; Sols marginaux ; Symbiontes; Eaux usées épurées; Stress environnemental.

Paper ID: 146

Exploring new hERG inhibitors using chemoinformatics and artificial intelligence from public datasets

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Abstract: The hERG (Human Ether-à-go-go-Related Gene) channel is crucial in cardiac repolarization. hERG inhibitors, which can cause life-threatening arrhythmias, often result from unintended side effects. This study uses a synergistic approach combining chemoinformatics and artificial intelligence (AI) to explore novel hERG inhibitors, leveraging public datasets.

To achieve this, we will curate and preprocess public databases containing hERG activity data and chemical structures. The aim of this project is to develop machine learning models capable of predicting hERG inhibition potential from molecular representations. We will use extensive feature engineering and model selection techniques to optimize the accuracy and interpretability of predictions.

The trained models will be used to virtually screen large chemical libraries, prioritising compounds with predicted hERG inhibitory activity for subsequent validation in vitro and in vivo. This work has the potential to accelerate the discovery of safer and more effective drugs by minimising hERG-related adverse effects. The integration of chemoinformatics and AI facilitates a data-driven approach to hERG safety assessment, ultimately contributing to the development of safer drugs across various therapeutic areas.

Keywords: hERG inhibitors, chemoinformatics, artificial intelligence, public data, cardiac arrhythmias.

Removal of cationic dye of Finishing and Dyeing Industrial Units by Transformed Textile Fiber Waste

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Abstract: Polyacrylonitrile Fibers (PANF) is the most polymeric material used for purification of wastewater produced in many industrial activities. It is a commercial and low-cost polymer material with high mechanical propriety and a large specific surface area. [1] Functionalized waste PANF were prepared through the reaction of PANF with a chelating agent to have an effective adsorbent for various organic dyes (anionic, cationic, and reactive dyes). [2,3]. In this work we investigated the efficiency of the synthesized material as an adsorbent for industrial organic dyes in aqueous solutions. The study was carried out by varying parameters such as pH, adsorbent mass, contact time, temperature, and initial concentration, and investigating their effect on removal efficiency and comparing obtained results with experience plan.
The results showed that these parameters strongly affect the removal efficiency, and that the optimization study is necessary to achieve the best possible removal efficiency. The results of the kinetic modelling prove that the adsorption rate is controlled by chemisorption which would involve forces and electron exchange between adsorbent and adsorbate. The findings underscored the profound influence of these parameters on removal efficiency, emphasizing the imperative nature of optimization studies to achieve the highest possible efficiency. The kinetic modeling results presented compelling evidence that the adsorption rate is predominantly governed by physisorption, implicating an electrostatic interaction between the adsorbent and the adsorbate. The conducted studies provide justification for characterizing the adsorption as monolayer and homogeneous. Notably, the maximum adsorption capacity, derived from the model equation, was determined to be 200 mg/g, highlighting the material's substantial potential in adsorptive applications.

Keywords: polyacrylonitrile fiber, textile, organic dyes, Industrial wastewater, adsorption

Integrated Valorisation of Organic Waste for Methane Production and Digestate Conversion into Biochar for Advanced Water Treatment in a Circular Green Energy Framework

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Abstract: Achieving zero waste through the efficient valorization of PBP organic waste presents an ongoing challenge, necessitating the exploration of cleaner methodologies. To address this challenge, a synergistic approach employing both anaerobic digestion (AD), a biological process, and adsorption, a physicochemical process, was adopted. The AD process facilitates the activation of biodegradable organic matter via microbial action, yielding a co-product known as digestate. This digestate, after chemical treatment with nitric acid and thermal activation at T = 500 °C, serves as the precursor for porous carbon characterized by a high specific surface area. The resultant activated carbon was employed in the treatment of wastewater containing dyes, effectively resolving issues related to solid−liquid separation in the adsorption process. Notably, the AD process demonstrated a substantial bio-methane potential (BMP), with an observed production of 15.04 L CH4 kg·SV−1 under optimal conditions of pH = 8 and an inoculum/substrate ratio of 3. Additionally, findings about the adsorption of methylene blue (MB) from water onto the activated carbon indicated a maximum adsorbed amount of 101.74 mg g−1. The experimental adsorption data exhibited excellent agreement with both pseudo-second order and Langmuir theoretical models. Furthermore, a thermodynamic analysis revealed that the adsorption process is characterized as endothermic and spontaneous. This integrated approach not only addresses the valorization of organic waste but also demonstrates the potential for generating bioenergy through AD while concurrently producing a valuable adsorbent for water treatment applications.

Keywords: Methane, Biogas, anaerobic digestion, porous carbon, adsorption

Paper ID: 149

Electrical Conductivity Characteristics near the Metal-Insulator Transition in the ^{70}Ge:Ga Metallic Sample at Low Temperatures

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Abstract. We investigated the electrical transport properties within sample 1 of the 70Ge: Ga system, characterized by an impurity concentration of $n=1.861\times10^{17}cm^{-3}$, in the absence of a magnetic field and within a temperature range of 0.53 to 0.017 K. Notably, the electrical behavior of sample 1 aligns with metallic properties. Our findings revealed an exponent p of 0.5 ($\sigma=\sigma(T=0)+mT^{p}$), consistent with the theories of weak localization (WL) in 3D and electron-electron interactions (EEI). Furthermore, our analysis positions sample 1 in proximity to the metal-insulator transition (MIT) on the metallic side.

Keywords**:** Electrical conductivity, ^{70}Ge:Ga Metallic sample, Low temperature**,** electron-electron interactions, weak localization

Paper ID: 150

Exchange couplings calculation in the Double Perovskite Material Sr_2CuIrO_6

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Abstract: This research gives a theoretical analysis of exchange couplings in double perovskite Sr_2CuIrO_6, using Monte Carlo simulation. The correlation between internal energy and magnetism at each site within the framework of the Ising model serves as the foundation for the numerical approach employed in this study. We have implemented a new parameter α and adopted the experimental Transition temperature reported beneath an external field of h = 0.1T in order to compute the exchange couplings. Along with the magnetization at each site, magnetic susceptibility, and specific heat, the internal energy from each magnetic arrangement has also been computed for this project. The exchange couplings that were obtained are $J_{Cu\text{-}Ir}$ = 2.40 meV, $J_{Cu\text{-}Cu}$ = -2.00 meV and $J_{Ir\text{-}Ir}$ = 0.365 meV.

Keywords: Double perovskite Sr_2CuIrO_6, Exchange coupling, Internal energy at each site, Magnetization at each site, Monte Carlo simulation.

Paper ID: 151

Evaluation of antimicrobial and cytotoxic activities of new thymol 1,2,3-triazoles derivatives.

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Abstract:. Thymol was used as a starting material for the synthetis of six new triazole derivatives by click chemistry using the copper catalyzed azide alkyne cycloaddition reaction. The evaluation of the biological effects of these new derivatives has made it possible to detect a certain anticancer potential, the results of the anticancer tests are in progress.

Key-words: thymol, triazole, antimicrobial, anticancer effect.

Paper ID: 152

Costal upwelling in the canary current system: variability and trends

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Abstract: The Moroccan Atlantic coast (36°N-21°N), located on Eastern Boundary Upwelling Ecosystems (EBUS) is influenced by the Canary Current, one of the four major upwelling generator currents with permanent activity. It is characterized by the presence of four upwelling areas whose activity is seasonal in the northern part and permanent in the southern part. This work examines the long-term climatological variability of the upwelling activity through the study of the variation of Hydrological parameters collected *in-situ* along the northern part of the Canary Current Large Marine Ecosystem (CCLME) over a period of 28 years (1994-2022). Three areas have been identified for this study, Cap Boujdour (25°30'N) Dakhla (23°30'N) and Cap Blanc (21'N). During this work, we used vertical distributions of temperature, salinity, oxygen and phosphate to a depth of 500 meters to detect mean upwelling activity during the four seasons. The results obtained confirm the permanent upwelling activity in the south Moroccan Atlantic coast. Cape Boujdour area is the most important active upwelling center of the Moroccan Atlantic coast. However, a strong upwelling activity was observed in summer, spring and winter seasons. While in autumn, the activity was very low and drifts south of Dakhla. In fact, hydrological parameters show that the Cap Blanc area is influenced by the South Atlantic Central Waters (SACW) which are deficient in oxygen, rich in nutrients and salinity below 36psu. This study can be considered as a trend reference of upwelling activity in this area.

Keywords: Upwelling, Canary Current, Moroccan Atlantic coast, Seasonal activity,

Paper ID: 153

Natural convection in a square porous enclosure filled with a nanofluidand and heated from the central parts of the bottom and left walls

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Abstract.: In the present work we investigate numerically natural convection induced in a nanofluid filling a square Darcy-Brinkman porous cavity, in the presence of a horizontal magnetic field. The cavity is heated with two segments located in the central parts of the left and bottom walls. The right wall is cooled with a constant temperature and the remaining surfaces of the cavity boundary are insulated. The effects of Brownian motion and thermophoresis are taken into account by using the Buongiorno model. A computational code based on the finite volume approach and SIMPLE algorithm is used to solve the governing equations. Numerical results are presented in terms of streamlines, isotherms, iso-concentrations and average Nusselt number for fixed Lewis number ($Le = 25$), Prandtl number ($Pr = 7$), buoyancy ratio, Nr, Brownian motion parameter, Nb, and thermophoresis parameter, Nt ($Nr = Nb = Nt = 0.1$). The dimensionless parameters varied in this study are the Rayleigh number ($10^3 \leq R_T \leq 10^6$), Darcy number ($10^{-5} \leq Da \leq 10^{-2}$) and Hartmann number($0 \leq Ha \leq 100$). It is found that an increase of R_T leads to an enhancement of heat transfer rate and an attenuation of the non-homogeneity of nanoparticles distribution in the cavity. An inverse tendency is observed when increasing the magnetic field intensity.

Keywords: Nanofluid, Porous medium, MHD Natural convection, Heat and mass transfer, Finite volume method.

Thermodynamics Assessment of a Binary System: Bridging Ab Initio Calculations and CALPHAD Modeling

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Abstract: This study employed the CALPHAD (CALculation of PHAse Diagrams) [1] method to model the thermodynamic properties of a binary system. Experimental and calculated data, including enthalpies of formation determined using density functional theory (DFT), served as input. The system was optimized by adjusting model parameters to accurately describe the Gibbs energies of various phases. Stoichiometric compounds were considered, and the excess Gibbs energy of the liquid phase was represented using Kaptay equations [2]. The calculated enthalpies of formation exhibited strong agreement with both values obtained using Win2K software and experimental data from the literature.

Keywords: CALPHAD , Win2K , PHAse Diagrams , enthalpies of formation .

Paper ID: 155

Improved Parameter Extraction Procedure for Silicon Carbide Power MOSFET Model

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Abstract: In this paper, an enhanced parameter extraction procedure for Silicon Carbide (SiC) power MOSFET model is presented. The improved parameter extraction method uses nonlinear optimization algorithm to find the optimal model parameters based on the measured I-V data points for the SiC power MOSFET device. A correct I-V model equations and good initial guess values of the model parameters are provided to algorithm in order to minimize the errors between the model and measured data. In addition, by providing good initial guesses the algorithm will give optimal solution avoiding convergence problem with reduced number of iterations. The nonlinear optimization program used in this work is Levenberg-Marquardt (LM) algorithm. The efficiency of the proposed extraction method is proved with the good agreements obtained between the model, datasheet and the measurement.

Keywords: Power device, SiC MOSFET model, Parameter extraction, Netlist, SPICE simulation, validation.

A new inorganic–organic composite coagulant: α-Costic acid, natural sesquiterpenoid plant from *Dittrichia viscosa*, as a modifier of polyaluminum chloride properties

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Abstract: In this work, α-costic acid (αCA), a natural sesquiterpenoid from *Dittrichia viscosa*, was grafted into polyaluminum chloride (PAC), forming a new eco-sustainable composite coagulant PAC-αCA with improved functionality. The α-costic acid fraction grafted into the PAC and the distribution of aluminum forms in the composite coagulant were evaluated for their effectiveness in removing bentonite and humic acid from synthetic water.

By monitoring the aluminum speciation in the composite coagulant PAC-αCA, it was discovered that the introduction of α-CA impacted the distribution of various aluminum forms, including mononuclear Ala, highly polymeric Alb, colloidal, and medium polymeric Alc. Furthermore, coagulation performance tests demonstrated that increasing the percentage of α-CA and promoting the prevalence of Alb and Alc species over Ala species in PAC-αCA led to improved removal of turbidity and UV254. This study provides an attractive and practical option for water treatment plants to remove colloidal suspensions in raw water effectively.

Keywords: α-Costic acid, *Dittrichia viscosa,* Composite coagulant, Polyaluminium chloride (PAC), Ferron method, Water treatment

Enhancing the catalytic characteristics of titanium dioxide through anionic doping: Application to Methylene blue removal

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Abstract: The challenge of removing pollutants, such as dyes, from contaminated water is highly intricate due to the diverse structures and varied chemical properties of multiple compounds involved. Among unconventional water treatment methods, heterogeneous photocatalysis stands out, relying on the generation of $OH_{\circ}$ radical active species responsible for breaking down organic pollutants. Titanium dioxide (TiO_2) has been identified as a highly efficient and promising photocatalyst. Using artificial light for large-scale wastewater treatment can incur significant costs, necessitating the utilization of natural light, such as solar energy. Solar photocatalysis, harnessing abundant and renewable solar energy, presents economic and environmental advantages. Previous studies have demonstrated the effectiveness of sunlight in solar photocatalysis; however, the catalyst must also be active in the visible spectrum. Therefore, doping TiO_2 becomes crucial to extend its activity into this range.

The primary aim of this study is to enhance the efficiency of TiO_2 in degrading Methylene blue through anion doping. Multiple doping protocols involving fluoride ions were employed, and the results indicate an enhancement in the elimination rate through the substitution of fluoride ions conducted to a satisfactory degradation rate over 95% in 2 hours of irradiation.

Keywords: Photocatalysis, Titanium dioxide, Anionic doping, Methylene blue

Photocatalytic degradation of dye by solar irradiation in dynamic photoreactor

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Abstract: Organic contaminants are widespread in the environment through activities linked to the production of textile industry. Moreover, these contaminants are currently the focus of particular attention. The identification of eco-compatible chemical reactions leading to the efficient degradation of these organic contaminants and their by-products represents a major environmental challenge for the preservation of the quality of natural environments. To meet these challenges, we are working to identify new mechanisms capable of degrading a wide range of organic pollutants, without strong oxidants, under physico-chemical conditions compatible with natural environments. Heterogeneous photocatalysis on titanium dioxide, which is part of the advanced oxidation techniques. This technique offers the possibility of mineralization of toxic organic molecules by the formation of hydroxyl radicals.

Our work focuses on the design and use of a pilot solar tubular photoreactor for the degradation of Violet 16 dye, chosen as a model pollutant. The catalyst used is PC500 TiO_2 supported on cellulosic paper fibers. The tubular photoreactor used in this study was a laboratory-made and has been realized with Plexiglass tubes (inner diameter, 18 mm). The influence of some experimental parameters on the degradation of Violet 16 has been studied, such as flow rate, initial concentration of the dye, the mass of TiO_2, and pH variation. The results obtained showed that a low flow rate of more than 96.6% of the pollutant disappeared for 0.5 L/min. A better elimination was obtained in low initial concentration (5 mg/L) for 540 min irradiation time and at basic pH. The 0.5 g/L TiO_2 dose gives similar results for 1 g/L, 96.6% and 98%, respectively. The kinetic study of the photodegradation of Violet 16 dye shows that the reaction mechanism seems to follow the model of Langmuir-Hinshelwood ($R^2 > 0.97$).

Keywords: Photocatalysis, Titanium dioxide, Dynamic solar photoreactor,

Paper ID: 160

Simultaneous Removal of Inorganic Pollutants from Moroccan Brackish Groundwater by Electrocoagulation Process: Optimization and cost evaluation, and Sustainable Pretreatment

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Abstract: Groundwater contamination by inorganic pollutants such as fluoride has emerged as one of the most pressing public health issues in many countries of the world since it is used as the prime source of drinking water. Therefore, a batch Electrochemical reactor using aluminum electrodes (Al-EC) was investigated as a pretreatment of real brackish groundwater to mitigate the concentrations of fluoride (F^-), silicate (SiO_2^{3-}), and total hardness (HD) to acceptable levels and reducing the possibility of scaling due to silica and hardness[1]. Indeed, this study was carried out to examine the combined impacts of ions on removal efficiency. A five-factor central composite experimental design (CCD) with an electrolysis time of 40 minutes was used to study the individual and combined effects of several operational parameters such as current density (A: 3-10 mA.cm^{-2}), pH (B: 6.5-8.5), salinity (C: 2-10 g.L^{-1}), fluoride (D: 3-10 mg.L^{-1}) and hydrated silica (E: 20-100 mg.L^{-1}) on desired responses. The specified responses were the removal efficiency of fluoride (R_{F^-}), hydrated silica (R_S), and total hardness (R_{HD}), as well as energy consumption (ENC). The optimal operating parameters predicted by CCD were determined to be A: 10 mA.cm^{-2}, B: 8, C: 10 g.L^{-1}, D: 6.5 mg.L^{-1}, and E: 60 mg.L^{-1}, with the highest inorganic pollutant removal efficiency and lowest energy consumption. The experimental values of R_{F^-}, R_S, R_{HD}, and ENC under these operating conditions were 84%, 99%, 33%, and 0.665 kWh.m^{-3}, respectively. The final concentration of fluoride is below the drinking water limit established by the World Health Organization (WHO) and Moroccan regulations. Furthermore, a quadratic regression model was used for mathematical modeling, and response surface analysis was employed to determine the link between independent factors and responses. The simultaneous adsorption of fluoride and silicate onto electrochemically generated hydroxides and metal oxide complexes was found to follow a pseudo-second-order adsorption model[2]. EDS, XRD, and FTIR analysis of the flocs revealed that the coagulant combines with silica to produce aluminum silicates, and fluoride substitutes a hydroxyl group in the flocs. Ultimately, electrocoagulation emerged as an economically viable and sustainable pretreatment method for brackish groundwater.

Keywords: Brackish groundwater; Electrocoagulation process; Inorganic pollutants removal; Pretreatment; Optimization; Removal mechanism.

Paper ID: 161

Advancing Solar Power Prediction of p-Si Panel By Considering Temperature and Solar Irradiance Fluctuations

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Abstract. This research presents a benchmarking model of an p-Si solar panel, with the aim of improving the accuracy of solar energy production prediction under variable environmental conditions. Understanding the impact of temperature and solar irradiance fluctuations on photovoltaic (PV) performance is crucial for efficient energy production and grid integration. This article uses a comparative analysis between the simulated and the experimental curve, to understand the interaction between temperature, solar irradiation, and solar panel power output. Furthermore, by taking these factors into consideration in the model, we aim to provide a more accurate long-term prediction of solar power production. The results of this study are expected to contribute significantly to the improvement of solar energy forecasting models, helping energy planners, grid operators and system integrators to optimize the deployment and operation of solar energy systems.

***Keywords*:** Solar panel, power prediction, modelization. Simulation.

Structural and optical properties of Dy and Li co-doped SnO_2 nanoparticles prepared via co-precipitation approach

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Abstract: Tin oxide (SnO_2) is an n-type transparent conductive oxide (TCO) widely used in energy conversion in photovoltaic cells. These mainly electrical and optical properties are usually enhanced by doping with transition metal or rare earth elements. The aim of this work is to prepare nanoparticles in the form of undoped SnO_2 powder and co-doped SnO_2 with Dysporsium (Dy) and Lithium (Li). This rare earth and alkali metal couple can be used for the improvement of photonic conversion in photovoltaic cells. The synthesis of tin oxide (SnO_2), co-doped with (Dy, Li) is prepared by a simple co-precipitation method at room temperature. The characterization of the nano-powders is performed by XRD, FTIR, and UV-Vis, the grain size and microstrain are studied by Williamson-Hall and Debeye-Scherrer formulas. All samples show a tetragonal rutile structure of polycrystalline SnO_2, the presence of a band at 690 cm^{-1} in the FTIR spectrum confirms the existence of the O-Sn-O bond; the crystal size of the studied samples varies from (9.4 nm – 53 nm) [1,2].

Keywords: SnO_2 nanoparticles, co-precipitation, semiconductor, structural properties, Rare earth, photovoltaic cell.

Paper ID: 163

Thermodynamic evaluation of the Cadmium-Cerium systems

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Abstract: The thermodynamic modeling of the Cadmium-Cerium (Cd-Ce) system was carried out with the help of CALculation of PHAse Diagram (CALPHAD) method [1] . The solution phases (liquid, FCC_A3 (γ-Ce), BCC_A2 (δ-Ce) and HCP_A3 (Cd)) were described by the sublattice formalism and the excess term of the Gibbs energy with the Redlich-Kister equation. The stoichiometric intermetallic compounds(Cd_3Ce, Cd_6Ce and $Cd_{17}Ce_2$) were modeled as line compounds. The non-stoichiometric CdCe, Cd_2Ce and $Cd_{58}Ce_{13}$ phases which have homogeneity ranges, were treated using a two-Sublattice model. A consistent set of the thermodynamic parameters leading to a reasonable agreement betweenthe calculated results and literature data was obtained.

Keywords: Cd-Ce system. CALPHAD method and Thermodynamic evaluations.

Comparative study of the integration of glazed and unglazed PV/T collectors in domestic application

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Abstract. This paper presents a numerical study to evaluate the effectiveness of the integration of the PV/T collector in domestic application for Moroccan subtropical climate. The solar system is designed to produce the electrical power and hot water for a single family in Agadir subtropical climate. To simulate the solar system, mathematical model based on thermal balance equations is developed. Two configurations of the solar collector are examined, hybrid collector with glass cover and another collector without glass. The numerical model is tested by comparing the present results with the literature experimental data. The obtained results show that, the glazed PV/T system provides higher thermal performances than unglazed collector. However, this later is electrically efficient. The daily thermal energies provided by both glazed and unglazed collectors are 4.37kWh and 3.14kWh respectively. Furthermore, the electrical powers are 1.28kWh and 1.34kWh respectively. The water temperature in tank achieves 46.11°C for glazed system and 38.6°C for uncovered collector.

***Keywords*:** Energy, Electrical, Thermal, PV/T collector.

Use of austrocylindropuntia subulata plant as a bio-coagulant flocculant for the treatment of clay-laden wastewater

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Abstract: Due to the drought problems that affect many countries around the world, the use of natural plants to produce bio-coagulants and flocculants for wastewater treatment is receiving increasing attention. A simple centrifugation process was used to produce a liquid bio coagulant from the plant of austrocylindropuntia subulata. The centrifugation process was optimized to determine the optimal speed and time parameters that allow for obtaining a clearer juice and less chlorophyll rich, the optimal speed was 9000 rpm. A mass balance study was performed to identify mass losses caused by centrifugation. The use of a bio coagulant flocculant in the treatment of clay-laden wastewater resulted in a 95% reduction in turbidity. Bioproducts for water treatment can be produced by the austrocylindropuntia subulata plant due to its active composition.

Keywords: flocculant ; bio coagulant ; Austrocylindropuntia subulata ; wastewater treatment

Low-Temperature Electrical Conduction in the 70Ge: Ga Semiconductor

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Abstract. The electrical conductivity in the three-dimensional system ^{70}Ge: Ga was analyzed on the both sides of the metal-insulator transition (MIT), at very low temperatures and in the presence of magnetic field. On the insulating side of the MIT and when K_BT is below the Coulomb gap, the electrical conduction is governed by variable range hopping (VRH) of Efros-Shklovskii (ES) in $T^{-0.5}$ $T^{-1/2}$. This behavior indicates that the Coulomb interactions reduce the density of states (DOS) in the vicinity of the level of Fermi EF by opening a pseudo gap Coulomb (CG) parabolic near of EF. When the temperature increased, the electrical transport is described by Mott VRH in $T^{-0.25}$ confirming that the DOS becomes almost constant in the vicinity of the Fermi level and that the electron-electron interactions are null which justifies the disappearance of the CG. In the system ^{70}Ge Ga, the electrical conductivity follows the law of the VRH Mott for samples which are located near the insulating side MIT of the latter. On the contrary, the electrical conductivity obeys the law VRH ES for the samples which are located far from the MIT. On the metallic side of MIT, we focused our study on metal systems^{70}Ge : Ga. We verified that the temperature dependence of the conductivity follows the law $\sigma(T) = \sigma_0+mT^{1/2}$. This result is predicted with the 3D weak localization (WL) and electron electron (EEI) theories. In the metal system 70Ge: Ga, the passage from the law in $T^{1/2}$ to the law in $T^{1/3}$($\sigma (T) = \sigma_0 + mT^{1/3}$) when one approaches the MIT is explained by the competition between the two length scales: the interaction length and the correlation length.

***Keywords*:**^{70}Ge:Gasemiconductor, Electrical conductivity, Variable range hopping, low temperature, metal-insulator transition, transport properties, impurity concentration, Density of state, Coulomb gap, Weak localization, Electron-electron interaction.

Paper ID: 169

Behavior of new citrus hybrid rootstocks to drought stress in greenhouse conditions

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Abstract: Citrus, a major fruit crop in the Mediterranean region, is significantly impacted by the continuous climate change that is defined by regular and severe droughts as well as regular rainfall, which has an adverse effect on plant physiology, morphology, and growth. Grafting is a technique for enhancing varietal traits. In this study, we examined the effects on three-month-old seedlings of six citrus hybrid rootstocks under three different water regimes (control, moderate drought, and severe drought), which are, respectively, 100%, 75%, and 50% ET_0. Proline, soluble sugar, chlorophyll content, growth rates, fresh and dry weight, and relative water content were all assessed. Water stress impacted all citrus rootstock seedlings. As the stress level increased, all growth parameters fell. H1 seedlings were the least affected, followed by H2 seedlings, and H3 seedlings were the most affected, according to growth indicators. H4 seedlings accumulated the maximum amount of proline, whereas H6 seedlings accumulated less. The amount of chlorophyll and stomatal conductance decreases as drought stress increases. Overall, H1 rootstock was more resilient to drought stress, but H3 appeared to be a hybrid rootstock that was more susceptible. The relative vulnerability of citrus species to drought should be taken into consideration for plant breeding initiatives, and growth of drought-tolerant citrus rootstocks should be promoted in dry and semi-arid areas for greater productivity

Keywords: citrus, hybrid rootstock, drought, water stress

Comparison of physicochemical characteristics, phytochemical composition of two oils extracted from Jihel date kernel (Phoenix dactylifera L.) Varieties cultivated in Zagora

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Abstract: The purpose of this study is to analyze and characterize the chemical composition of two distinct vegetable oils obtained from the kernels of Jihel date palms grown in the Zagora province of South East Morocco. The date pits are subjected to drying and grinding, and the resulting powder is extracted with hexane using two different methods: decoction and soxhlet extraction. The yields obtained were 8.03% and 10.75%, respectively. The analysis of the oils using GC-MS revealed that oleic acid (44.90-44.99%) constituted the most prevalent fatty acid, succeeded by lauric acid (19.43-20.18%). Saturated fatty acids accounted for 46.60-48.01% of the total content of fatty acids, while unsaturated fatty acids represented 51.59-52.61%. The overall sterol content in the oils obtained by soxhlet and decoction was 3589 and 3560 mg/kg of oil, respectively. In both oils β-sitosterol was the primary sterol, accounting for 64.3% and 63.9% of the total amount of sterol in the decoction and soxhlet-extracted oils, respectively. γ-tocopherol was the main constituent, with a range of 52.99-57.32%. These findings imply that our date kernel oil may find use as a functional food formulations or cosmetic ingredient.

Keywords: date palms, soxhlet extraction, unsaturated fatty acids, β-sitosterol, γ-tocopherol.

A Modified NRTL Equation for Modeling of Liquid – Liquid Equilibrium: Application to System phosphoric acid – Methyl isobutyl ketone (MIBK) – water at 298.15, 308.15 and 318.15 K

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Abstract: Experimental liquid-liquid equilibrium (LLE) data for a ternary system containing phosphoric acid, water and Methyl isobutyl ketone (MIBK) were determined at temperatures 298.15, 308.15, and 318.15 K under atmospheric pressure, respectively. The measured solubility data were obtained by cloud-point titration method. Tie line measurements were carried out by NaOH titration and the Karl–Fischer techniques. The experimental value of plait point was obtained by using the graphical method based on the Hand correlation and the solubility data. To obtain a good representation of liquid-liquid equilibrium near to and far from the plait point, a modified NRTL model was used to express the activity coefficient. To regress the binary interaction parameters using the particle swarm optimization (PSO) method in the mathematical software “MATLAB”. To validate a coherence of the optimized parameters, a Graphical User Interface (GUI) v.2.0 tool was used to check the model parameters [1].

Keywords: Phosphoric acid, Liquid –liquid equilibrium data, Methyl isobutyl ketone, modified NRTL model.

Paper ID: **173**

Biodegradation of textile dyes by *Trametes versicolor* laccase cross-linked on layered doubled hydroxide-biopolymer composite beads

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Abstract. Laccase is an oxido-reductase known for its applications in biomass valorization (lignin depolymerization), fine chemicals (building-blocks synthesis) or the environment (wastewater treatment). It works with molecular oxygen and produces water as its only by-product. However, its practical application is far from satisfactory due to the low stability and poor reuse of free laccase. To overcome these challenges, a laccase from *Trametes versicolor* was immobilized onto layered double hydroxide and biopolymer composite beads. The activity of the immobilized biocatalyst was measured with ABTS model substrate and pollutants dyes. The effects of laccase concentration, pH, storage stability and thermal resistance of the samples were also studied. Immobilized laccase showed high efficiency in removing diazo dyes. In conclusion, these results suggest the use of immobilized laccase on LDH-biopolymer composite beads as a promising and environmentally friendly tool for the degradation of environmental pollutants, in particular for the removal of diazo dyes from wastewater.

***Keywords*:** Laccase, immobilization, LDH, biopolymer, environmental application, wastewater

Computational study of a double perovskite rich in sodium as electrolyte for solid-state sodium batteries

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Abstract: For next-generation energy storage, solid-state batteries have shown great promise due to their high energy density, increased longevity, increased safety, and expanded operating temperature range. In this work, a double perovskite type $A_2BB'O_6$ has been studied as electrolyte for solid-state sodium batteries because of its great specific capacity and stable cycle performance. The structural and electronic properties have been investigated through first principles calculations using the full potential linearized augmented plane waves (*FP-LAPW*) approach. The results of the electronic density of states and the band structure reveal that this material has a direct band gap semiconductor, and the calculation of the voltage suggests that this material has the potential to serve as a favorable option for a solid electrolyte in sodium batteries.

Keywords: First-principles calculations, Band gap, Electronic properties, Sodium-ion batteries

Optimized immobilization of *Trametes Versicolor* laccase on LDH-alginate composite beads

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Abstract: One of the most important aims of enzyme technology is to enhance the stability and reusability of enzymes through immobilization processes. This work explores the optimized immobilization of *Trametes Versicolor* laccase on composite beads composed of layered double hydroxide (LDH) and alginate. The immobilization process was systematically optimized to enhance the catalytic efficiency and stability of the enzyme. The study investigates the influence of optimal conditions such as enzyme concentration, LDH-alginate ratio, and immobilization time on the overall performance of the resulting biocatalyst. Characterization of the immobilized laccase includes assessments of activity, stability, and structural changes. The findings underscore the significance of the immobilization strategy in improving enzyme properties, offering insights for the development of efficient and stable biocatalysts with potential applications in various industrial and environmental processes

Keywords: Laccase, Immobilization, Stability, Reusability, environmental application**.**

Paper ID: 178

Improved boron rejection using electrocoagulation as a pretreatment of SWRO desalination lines: Unveiling performance, removal mechanism, and cost-energy evaluation.

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Abstract: This study aimed to evaluate the applicability of the electrocoagulation process as a pretreatment for boron mitigation before seawater desalination through reverse osmosis. Experiments were conducted to investigate several operational parameters on the boron removal from synthetic and real seawater, including current density, electrolysis time, aluminum dissolution, initial pH, initial boron concentration, and the presence of other ions. Increasing the current intensity initially accelerates the dissolution of aluminum and the adsorption of boron, but beyond a certain point it leads to the rapid formation of large particles of ineffective aluminum hydroxide with a reduced capacity to adsorb boron. Generally, boron is best removed (72%) at a current density of 16.67 $mA.cm^{-2}$, electrolysis time of 90 min, pHi 8, and initial boron content of 5 $mg.L^{-1}$. Nevertheless, the real application to seawater has been challenging due to the complexity of the matrix and competitive adsorption with ions like magnesium, resulting in lower deboronation rates. Regarding EDS, XRD, and FTIR analysis, it confirmed the reduced content of boron in solid samples from synthetic seawater at 20 $mA.cm^{-2}$ compared to 16.67 $mA.cm^{-2}$, indicating the formation of less efficient crystalline boehmite. Kinetic studies demonstrated adherence to Lagergren's pseudo-first-order mechanism and the adequacy of the intraparticle diffusion model, suggesting the transport of boron molecules from the aqueous phase to the $Al(OH)_3$ surface, and then diffused into the pores. Finally, electrocoagulation is cost-effective for targeted boron removal but faces challenges in seawater deboronation.

Keywords: Seawater; Boron removal; Electrocoagulation process; Performance analysis; Kinetics modeling; Cost-energy analysis.

Paper ID: 180

Study and optimization of the solar sludge drying process

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Abstract: The increasing global population and industrial activities have led to a rise in wastewater generation, making the management of sludge generated during wastewater treatment a pressing issue. Traditional disposal methods are deemed unsustainable due to environmental concerns and resource depletion. Solar energy has emerged as a promising and sustainable solution for drying wastewater sludge, offering cost-effectiveness and reduced environmental impact.
Solar drying of wastewater sludge offers a promising and sustainable solution for its management [1], as it utilizes sunlight and ambient air to evaporate water from the sludge, resulting in volume reduction and solid residue formation. Factors such as sludge layer thickness, drying bed surface area, temperature, airflow, and composition of the sludge itself should be carefully considered to achieve efficient solar drying.

Keywords: Solar dryer, Sludge management, Numerical simulation, Heat transfer, Mass transfer, Climatic conditions.

Removal of methylene blue dye through adsorption using a powder derived from mussel shells: characterization and valorisation

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Abstract: Mussel shells, abundant in Morocco, have gained attention for their diverse applications. These natural byproducts are rich in calcium carbonate and exhibit potential for various purposes, including environmental solutions like wastewater treatment. This research contributes to the search for an efficient and cost-effective adsorbent, serving as an alternative to activated carbon. We focused on an abundant natural material: powder derived from mussel shells. The material's effectiveness was tested using an organic dye, methylene blue (MB). The powder obtained was characterized by performing the following analyses, namely TGA-DTG, SEM, DRX, and FT-IR. Various parameters influencing adsorption (contact time, adsorbent mass, initial concentration, agitation speed, and particle size) were studied. Isotherm analysis revealed that the Langmuir model best describes MB adsorption on the mussel shell powder (MS), with kinetic results better fitting the pseudo-second-order model. A 2^5 full factorial design was then applied to the adsorption process to assess the impact of factors and their interactions on dye removal. This study provides insights into the potential of mussel shell-derived powder as an effective and economical adsorbent, paving the way for scaling up the adsorption process and exploring its application in real-world wastewater treatment scenarios.

***Keywords**:* Mussel shells, adsorption, methylene blue, TGA-DTG, SEM, DRX.

Study of the effect of micro arc oxidation on metallic biomaterials based on the alloy of Ti and Mg

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Abstract: MAO micro arc oxidation surface treatment, also called PEO plasma electrolytic oxidation, is a unique electrolytic surface conversion process that produces highly protective ceramic (metal oxide) layers designed for specific applications where anodizing usual is insufficient[1]. This ecological and antibacterial process becomes a new choice in the field of metallic biomaterials due to the characteristics it offers. MAO coatings are bioinert and biocompatible and improve the osseointegration of orthopedic and dental implants, thanks to the porosity of the oxide layer, which facilitates the integration of bone cells[2].

In this study, we will treat by MAO the surface of titanium (Ti6Al4V) and magnesium (AZ31) alloys, used in the manufacture of endosseous implants, using alkaline electrolytes based on silicate and phosphate ions. and acetates.

The bath is charged with a high voltage of approximately 200 V, which generates a high temperature, causing a plasma discharge, which initiates oxidation of the metal surface. A comparative study of the corrosion resistance of MAO-coated alloys is to be carried out in artificial physiological solutions based on NaCl, $CaCl_2$ and NaH_2PO_4.

Keywords: plasma electrolytic oxidation, metallic biomaterial, surface treatment, implants, anti-corrosion resistance, ecological process.

Paper ID: 184

Response Surface Methodological Approach to Flotation Optimization of Iron Oxide-Copper Ore

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Abstract: In this study, batch flotation tests were conducted to investigate the flotation of oxidized copper ore from the Anti Atlass deposit. Utilizing the Response Surface Methodology (RSM), the effects of parameters-such as collector dosage, sulphidizing agent, copper oxide and iron oxide grades, and particle size-on copper recovery were explored. ANOVA and 3D response surface plots elucidated the complex behavior of copper flotation. Mineralogical analyses of the initial feed and post-flotation tails were performed on an industrial scale using Zeiss microscopy. The quadratic model, with R^2 of 94%, effectively captured the impacts of various process parameters on copper recovery. Notably, the sulfidizing agent displayed the most influential quadratic effect, while the copper oxide grade exerted the most pronounced linear impact on recovery. An essential observation highlighted the correlation between copper losses in tailings and specific iron oxide-copper associations. Through optimization efforts, conditions were identified that led to a maximum copper recovery rate of 71%. Upon industrial validation, the model exhibited strong applicability for similar mineral processing scenarios. The mineralogical insights derived from this study not only deepen our understanding of the Anti Atlass deposit but also provide a robust foundation for subsequent comprehensive mineral processing investigations

Keywords: Iron oxide-copper association, Box-Behnken Design, flotation, mineralogy, Response Surface Methodology, copper recovery

Effect and thermal impact of ecological composite materials on the envelope of building

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Abstract: The increasing demand for energy in the building sector is considered a major problem as it leads to both energy shortages and environmental impacts such as climate change and global warming. This demand is constantly increasing due to the high needs in thermal comfort.
The objective of this work is to present a passive approach to reduce the energy demand of a building by improving the composition of its envelope. For this purpose, the choice of the composition of the walls and roofs has been chosen taking into account the location of the site and its climatic zone while respecting the thermal transmittance coefficients of each zone. Two proposals of envelope composites were given: (plaster-cork and cement coating) and (clay-cork) based on the Moroccan climatic zones: Zone 1 (Agadir) and Zone 4 (Ifrane). A simulation of a room at the scale of a 12m2 room by the software COMSOL Multiphysics, was carried out for a dynamic thermal analysis, annual results were presented for all envelope configurations of the room to conclude on the best choice of composite walls and roof and its impact on the energy efficiency of this building.

KEYWORDS Passive approach, Thermal comfort, Building envelope, Energy efficiency, Transmission coefficient

Photo-Fenton degradation of textile dyes using muscovite mica combined with Fe3O4 nanoparticles

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Abstract: The discharge of untreated wastewater containing pollutants into the natural environment has become a significant and concerning problem, primarily due to its adverse effects on both the environment and public health. This concern is particularly heightened when the pollutants involved are non-biodegradable or non-toxic, exemplified by heavy metals and dyes. The treatment of dyes, especially in the context of wastewater treatment and environmental remediation, involves crucial processes such as adsorption and degradation. This study focused on utilizing a combination of muscovite mica and Fe3O4 nanoparticles to create a novel bio-composite known as Fe3O4@Mus. Comprehensive characterization of Fe3O4@Mus was carried out employing various techniques, including XRD, FTIR, SEM, EDX, XRF, and PZC. The assessment of this composite aimed to evaluate its effectiveness in both adsorption and degradation processes for removing textile dyes. The composite's degradation performance was assessed through a photocatalytic process activated by sunlight. Consequently, the composite exhibited remarkable efficacy in breaking down AB113 dye, with over 95% degradation achieved within 90 minutes under conditions of 2 mL H2O2, an initial AB113 concentration of 40 mg/L, and a catalyst quantity of 0.25 g/L. The degradation data were well-fitted by the first-order kinetic model ($R2 > 0.96$). The degradation of AB113 was primarily linked to the generation of hydroxyl (OH.) radicals, facilitated by the catalytic decomposition of H2O2 using the Fe3O4@Mus composite. Fe3O4@Mus is a promising photo-Fenton catalyst.

Keywords: Photo-Fenton, catalyst,dye, Clay, Fe_3O_4.

Paper ID: 190

Vector control of an asynchronous motor through flux orientation

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Abstract. In the context of this study, our focus has been on the in-depth analysis of performance related to speed and torque regulation, in conjunction with rotor flux orientation within an asynchronous motor. We present in detail an innovative control scheme applied to an asynchronous motor, powered by a Pulse Width Modulation (PWM) inverter. This control strategy relies on two independent Proportional-Integral (PI) controllers, each responsible for regulating the rotor flux and motor speed, respectively. The outputs of these controllers are directly involved in selecting the components of the voltage vector through vector modulation. Results from numerical simulations convincingly demonstrate the effectiveness of this innovative control method, highlighting its optimal performance in asynchronous motor regulation.

***Keywords*:** Asynchronous motor, Modeling, Simulation.

Parameter optimization of cationic dye adsorption on natural clay based on central composite design, desirability function, and artificial neural network

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Abstract: The presence of synthetic dyes in water causes serious environmental issues due to the poor water quality, toxicity to the environment and human carcinogenic effects. Adsorption has evolved into an affordable and practical technology for the purification of colored effluent. Clay minerals offer an intriguing substitute for eliminating colorants from colored aqueous solutions. Because they are affordable, simple to extract and handle, and non-toxic. In the present study applies a systematic procedure for the parameter optimization of Cationic dye Adsorption by Muscovite-Kaolinite clay. The adsorbent was characterized by X-ray Diffraction (XRD), pH value at the zero-charge point (PZC), Fourier Transform Infrared Spectroscopy (FTIR), X-ray fluorescence (FX), and Scanning Electron Microscopy coupled with an Energy Dispersive X-rays Spectroscopy elemental compositions analyzer (SEM- EDXS). The principal minerals found in the studied clay are muscovite, kaolinite, and quartz. Possible parameters experimental conditions such as adsorbent's dose, time, adsorbate concentrations, pH, and temperature has been investigated, in order to understand the adsorption behavior of the dye molecules onto Kaolinite clay. The central composite design of response surface methodology (CCD-RSM) was used for adsorption modeling and optimization. Variance analysis, response surfaces, iso response curves, and desirability function show that the model is a good predictor, and the optimal parameters for maximum response are estimated as 25.9 mg of adsorbent dose, 51 mg/mL of initial concentration, 25°C of temperature, pH 7.99, and a contact time of 31.48 min. An artificial neural network (ANN) training set was also created using the exact same architecture. The optimized ANN model with 3 neurons in the hidden layer shows a strong positive correlation between experimental and predicted values. The CDD-RSM and ANN (3) models were available with correlation coefficients of 0.9719 and 0.9859, respectively. Further, ANN(3) is the best predictive model, according to the error analysis.

Keywords: kaolinite, Muscovite, adsorption, optimization, CCD-RSM, ANN.

Study of a neutral micro emulsion solution by dynamic light diffusion

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Abstract. The quasi-elastic scattering of light allows access to the dynamics of the thermal fluctuation of the concentration and to probe the number of relaxation modes in a colloidal solution. In the case of dilute system, the measurement of the self-scattering coefficient allows us to have information on the size of colloidal particles using the Einstein stock relationship. In this paper, we studied the dilute neutral system is formed of Triton X100 as active voltage, octanol as active voltage and water as solvent. Then we studied the dynamics of the solutions by using the Dynamic Light Scattering (DLS) technique. For the neutral system, in a dilute regime, we obtained the value of the diffusion coefficient and the hydrodynamic radius, for the diluted micro emulsion, the results showed the presence of a single mode of relaxation associated with concentration fluctuations. We deduced the values of and hydrodynamic radius.

***Keywords*:** Diffusion coefficient, self-scattering coefficient, Dynamic Light Scattering

Paper ID: 193

Valorisation of rainwater by monitoring the growth irrigated cultivation and hygienic quality of the crop produced

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Abstract: Irrigated agriculture, the sector that consumes the most water, today faces an urgent need to conserve it, or even limit it in the face of water scarcity and soil degradation. The global food crisis has led to violence in some countries, raising expectations for irrigated agriculture. In Morocco, the depletion of water resources and soil degradation are notable. The quality of these resources remains a growing concern for the national and international community. In addition, starchy foods occupy an important place in food systems agriculture, and play an important role in the development of the agricultural economy of many countries of the world because of the area they occupy.

The present work focused on valuing rainwater collected in the Faculty of Science Dhar El Mahraz (FSDM) of fez city, as well as monitoring the growth of irrigated cultivation and analyzing the hygiene status of the crop produced. The radish was chosen for irrigated cultivation.

To reach our objectives, we conducted physicochemical (pH, conductivity, orthophosphates, nitrates, etc.) and bacteriological analyses of the rainwater collected. To conduct microbiological analysis, we performed a membrane filtration count of faecal coliforms, as well as a search for *Salmonella* and *Vibrio cholera.* For monitoring the growth of radish, we measured vegetative growth parameters such as number of leaves per branch. To analyze the hygiene status of the crop produced, we counted total aerobic mesophilic flora, total coliforms, fecal coliforms, *E. coli*, *S. aureus*, Sulphite-Reducing Anaerobic and *Salmonella spp.*
The results obtained showed compliance of rainwater quality with the irrigation standard. Radish grew 10 days earlier compared to the control plant irrigated with drinking water. We also found a significant increase in vegetative growth parameters in radish. Furthermore, the crop produced was in compliance with the regulation regarding hygiene standards.

The treatment performed enabled the recycling of collected water and adaptation to the developers' use. Our study could serve as an interesting reflection to motivate stakeholders to better manage water resources.

Keywords: Valorisation, irrigation, rainwater, crop monitoring, vegetative growth parameters, hygienic analysis.

Paper ID: 195

Transmissivity of the Glazing Surface of a Solar Still Single Slope Based on the Metrological Parameters of Agadir, Morocco

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Abstract. Water desalination by different techniques, in particular solar distillation, is an interesting solution for the drinking water supply of arid regions that are characterized by the presence of salty waters and the solar energy that is widely available during the majority of the year. In this research, the effect of glass transmissivity on the performance of the conventional solar still was theoretically investigated. The numerical calculation code is developed using a Matlab programming language, and the transfer equations are solved using an iterative Rung Kutta method of order 4. Low-iron (extra-clear) glass and commercial glass are used as glazing materials. The results showed that the cumulative production of solar stills with low iron glass is higher than the cumulative production of solar stills with commercial glass, so the daily production is 5,645 kg/m^2.day and 5,164 kg/ m^2.day for low iron glass and commercial glass, respectively. It was also found that increasing the transmissivity of glass from 0,75 to 0,95 will increase productivity by 31,55%.

Keywords**:** Desalination, Energy, Heat transfer, Transmissivity, Solar energy

Modélisation et simulation numérique du procédé de dessalement membranaire utilisant l'AGMD

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Résumé: Cette étude présente une investigation théorique et simulation numérique du processus de distillation membranaire à couche d'air (AGMD). Un modèle de distillation unidimensionnel (1-D) a été conçu pour la distillation membranaire pour le dessalement et la purification de l'eau, en utilisant l'AGMD comme membrane d'espace d'air. C'est un modèle qui comprend des études sur le développement des modules, des études théoriques et de simulation numérique, des analyses théoriques, et la modélisation du transfert de chaleur et de masse. La distillation membranaire repose sur l'utilisation d'une membrane microporeuse hydrophobe comme intermédiaire pour assurer le contact entre deux fluides à température différentes. La séparation thermique a été mise en place en transférant de masse dans la phase vapeur. L'influence des paramètres de fonctionnement du système a été étudié, en prenant en compte le débit, la concentration du sel, l'épaisseur et le type de la membrane.

Keywords : Modélisation, distillation, membrane. Dessalement, AGMD

Study of liquid water transfer of porous building materials under isothermal conditions

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Abstract. The objective of our work is to improve the analysis and interpretation of conventional tests for the characterization of the hydric behavior of porous construction materials. A homogeneous layer is analysed under isothermal conditions in one dimension. The layer is initially in moisture balance with the ambient air, having constant relative humidity. At time zero there is a sudden change in the relative humidity of the surrounding air. The structure is perfectly airtight. The simulated results are in good agreement with the analytical results of the benchmark report in the international project HAMSTAD [1]. Based on the validation results, a wall study is carried out. The wall is composed of the brick and hemp concrete. To model the transfer moisture in building materials, two types of materials are used in this study, hemp concrete and brick. The results show that the materials have a different distribution of water.

***Keywords*:** Simulation, moisture transfer; porous materials; validation.

Paper ID: 202

Integration of local production of renewable energy in smart buildings

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Abstract: Abstract: The building sector is a major contributor to global energy consumption and CO2 emissions, accounting for nearly 40% of the total. To address this challenge, rapid integration of renewable energy technologies into building design is essential. Smart buildings, with their ability to adapt to their surroundings and occupants' needs, offer a promising avenue for improving energy efficiency through renewable energy integration. This work provides a comprehensive overview of the current state-of-the-art in integrating renewable energy sources like solar, wind, and geothermal into smart buildings.It explores how these locally produced energy sources can be harnessed alongside smart energy systems, automation, and sensor technologies to significantly reduce building energy consumption. Additionally, the paper highlights the key challenges and barriers associated with this integration and proposes potential solutions to overcome them.

Keywords: Smart Building, Renewable Energy, Energy Efficienc.

Study of surface water treatment by process combining the internal loop airlift system and electrocoagulation-flotation using $CaCl_2$ and NaCl as electrolytes

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Abstract: In this work, we studied a system in which water intended for drinking water production was treated using a combination of the internal loop airlift technique and electrocoagulation. For this purpose, synthetic solutions with well-defined turbidities were prepared. The airlift reactor consists of two parallel compartments, separated by a partition, one with an upflow, the Riser, and the other with a downflow, the Downcamer. Two flat aluminum electrodes are immersed in the riser. They are powered by a variable-potential DC generator (0 to 12 volts). Energizing the two electrodes releases Al^{3+} at the anode and OH^- and hydrogen at the cathode. The presence of these small-diameter gas bubbles in large quantities ensures the recirculation of synthetic solutions without any stirring instrument, and promotes the electrocoagulation-flotation process. A qualitative study showed that the height of floating foam increased with treatment time and the conductivity of the electrolytes added. The performance of the combined system is evaluated by monitoring the effect of the electrolytes on the following parameters : Turbidity, pH, conductivity and oxidizability. The results of these tests are very conclusive. They showed a clear reduction in suspended matter and natural organic matter. The use of both NaCl and $CaCl_2$ electrolytes at a concentration of 120 mg/l, during 30 min of electrocoagulation-flotation, resulted in removal efficiencies of 94% and 88% for turbidity, and 58.92% and 75% for organic matter respectively. These results are confirmed by analysis of the IR spectra of the sludge obtained after treatment.

Keywords : Electrocoagulation-flotation, internal loop airlift reactor, turbidity, organic matter, surface water, electrolytes, calcium bridge.

Paper ID: 183

Performance Study of Anaerobic Digestion of Vinasse in Mesophilic regime using a continuous stirred tank semi-industrial reactor

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Abstract: Much attention has been recently drawn toward the possibility of exploiting organic or biodegradable waste, including industrial wastewater as sources of renewable energy.
Indeed, Industrial processes generate waste of varying composition and quantity at different stages. Residues and waste, including vinasse, inedible oilseed cakes and wastewater, are increasingly posing huge environmental challenges. Vinasse is a mixture of water, organic and inorganic compounds [1]. This liquid residue after distillation of the alcohol, present a surcharge for the industry distillers, views its high pollution load, which can contaminate water and soil, causing a big environmental problem [2]. Notably, anaerobic digestion (AD) of this kind of waste can mitigate environmental, damage and then produce biogas which is particularly worthwhile in developing countries.
This work, we focused on the study for start-up anaerobic digestion of vinasse applying a ratio Inoculum/Substrat ratio (I/S= 0,7) with an acclimate of sludge in the purpose to evaluate the elimination of organic matter, following stability of the process and production of biogas in a continuous stirred Tank reactor on mesophilic-condition (37°) for a hydraulic retention time (HRT) of 60 days.
The results of this study show that the start-up of inoculum/vinasse ratio of 0.7 feeding in semi-continuous mode present a production of methane has reached 64%, a removal rate of organic matter (COD) and Volatile solids (VS) respectively 76% and 72%. The average pH during digestion was pH= 7.66, which shows good operating stability and almost no inhibition during the experiment. For biogas, the cumulative value recorded was 356NmLbiogas.kgCOD^{-1} which, when compared with the literature where some average vinasse production is 232.31 NmLbiogas. kgCOD^{-1}, our work represents an interesting result.

Keywords: Biogas, CSTR reactor, organic matter, mesophilic regime

Paper ID: 210

Study of the Chemical Inhibition of Scaling's water Sanitary of commercial inhibitor

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Abstract. The dynamic effect of the tourism sector on the main macro-economic variables and on the other sectors of the regional economy has enabled the Agadir region to occupy an important place in national tourism. However, the consumption of water in the hotel sector is surrounded by a problem of clogging of the pipes carrying hot sanitary water. Indeed, the great Agadir is served with water from underground and surface sources with a high hardness. This has led to the formation of hard and adherent deposits on the internal walls of the pipes and structures that carry the water, and consequently the scaling phenomenon. This scaling process is even more accentuated when the water temperature is high. Therefore, it is essential to find a new generation of scale inhibitors which are distinguished, on the one hand, by a better scale inhibiting efficiency and, on the other hand, by their ecological effect due to the respect of health and environmental standards, to prevent or delay the formation of scale deposits

In this work we have tested inhibitor commercial. This inhibitor was tested at different concentrations The results obtained show that the contents of 65 of inhibitor inhibited the precipitation of calcium carbonate

Keywords: Germination pH; Inhibitor; Chemical inhibition; Scaling.

Paper ID: 231

Environmental and ecological risk assessment of water quality variation of Oum Er Rbia estuary, Morocco: physicochemical and biological analysis

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Abstract. This study investigates water quality variations in Morocco's Oum Er Rbia estuary. Chemical and biological analyses revealed high pollution levels, likely originating from industrial and agricultural waste, exceeding established safety guidelines. Statistical methods pinpointed pollution sources near urban wastewater discharge points. Our findings highlight the urgent need for regular monitoring and intervention to safeguard the estuary's health, particularly in light of the concerning trend of declining water quality in Moroccan rivers due to human activities.

***Keywords*:** Water quality, Physicochemical and Biological analysis, Spatial interpolation, Statistical analysis, Oum Er Rbia estuary, Morocco.

Paper ID: 230

Characterization and Treatment of the Leachates of the landfill of Niamey 2000 (Niamey-Niger) with Moringa Oleifera Grain

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Abstract: One of the consequences of the presence of waste is the production of leachates, which are highly contaminated wastewater [1]. With a view to addressing environmental issues, the aim of our study is to treat the leachates produced at the Niamey 2000 landfill site (Niamey). The treatment was carried out using Moringa Oleifera seeds, a biomaterial. Leachate treatment tests were carried out by coagulation-flocculation using Moringa Oleifera seeds in three forms: raw powder, calcined powder and a mixture of powder and calcined powder. The parameters pH, conductivity, turbidity, organic matter and trace metals were analyzed before and after the treatment process. We obtained an abatement rate of 98% for organic matter and 99% for turbidity and most trace metals. The pH and electrical conductivities varied only slightly during the various treatments. Our results are encouraging and should be used for the large-scale treatment of leachates produced at all landfills in the city of Niamey.

Keywords: Niamey 2000 landfill, leachates, coagulation-flocculation, Moringa seeds.

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