CMTDE 2024 OPENING KEYNOTE

Emeritus Professor Béchir HAMROUNI

Chairman of the CMTDE 2024

President of the Tunisian Desalination Association

Mr. Mondher Belaid, Minister of Higher Education and Scientific Research,
Mr. Hamadi HBAIEB, Minister of Agriculture, Water Resources and Fisheries,
Prof. Moez ECHAFRA, President of the University of Tunis El Manar,
Prof. Hakim GABTNI, General Manager of Water Research and Technologies Center

Dear Colleagues, Dear participants,

On my behalf and on the behalf of the organization committee we welcome you to the 9th edition of The Mediterranean Conference on Desalination and Water Treatment (CMTDE 2024).

The Ministers have kindly agreed to honor us by presiding over the opening ceremony of our event, demonstrating their interest in Tunisia's water problem.

The 9th edition is organized by Tunisian Desalination Association (TDA) in collaboration with the University of Tunis El Manar (UTM), the Water Research and Technologies Center (CERTE), the European Desalination Society (EDS) and the Research Laboratories LR19ES01, LR and LR, respectively from the Faculty of Sciences of Tunis, the National Engineering School of Tunis and the the Faculty of Sciences of Gafsa.

I would like to thank Tunis El Manar University, headed by its president, Prof. Moez Chafra, for its valuable contribution, both morally and materially, to the success of this event. I would also like to thank Prof. Hakim Gabtni for his support.

Professor Miriam BALABAN has always honored us with her presence, she apologizes this time. We would like to express our gratitude for his continued support and for making special issues possible in "Desalination and Water Treatment" journal.

Many thanks to our speakers who accepted our invitation to make us benefit from their experiences.

***Dear guests, Dear participants**,*

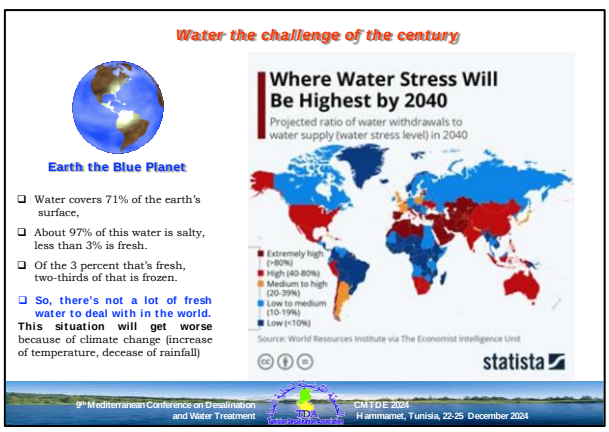
Ttoday everyone agrees that water is the challenge of the century. That's precisely why we're here.

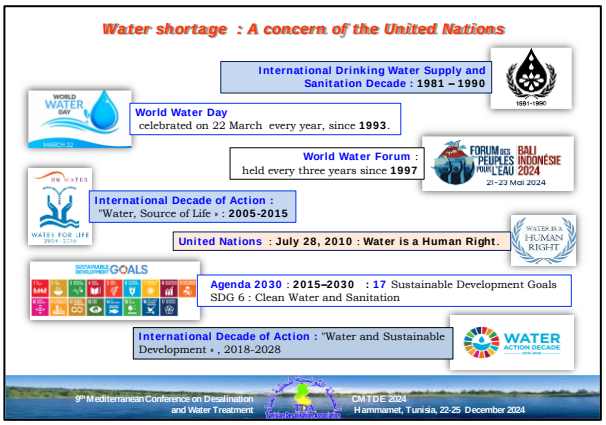
Just look at the following map: the red indicates countries experiencing water

shortages, with a quota of well under 1000 m³ per capita per year. Yet 71% of the surface area of planet earth (known as the blue planet) is covered by water. Unfortunately, only 1% of this water is usable by human beings

The countries most affected are those of the Middle East and North Africa.

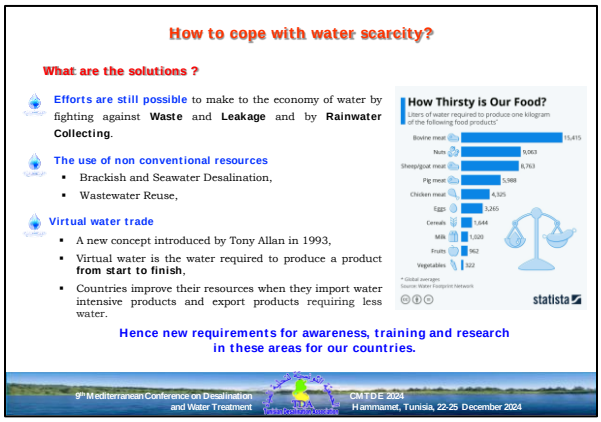
Faced with this situation, the United Nations has, since 1981, multiplied meetings, demonstrations and recommendations.

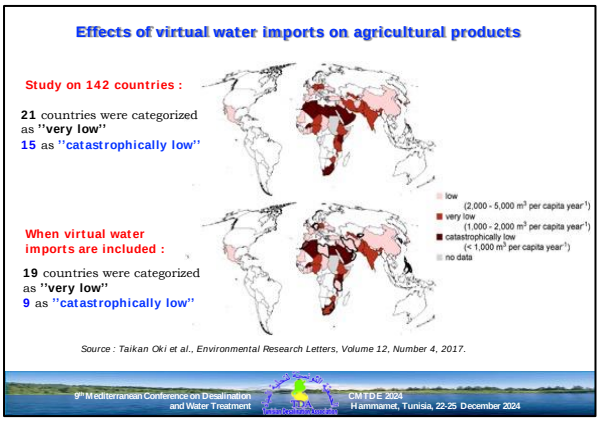




The use of non-conventional resources has become a crucial issue in the face of water scarcity, particularly in the context of climate change and increasing drought. With an integrated, collaborative approach involving all stakeholders, it is possible to develop these resources while preserving natural environments and meeting growing water needs.

The solutions are Brackish and Seawater Desalination and treated Wastewater Reuse. What's more, we mustn't neglect the effects of virtual water imports on agricultural products.





Desalination and water reuse: a fast-growing sector. In 2023, nearly 23,000 desalination plants were in operation worldwide, representing a significant increase on previous years. Global desalination capacity reached around 100 million cubic

meters per day, while wastewater capacity reached around 238 million cubic meters per day.

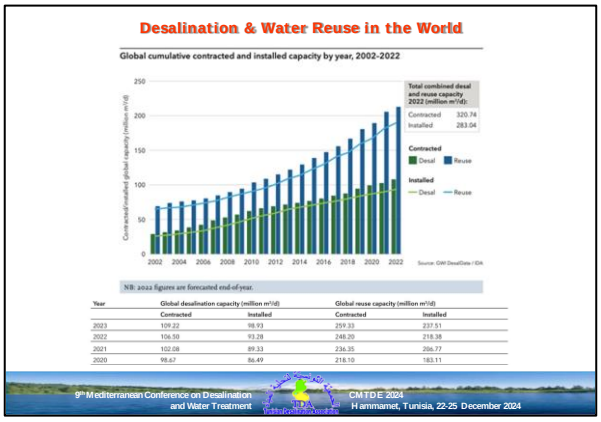
However, each of these approaches presents significant technical, environmental and economic challenges.

Desalination challenges are:

- ✓ *High cost and energy consumption.*
- ✓ *Environmental impact due to brine discharge and chemicals used.*

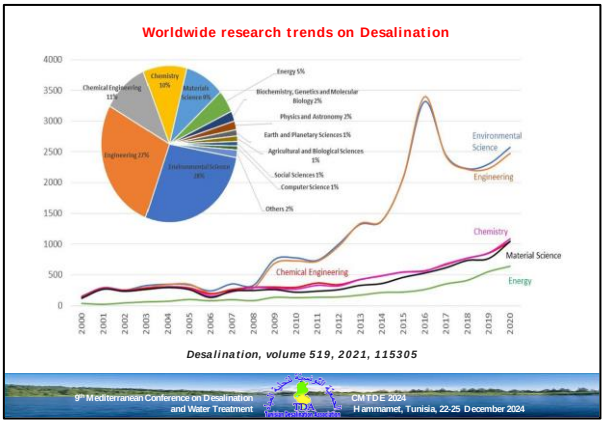
Challenges of wastewater reuse are:

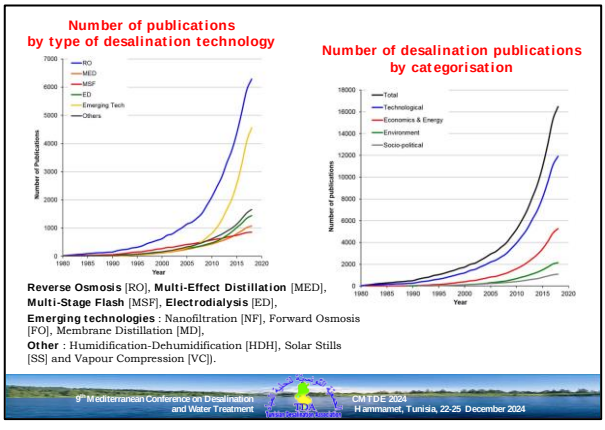
- ✓ *Significant initial investment for infrastructure and technology.*
- ✓ *Social resistance to the use of treated wastewater for human consumption or agriculture, requiring awareness-raising and education efforts.*
- ✓ *Regulatory standards: Water quality regulations need to be strict to guarantee sanitary safety, which can complicate the implementation of reuse projects.*



Research in these areas focuses on improving existing technologies, reducing energy and environmental costs, and integrating sustainable solutions. Recent Worldwide research trends on Desalination highlight significant growth in both the technological advancements and scholarly work surrounding desalination.

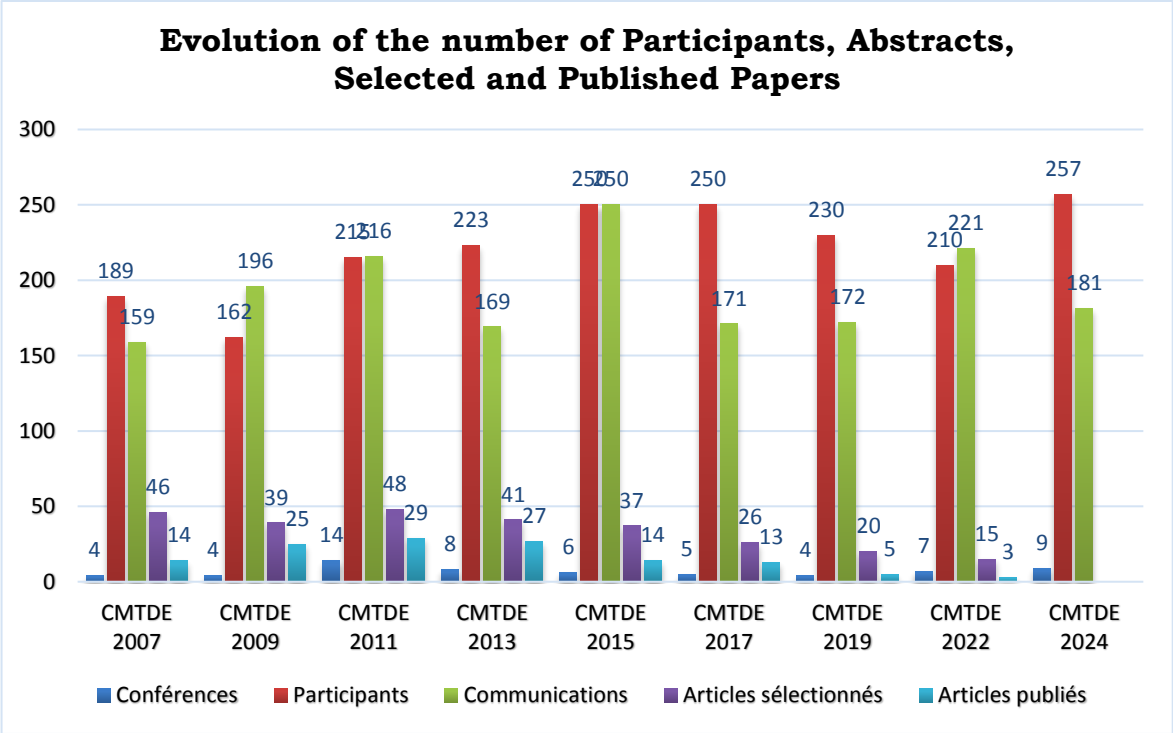
A bibliometric analysis indicates an exponential increase in publications related to desalination since 2008, with notable contributions primarily from China, the USA, and India.





The number of publications by type of desalination technology mainly concerns reverse osmosis, emerging technologies and electrodialysis.
The number of desalination publications by categorisation covers technological, economic, energy and environmental aspects.
These different aspects will be covered in the CMTDE 2024 conference that offers you 9 plenary lectures, 181 communications (for oral and poster presentations) and a panel session on innovation opportunities for the future and the establishment of scientific collaborations between laboratories on both sides of the Mediterranean.

Since the first edition of CMTDE, in 2007, the evolution of the number of participants, communications, selected papers and published papers is summarized in the following histogram:



Selected papers will be published, after peer review in the Journal "Desalination and Water Treatment"
This symposium aims to:

- ✓ *Discuss the latest technological innovations in water treatment and desalination.*
- ✓ *Assess the environmental challenges associated with these processes.*
- ✓ *Foster exchanges between researchers, industrialists and political decision-makers to promote integrated, sustainable solutions for water resource management.*

We invite you to take an active part in the debates that will follow the presentations, to enrich our collective thinking on these vital issues.

I wish you a pleasant stay and great success in our collective work.

We look forward to seeing you at the 10th edition of the Mediterranean Conference on Desalination and Water treatment.

Tunis, December 22, 2024

Prof. Béchir HAMROUNI

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Sami BEN REJEB

Sami Ben Rejeb is an Energy Specialist with 17 years of experience in the oil & gas and energy transition sectors. He is an energy engineer with a PhD from North Carolina State University and holds a law degree specializing in energy. He has worked in Tunisia, the UAE, the USA, Algeria, and Mauritania. Currently, he works with international development agencies and funding providers.

Water and Energy Transition

Abstract

It is well-known that in Tunisia, as in many other Mediterranean countries, the challenges surrounding water and energy are of critical importance. Numerous nations in the region are grappling with alarming levels of water scarcity alongside a fragile energy balance. At first glance, water and energy transition might appear to be separate issues, but they are, in fact, deeply interconnected. Clean energy is vital for water extraction, desalination, and pumping, just as water is indispensable for key aspects of energy transition, particularly in the production of green hydrogen. This presentation aims to shed light on this crucial interdependence between water and energy.

Alberto FIGOLI

Alberto FIGOLI is Director of the Institute on Membrane Technology – National Research Council of Italy (CNR-ITM), Rende (CS) Italy, since 1st March 2019.

He is President of the Territorial CNR Research Area of Cosenza, Italy, since 1st January 2021.

Winner of Global Prize for Innovation in Desalination 2023 – Section “Beyond Water”, Jeddah (Saudi Arabia) 2023.

In May 1997, he started his PhD degree at Membrane Technology Group, Twente University (Enschede, NL), on Development of novel membranes for facilitated transport for the separation O2/N2, and he got the PhD degree in October 2001.

He graduated in Food Science and Technology at the University of Milan (Italy) in March 1996. He had a working experience at the Research Group of Quest International (Unilever) in Naarden (NL), May-December 1996.

He was researcher at CNR-ITM in Rende (CS, Italy) for the period December 2001-February 2019.
He has been elected in the board of the European Membrane Society (EMS) and he was responsible for Awards and Summerschool (2015-2017) and Secretary (2017-2019).
Winner of Global Prize for Innovation in Desalination 2024 – Section "Beyond Water", 2023.
He is involved in many international, European and national projects, as CNR-ITM scientific coordinator and/or participant. He has been invited speakers in several international Conferences, Seminars and Courses. He is reviewer of several International projects (ERC, National projects) and Research Agencies (as APN (France), NWO (Netherlands), FWO (Belgium), etc). He is author of more than 300 scientific papers and chapters published in international journals and 7 National/International patents on membrane technology. He is Co-Editor of 9 books and several special issues. Hindex (Scopus) 56.
Alberto Figoli is expert in the field of membrane technology, particularly in membrane preparation and characterisation and application in environmental filed and water treatment.

Membranes in water treatment:
From traditional to advanced membrane processes

Alberto FIGOLI

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Abstract
In order to meet the increasing worldwide demand of freshwater, new strategies and efficient technologies have to be put in place aiming at preserving water natural resources and at reusing the treated wastewaters.
Membrane processes are widely recognized as a modern and effective technology in a wide variety of processes such as desalination and water purification, gas separation and concentration, purification and fractionation of complex mixtures in the food and pharmaceutical industry. In particular, membrane-based operations are a consolidated technology in the water and wastewater treatment sectors [1]. The membrane acts as a semipermeable barrier regulating the transport of substances allowing a selective separation at molecular level. The separation performance strictly

depends on the structure and properties of the membrane. Membrane demand tends to follow overall economic activity; thus, a strong correlation exists between membrane consumption per capita (including membrane modules, systems, and additional equipment) and the global gross domestic product (GDP) per capita. The membrane growth in an emerging market is expected to increase from 5.4 billion USD in 2019 to 8.3 billion by 2024 USD.

The presentation is devoted to report the latest trends on how innovative membrane development could influence and improve the membrane process in water treatment. In particular, the discussion will focus on the use of innovative membranes, produced using more sustainable solvents, for reducing fouling and improving their life time in traditional processes as, Membrane bio-reactors (MBR), and also in innovative processes as Membrane Distillation (MD) [2-5].

Keywords: membranes; water treatment; desalination; green solvents.

References

[1] Figoli A., Criscuoli A., Sustainable Membrane Technology for Water and Wastewater Treatment. Springer, 2017, https://doi.org/10.1007/978-981-10-5623-9; e-IBAN: 978-981-10-5623-9.

[2] Figoli, A., Hoinkis, J., Gabriele, B., De Luca, G., Galiano, F., Deowan, S. A., Bicontinuous microemulsion polymerized coating for water treatment, Patent EP20140786454 20140926; WO 2015/044335.

[3] F. Galiano, I. Friha, S. A. Deowan, J. Hoinkis , Y. Xiaoyun, D. Johnson, R. Mancuso, N. Hilal 6, B. Gabriele, S. Sayadi, A. Figoli, Novel low-fouling membranes from lab to pilot application in textile wastewater treatment, International Journal of Molecular Science, 20 (2019) 2696.

[4] A.Figoli, T. Marino, S. Simone, E. Di Nicolò, X.-M. Li, T. He, S. Tornaghi and E. Drioli , Green Chemistry, 16 (2014) 4034-4059.

[5] https://www.melodizer.eu/

Acknowledgments

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Hamza ELFIL

Hamza ELFIL is the Head of Laboratory Desalination and Natural Water Valorization (LaDVEN) in CERTE. In 1999, he obtained his PhD in Process Engineering – Water Treatment - from INSA Toulouse, France. His main research interests are related to water desalination, water quality and scaling phenomena in natural water. He offers many activities and lectures about water desalination and qualities and related topics for the public to make science more attractive and understandable**.**

Desalination of treated wastewater and its valorization in Aquaponics

Hamza ELFIL

Head of Desalination and Valorization of Natural Water Laboratory (LaDVEN)

Water Research and Technologies Center (CERTE)

Abstract

To face water shortage, Tunisia and Maghreb countries are led to develop approaches allowing efficient and sustainable use of the significant potential of treated wastewater (TWW).

In Tunisia, the recycling rate of TWW in agriculture has stagnated at low levels (< 7 %) for several years. This is due not only to the instable quality of TWW, which often does not meet standards, but also to its relatively high salinity, which can exceed 3 g/L and complicates its reuse in agriculture.

Taking advantage of the maturation basin at the GDA Sidi Amor site (Borj Touil – Ariana), which receives TWW from the Tunis North treatment plants (Canal Elkhlij - Raoued), an experimental plant for TWW desalination and aquaponics valorization system was installed within the framework of the *WaterReTUNe* Project (TUNGER18-044; Partners CERTE, ADJ, FiW, Terra Urbana).

This plant is composed of three units:

- An advanced tertiary treatment mainly for the protection of the membranes: It consists of a bioreactor, a planted filter, a sand filter and an activated carbon filter.
- A desalination unit using a hybrid membrane process (Nano-filtration/Reverse Osmosis to produce high-quality water.
- An aquaponic production unit: It consists of two fish farming tanks, a bioreactor and a hydroponic system.

Desalinated water with salinity between 0.5 and 1 g/L is stored to be used for Aquaponics (Nile Tilapia). Fish farming waste is also recovered to be used as nutrients for plants.

Bacteriological analyses carried out have confirmed that the fish and vegetables grown are healthy for human consumption.

The recovery of brine discharges from the desalination unit was developed by exploiting the potential of halophyte plants and their ability to assimilate salts and phyto-desalination of soils.

This project, which won first prize in the 2024 national collaborative innovation competition, aims to develop a diversified value chain for TWW in Tunisia's agricultural, targeting the zero-discharge objective.

Vahid VATANPOUR

Vahid VATANPOUR was born in Iran in 1983. He received his bachelor's (2005) and master's (2007) degrees in applied chemistry from university of Tabriz. He completed his PhD (2012) in applied chemistry from Razi University, Iran. He became assistant professor in 2012, associate professor in 2017, and professor in 2021at Kharazmi University, Iran. He is a guest professor in Istanbul Technical University. The main research area of Dr. VATANPOUR is the fabrication and modification of membranes for improving permeability, selectivity and antifouling properties for removal of environmental pollutants. He published more than 300 ISI papers in this field and more than 1800 citations (H-INDEX = 71 in Scopus). He is located in the list of 1% chemistry scientist of Wed of Sciences from 2019. Also, he selected as highly cited researchers in 2023from WOS.

Development of Nanocomposite Desalination membranes: Merits and Challenges

Vahid Vatanpour [a,b]

[a] Department of Environmental Engineering & National Research Center on Membrane Technologies, Istanbul Technical University, Maslak, 34469 Istanbul, Türkiye

[b] Department of Applied Chemistry, Faculty of Chemistry, Kharazmi University, 15719-14911 Tehran, Iran

Abstract

In the last decade, the use of nanomaterials with diverse internal structures and tuned surface functionalities in the fabrication of polymeric membranes has shown great promise for the development of high-performance desalination membranes. Along with the remarkable development of nanotechnology, multifunctional nanomaterials have been included as powerful additives in the development of membrane materials. The general idea for the development of nanocomposite membranes has been to induce the hydrophilic, photocatalytic and antibacterial properties of nanomaterials into the pristine membrane, resulting in the improvement of membrane permeability and selectivity, control surface topography, and increase antifouling capability [1-4]. For example, TiO_2 nanoparticles efficiently increase hydrophilicity and generate highly oxidizing hydroxyl radicals that readily attack and degrade organic pollutants in water [5]. GO nanosheets and carbon nanotubes offer an exciting opportunity to integrate all these desirable properties [6, 7]. However, the incorporation of nanomaterials into a polymer film to make a desalination nanocomposite membrane may not induce the desired performance to the polymer and may even worsen its permeation properties. The main challenge is the severe aggregation of these nanomaterials, which form non-selective cavities in the polymer matrix and significantly reduce the rejection of the NF/RO thin film composite membranes [8]. This problem becomes more severe when nanomaterials with higher aspect ratio such as GO and CNT are added to the polyamide thin layer. Although the nanocomposite membranes developed for the membrane process have shown improved permeability, surface wettability, less washing requirement and improved antifouling tendency, the development of robust and defect-free nanocomposite membranes, especially in TFC membranes, is still an open research field.

Nanofillers are incorporated into the membrane structure in five general ways: (1) bulk incorporation in the upper selective layer, (2) bulk incorporation in the support layer, (3) coating on the surface of the upper selective layer, (4) incorporation as an intermediate layer, between top layer and substrate, and (5) use as a selector layer or stand-up support. By systematically investigating the surface properties of nanomaterials, and carefully optimizing the synthesis routes, new and integrated nanocomposite membranes can be designed for water and wastewater treatment applications.

Keywords: Nanomaterials, mixed bed membranes, water and wastewater treatment, nanofiltration, reverse osmosis

References

[1] X. Sui, Z. Yuan, Y. Yu, K. Goh, Y. Chen, 2D material based advanced membranes for separations in organic solvents, *Small.* 16 (2020) 2003400.

[2] E.M.V. Hoek, M.T.M. Pendergast, A.K. Ghosh, Nanotechnology-based membranes for water purification, in: Nanotechnology Applications for Clean Water, 2nd Ed., 2014, 133–154,

[3] J.R. Aguilar Cosme, R. Castro-Munoz, V. Vatanpour, Recent Advances in Nanocomposite Membranes for Organic Compound Remediation from Potable Waters, ChemBioEng Rev 2023, 10, No. 2, 1–22.

[4] W. Sun, J. Shi, C. Chen, N. Li, Z. Xu, J. Li, H. Lv, X. Qian, L. Zhao, A review onorganic–inorganic hybrid nanocomposite membranes: a versatile tool to overcome the barriers of forward osmosis, RSCAdv. 8 (2018) 10040–10056.

[5] B. Khorshidi, I. Biswas, T. Ghosh, T. Thundat, M. Sadrzadeh, Robust fabrication of thin film polyamide-TiO2 nanocomposite membranes with enhanced thermal stability and anti-biofouling propensity, Sci. Rep. 8 (2018) 784.

[6] A. Karkooti, A.Z. Yazdi, P. Chen, M. McGregor, N. Nazemifard, M. Sadrzadeh, Development of advanced nanocomposite membranes using graphene nanoribbons and nanosheets for water treatment, J. Memb, Sci, 2018.

[7] V. Vatanpour, N. Zoqi, Surface modification of commercial seawater reverse osmosis membranes by grafting of hydrophilic monomer blended with carboxylated multiwalled carbon nanotubes, Appl. Surf. Sci. 396 (2017) 1478–1489.

[8] J. Farahbakhsh, M. Delnavaz, V. Vatanpour, Simulation and characterization of novel reverse osmosis membrane prepared by blending polypyrrole coated multiwalled carbon nanotubes for brackish water desalination and antifouling properties using artificial neural networks, J. Membr. Sci. 581 (2019) 123–138.

Mourad AMARA

Professor at the university since 2010, PhD in Materials Chemistry in 2003, author of several scientific publications and textbooks in chemistry. He has been a reviewer for more than twenty scientific journals, in addition to the Scientific Journal of Analytical Chemistry, Water Desalination, Fresenius Environmental Bulletin, Journal of Hazardous Materials, Journal of Membrane Sciences, Journal of Hazardous Materials, Chemosphere, and other journals.

Invited speaker at several international conferences; consultant in the fields of electrolysis, water treatment, chemistry, and metal classification. He has supervised several national and international proposals and projects in various fields related to chemistry.

In addition to being the head of the Ion Exchange Membrane Materials Team, he was the director of hydrometallurgy lab and former Dean of the Faculty of Chemistry at the University of Science and Technology in Algiers; he is also Vice President of the Algerian Chemical Society. In addition, he has supervised a number of studies and doctoral theses in membranes, water treatment, solution chemistry and metal valorization. He is also one of the founders of the Maghreb Society of Chemistry. He is actually professor at the Higher School of Nanoscience and Nanotechnology in Algiers.

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Polymer chelating properties to enhance selectivity in membrane separations process

Mourad AMARA

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Abstract

Basic concepts in structural chemistry serve as the starting point for the action mechanism of membrane separation of chemical species, which has emerged as a more effective and clean technique. In addition, membranes are commonly employed as porous materials, but due to their surface charge, hydrophilic/hydrophobic balance, texture, and several other physical and chemical characteristics that rely upon the medium matrix, they are also essential to carrying and separation of species. Since of the complexes that might form within the membrane material during the chelation process of transport, the development of selective membranes needs the adoption of an individual concept of separation

In consequence of this, the membrane has a very selective property with regarding particular species that exist in a wide range of conditions. Polyethyleneneimine (PEI), which may chelate in aqueous medium, has been used to create this particular type of membrane. In aqueous solution, this polymer behaves as a polyelectrolyte; its viscosity, protonation rate, and conformation are all influenced by the water's pH and

ionic strength. Maintaining the pH at or close to pKa=8.8 polarizes the membrane surface and produces a structure containing both amine and ammonium groups. Compared with ion exchange mechanisms, complexation mechanisms, non-binding nitrogen groups, and amino groups are more prevalent in alkaline media. At higher pH values, negatively charged metal-ligand complexes are transported. Through the ion pair process to the bulk of the membrane. The study of various aspects of acid-base behavior and complexation formation in PEI in aqueous solutions, as well as within membranes as a surface modification and ion transport mediator through complexation, has been the subject of our research for more than 20 years. Copper ion has been studied in depth among other heavy metals along with organic acids. Moreover, polyvinylpyrrolidone (PVP) and polyethylene glycol have been also investigated.

Mohamed ZAARA

Mohamed ZAARA est un Expert International dans le dessalement des eaux. Actuellement Directeur Central du Projet de construction de la station de dessalement d'eau de mer de Sfax de capacité 200 000 m3/j.

En 1986, Ingénieur Principal en Hydraulique, diplôme de l'Ecole Nationale d'Ingénieur de Tunis et depuis intégré à la SONEDE dans le département des Etudes. En 1992, DEA professionnelle dans la gestion de l'environnement de l'Université Internationale au Service du Développement Africain à Alexandrie d'Egypte

Il travaille sur le dessalement des eaux depuis 1988 à ce jour :

- Développement du programme national de dessalement des eaux en Tunisie.
- Participation dans le développement des projets de dessalement d'eau en Tunisie.
- Directeur Général de SONEDE INTERNATIONAL avant de partir en coopération internationale en 2010.
- Contrôle de la réalisation du programme de dessalement d'eau de mer en Algérie (2010-2020) pour le compte des banques algériennes qui ont financé le programme projet (10 stations de dessalement d'eau de mer de capacité cumulé 2.3 millions de m3/j).
- Expert de la Commission Européenne pour l'évaluation d'un programme de recherche/développement régional ADIRA (dessalement dans les milieux ruraux isolés à travers l'intégration des énergie renouvelables).
- Expert de la Commission Européenne pour le développement du projet de dessalement d'eau de mer de Djibouti (45 000 m3/j).

- Retour à la SONEDE en 2016 et depuis dans le développement du programme de dessalement d'eau de mer en Tunisie.

Conference title's**: Seawater desalination in Tunisia**

Hatem RADDADI

Hatem RADDADI a mené une carrière impressionnante en tant que responsable et chef de laboratoire des analyses des eaux usées et valorisation énergétique de déchets au cours de ses 25 années de travail dans l'office national d'assainissement au laboratoire de la station de traitement des eaux usées et valorisation énergétique de boues. Hatem Raddadi a également enseigné les étudiants en mastères professionnelles MP2 pour les modules de traitements des eaux usées industrielles et naturelles ainsi que la valorisation de déchets à la faculté de sciences Tunis Manar. En tant que responsable de l'encadrement des étudiants en mastères professionnelles, mastères de recherches et projets fin d'études des ingénieurs de spécialités génie chimiques, génie biologiques, génie agro-alimentaires et génie énergétiques , Hatem Raddadi joue un rôle majeur dans le développement du domaine de l'environnement.

Amélioration de la qualité des eaux usées traitées par la culture des microalgues et valorisation énergétique des boues

Résumé

Notre travail avait pour objectif principal de sélectionner, de caractériser, d'isoler et de mettre en culture des espèces indigènes de microalgues vivant dans les eaux usées traitées destinées à l'irrigation du bassin de maturation de la station de Sidi Amor de Borj Touil, en vue de leurs applications dans des essais de traitement secondaire et tertiaire des eaux usées de la STEP de Chotrana, avec valorisation énergétique par biométhanisation. Le biogaz est une source d'énergie qui peut être utilisée directement en remplacement du gaz naturel pour produire de la chaleur, du froid et de l'électricité par trigénération ou encore servir à la production de biocarburant pour les véhicules. Cette récupération permet également de réduire les quantités de déchets et les

émissions de gaz à effet de serre dans des conditions contrôlées au laboratoire. Le consortium de trois espèces de micro-algues principalement du genre Chlorella sp1 a montré un potentiel important avec des taux élevés d'élimination de la DBO, de la DCO, du MES, de l'azote total et du phosphore total, ainsi que pour l'abattement des coliformes fécaux des eaux de sortie de la STEP de Chotrana. En effet, un épuisement supérieur à 80 % est obtenu au bout de 15 jours de traitement pour la DBO, la DCO, la MES, l'azote total et le phosphore total. Les coliformes fécaux sont totalement abattus. Les résultats obtenus mettent en évidence le potentiel de Chlorella sp1 en tant qu'agent de traitement secondaire et tertiaire, et la valorisation du biogaz devient un enjeu majeur dans la perspective d'un développement énergétique durable.

Mots-clés : Traitement biologique, eaux usées urbaines, diversité phytoplanctonique, culture de microalgues , Chlorella sp1, énergie, biogaz, valorisation de l'azote total, du phosphore total, de la DCO, de la DBO, de la MES et des coliformes fécaux.

Philippe HABERSCHILL

Philippe HABERSCHILL (71 ans) est ingénieur, docteur ingénieur et habilité à diriger des recherches de l'INSA de Lyon où il a été enseignant chercheur. Assistant, puis maitre de Conférences, il y a enseigné notamment la thermodynamique générale, les mesures physiques et le Froid Industriel au département de Génie Énergétique et Environnement pendant pas loin de 40 ans. Retraité depuis 2017, il a été maître de Conférences émérite jusqu'en 2023 au Centre d'Énergétique et Thermique de l'INSA de Lyon où il reste actif en tant que bénévole. Son domaine de recherche est l'étude expérimentale et la modélisation dans le domaine de la réfrigération et des pompes à chaleur, ainsi que la caractérisation des fluides frigoporteurs diphasiques. Sur ces thèmes il a supervisé une trentaine de thèses et participé à la rédaction de plus de 100 publications et communications lors de congrès. C'est un membre reconnu de la communauté française du froid, à ce titre il est membre du comité de rédaction de la Revue Générale du Froid depuis 2008 et titulaire de la médaille C. Tellier de l'AFF dont il est administrateur depuis 2023.

R-290 le fluide de l'avenir ?

Philippe HABERSCHILL

Résumé

Après les accords de Kyoto, dès 1997, l'industrie du Froid a subi des mutations successives liées essentiellement à l'impact environnemental des fluides frigorigènes. Ainsi, les Chlorofluoro carbures (CFC) ont été réduits progressivement pour disparaître dès 2015, ce fut ensuite les hydrochlorofluorocarbure (HCFC). Avec le règlement européen FGaz III, ce sont aujourd'hui les HFC qui sont touchés et la fin de leur utilisation est envisagée pour 2030. D'ici là il faut trouver des solutions de remplacement. Parmi celles-ci le propane R-290 devrait occuper une place de choix. Du point de vue énergétique, il présente des performances très intéressantes et pourrait se généraliser s'il n'était pas fortement inflammable. L'exposé proposé est un résumé des contraintes liées à l'usage du propane dans le froid domestique, commercial et industriel. Le respect de ces contraintes permet d'envisager l'exploitation des installations au propane en toute quiétude. Tous les aspects sont envisagés : conception des installations, entretien-maintenance, démantèlement, protection des personnels et du public…

Yong YEOW LIANG

Yong YEOW LIANG holds a Ph.D. in Chemical Engineering from the University of New South Wales, Australia, and currently works as an associate professor at Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA). He is a chartered engineer with IChemE and a professional technologist registered with the Malaysia Board of Technologists. He has led collaborative research projects focused on various aspects of Desalination, including modeling flow and mass transfer within membrane channels, modifying feed spacers, developing membrane module-scale models, exploring unsteady shear strategies and simulating hybrid desalination systems. He has published more than 40 papers as the corresponding author in high-quality journals. Dr. Liang has been awarded the journal article publication awards by UMPSA for the years 2018, 2019, 2021, 2022, and 2023.

Advances in CFD Modelling for Spacer-Filled Membrane Channels in Desalination Membrane Systems

Abstract

This study presents the role of spacer design in improving the efficiency of membrane systems for desalination. Innovative spacer designs significantly influence hydrodynamics and mass transfer, which are critical for optimizing performance. Initially, a 2D CFD model provided insights into general trends, but advancements in computational power have made 3D CFD models more prevalent. These 3D CFD models allow for a deeper understanding of how different spacer designs affect mass transfer and friction loss (i.e., Sherwood number and friction factor) at the spacer scale. While the 2D CFD model offers valuable insights, the 3D CFD model captures the complex flow patterns and interactions present in real systems. This knowledge will guide the development of more efficient spacer geometries for desalination membrane applications.

ABSTRACTS - CONTENTS

CMTDE 2024_1	Assessment and comparison of triazole pesticides in agricultural draining water from Tunisia NECIBI Mouna, ABDELAOUI Dorsaf, MZOUGHI Nadia
CMTDE 2024_2	Selective extraction of Co (II) and Ni (II) from sulfate medium by synergistic solvent extraction LOUICHAOUI Tassadit, GHEBGHOUB Fatima, BARKAT Djamel, KHETTALA Amel
CMTDE 2024_3	Elaboration and Characterization of Microfiltration Ceramic Membrane BOUZERARA F
CMTDE 2024_4	Synthesis, Characterization, and Photocatalytic Performance of $Bi_{12}CoO_{20}$, ZnO, and BCO/ZnO Nanomaterials MADJI Sérine*, BELMEDANI Mohamed, MEKATEL Elhadj
CMTDE 2024_5	Comparative Study of Violet Crystal Adsorption on Raw and Purified Nanomaterials ZABAT Nacéra*, ZITOUNI Imène, BOUNAB Bouchra
CMTDE 2024_6	Physico-chemical study of wastewater discharged in the environment in the East-Algeria sector CGS LaBelle Annaba BOUBIDI Fatima*, BOUASLA Ihcène, HABBECHE Amina, DJEDIOUI Abdallah, DENDANI Boutheina & DEBILI Mounia
CMTDE 2024_7	Removal of emerging contaminants from desalination plane effluent by activated biowaste LOUADJ Amel*, BOURAS Omar, HOUARI Mohamed, KOURDALI Sidali
CMTDE 2024_8	Environmental impact study of reverse osmosis desalination plants LOUADJ Amel*, BOURAS Omar, EZZROUG Kaouther, HOUARI Mohamed, KOURDALI Sidali
CMTDE 2024_9	Incorporation of a Nickel Into Polytungstic Matrix $(\alpha_2P_2W_{17})^{10-}$ Nanoparticles: A Green and Recyclable Catalyst for Dye Decolorization ZABAT Nacéra
CMTDE 2024_10	Study of the Adsorption Characteristics of Various Aqueous Substances Using a Local Adsorbent MECHRAOUI Nessrine, BENALIA Mokhtar and BOUDAOUD Asma
CMTDE 2024_11	Synthesis and Evaluation of Novel Spirooxypirimidine Derivatives as Antibacterial and Antioxidant Agents CHOUHA Nora, BOUKEZZOULA Faiza, HAB Hamada
CMTDE 2024_12	Synthesis and characterization of composites-based zeolite Y/TiO_2 for the treatment of BB41 dye from synthetic solution. NIBOU Djamel, HAMMOUDI Hadda Aya, SEBATI Farouk, FERHAT Djawad, AMOKRANE Samira

CMTDE 2024_13	Hydrogen gas production using semiconductors Fe_2O_3, CuO, ZnO and composites Clay/Fe_2O_3, Clay/CuO and Clay/ZnO by photo catalysis AMOKRANE Samira, FERHAT Djawad, SEBATI Farouk, NIBOU Djamel
CMTDE 2024_14	Using Support vector machine optimized with Mosquito Swarm Algorithm to predict water productivity of a nanofluid-based solar still equipped with thermoelectric modules EULDJI Amel, LAIDI Maamar*, HENTABLI Mohamed
CMTDE 2024_15	Wastewater treatment with activated carbon prepared from green residues BOUMESSAIDIA Selman*, BENSALEM Fella, HOUTI Iman, MOHAMMEDI Ourida
CMTDE 2024_16	Physicochemical and biochemical responses of apple cultivars during storage as induced by saline water irrigation ABIDI Walid*, AKRIMI Rawaa
CMTDE 2024_17	Study of the elimination of phenol from water with intensive and extensive processes. BELAYACHI Hanane, BELAYACHI Amel, BOURAHLA Sarra, NEMCHI Fadéla, BELHAKEM Mostefa
CMTDE 2024_18	Water treatment by Photo-catalytic Degradation using Ruta Extracts LETTREUCH Hichem, DRIOUECHE Asma, BOUTOUMI Hocine
CMTDE 2024_19	Optimization of the extraction parameters of bioactive compounds from leaves of the olive cultivar «Chemleli» as induced by saline water irrigation AKRIMI Rawaa *, SESSI Marwa, ABIDI Walid
CMTDE 2024_20	Development of a novel antimicrobial and optimization for future application in poultry farming GRAMI Emna, HEDHIRI Rihab, BELHASSEN Gassemi, SAIDI Neila
CMTDE 2024_21	Adsorption of heavy metals using synthetic biomaterial: application to marine environment SALHI Noussaiba, TOUAYLIA Samir, BOUSLIMI Sondes, SAIDI Neila
CMTDE 2024_22	Effect of the mass ratio of phosphoric acid on the chemical impregnation of a vegetal waste for the preparation of a porous material RABIE Renad*, BELGACEM Ahmed, HADOUN Hocine, DJEMA Fatma
CMTDE 2024_23	Facile biosynthesis of Fe_3O_4 nanoparticles and their use for rapid removal of a toxic cationic dye “Methyl Violet” from wastewater TERKHI Mohammed Cherif, HAMMOU Kayra, BELHADJI Kinza Amel, TERKHI Sabria, GHEZZAR Mouffok Radouane, ABDELMALEK Fatiha, NEDJIMI Mohammed Said, TLILI Salah, ADDOU Ahmed
CMTDE 2024_24	Optimization and kinetic studies for real industrial liquid waste treatment using combined electrochemical processes HAMROUNI Najia*, SASSI Wafa, NAFADY Ayman, HIHN Jean-Yves, AMMAR Salah

CMTDE 2024_25	Preparation of novel porous ceramic membrane supports based on silicon carbide/bentonite mixtures at very low- sintering temperature HECINI Mouna*, SAIGHI Nabila, KERCHICH Yacine, TABLAOUI Meftah, MANSERI Amar, BOUCHELAGHEM Ouahiba, MERIBAI Nadjib
CMTDE 2024_26	Experimental Investigation of Desalination and Brine Concentration Using Membrane Distillation on a Pilot Scale GARUDACHARI Bhadrachari*, MANSOUR Ahmad, RAJESHA KUMAR Alambi, AL-MESRI A., JIBU P. Thomas
CMTDE 2024_27	Characterization of the Removal of a Tanning Dye by Adsorption on Gibbsite. BOUHOUF Loubna, BOUKHALFA-DJEBBAR Chahrazed
CMTDE 2024_28	Activated Carbon Derived from Sawdust Combined with Ultrafiltration as a Pretreatment of Textile RO Brine: Impact on Water Quality and UF Fouling BEN SALAH Sarra, ZAVISKA Francois, HERAN Marc, BEN AMAR Raja
CMTDE 2024_29	Water treatment facility maintenance of flash evaporators FRIOUI Salah
CMTDE 2024_30	Synthesis of an organic-inorganic nanohybrid composite for dye removal KAMOUN Nesrine *, MELLITI Emna, OUNIS Fatma, ELFIL Hamza
CMTDE 2024_31	Degradation of Textile Dyes from Wastewater Discharges Using Zeolite Catalysts HAMIDI F., SARI MOHAMMED H., SELADJI M
CMTDE 2024_32	Characterization of water polluted by wastewater and impacts on the quality of irrigated soil in the short term HEDHIRI Rihab, HABOUBI Ibtissem, GRAMI Emna, SAIDI Neila
CMTDE 2024_33	Hydrochemical and Hydrogeological Characteristics of the Upper Visean Aquifer of Hassi Abdallah, Tindouf Saoura Watershed (Southwest Algeria) BEKKOUCH Mohamed Fouzi, LASGAA Ibrahim, ZANETI Djelloul, IBRAHIM Mohamed, ALLOUACH Ahmed Amine
CMTDE 2024_34	Adsorption capability of sugar scum as industrial waste for cationic dye removal: experimental and advanced statistical physics modeling ATMANI Fatiha, KACI Mohamed Mehdi, AKKARI Imane, YEDDOU-MEZENNER Nacera, BENSAADI-OUZNADJI Zohra, BALAMANE-ZIZI Ouafia, MOKHATI Asma
CMTDE 2024_35	Recovery of Ni (II) from Aqueous Sulphate Solution Using Di (2-Ethylhexyl) Phosphoric Acid & 1-octanol KHETTALA Amel*, LOUICHAOUI Tassadit, GHEBGHOUB Fatima, BARKAT Djamel
CMTDE 2024_36	Wind direction effect on the thermal performance of the single-slope solar still RAHMANI Ahmed*, CHOUAF Fethi, BOUZID Lakhdar

CMTDE 2024_37	Study of a Building-Integrated Solar Still HADDAD Zakaria*, NAHOUI Azzedine, OUCIF Omar
CMTDE 2024_38	Performance analysis of a hybrid forward osmosis-membrane distillation system for seawater desalination TRIKI Zakaria *, MENASRI Rabah, FERGANI Zineb
CMTDE 2024_39	Structural Analysis and Biological Assessment of a Novel Zwitterionic Cadmium Complex with Antioxidant, Antidiabetic, and Anti-inflammatory Activities WALHA Sandra, BOURWINA Mansoura, ZAMMEL Nourhene and NAÏLI Houcine
CMTDE 2024_40	Synthesis and characterization of modified activated carbon (Iron Oxide/AC) for cationic dye adsorption: equilibrium isotherm and kinetic studies HAMZA Wiem, OULED LTAEIF Olfa, OUALI Kouthar, BENZINA Mourad
CMTDE 2024_41	Optimization of a Hybrid PV/Wind/Diesel/Battery Energy System for Isolated Military Sites in Tunisia Using PSO and HOMER Software YOUSSEF Moez *, BOUBAHRI Chokri, MEHERZI Radhouane
CMTDE 2024_42	Comparative evaluation of the effects of ethanol and isooctane addition on the performance and NO_x emissions of a spark-ignition engine using commercial unleaded gasoline MEHERZI Radhouane, BOUBAHRI Chokri,YOUSEF Moez, ODOUNGA LENDOYE Darcy, ELLEUCH Amal, BESSROUR Jamel
CMTDE 2024_43	Potential elimination of diclofenac sodium (DCF) from aqueous solution by adsorption using orange peel solid waste-based activated carbon SALAH Zouhair, ALOULOU Hajer, BEN AMAR Raja
CMTDE 2024_44	Experimental and Numerical Study of the Performance and NOx Emissions of a Spark Ignition Engine Operating with an Ethanol-Unleaded Gasoline Mixture. BOUBAHRI Chokri, MEHERZI Radhouan, MOEZ Youssef
CMTDE 2024_45	Bio-based ceramic membrane preparation and application to textile wastewater treatment for color removal ATTIA Afef, BAHROUNI Jamila, BAKLOUTI Lassaad, DAMMAK Lasâad, BEN AMAR Raja, and DERATANI Andre
CMTDE 2024_46	Effects of nanoparticles on the performance of a solar distiller NAHOUI Azzedine, HADDAD Zakaria
CMTDE 2024_47	Study of the influence of climatic parameters on the water rate evaporation from a free surface FOUDHIL Walid, BEN JABRALLAH Sadok
CMTDE 2024_48	Evaluating Seawater Intrusion Vulnerability in a coastal Aquifer: Application of the Modified GALDIT Model in the Northeast Tunisia Region KOUAIED Amal, CHENINI Ismail, PISTRE Severin

CMTDE 2024_49	Bacteriological Quality of Seawater in the Bousmail Region (Tipaza Province). BOUCHENAK Fatima, CHAOUIA Cherifa, MOUAS Amina
CMTDE 2024_50	Urban wastewater Treatment by infiltration percolation using a filter bed intended for composting: crushed dry palms and smectitic clays ETURKI Saifeddine, BEN SAED Massouda, HAJJAJI Feryel, OUESSAR Mohamed
CMTDE 2024_51	Design and Study of a Plate Heat Exchanger with Phase Change Materials for HDH Desalination BEN HASSEN Khouloud, FRIKHA Nader, GABSI Slimane
CMTDE 2024_52	Experimental study of a vacuum membrane distillation system comprising an immersed hollow fiber module BEN ABDALLAH Samira, FRIKHA Nader, GABSI Slimane
CMTDE 2024_53	Investigation of methylene blue Adsorption by Fe_3O_4 Nanoparticles : An Optimization Study Using Response Surface Methodology GRITLI Imene*, CHEMINGUI Hajer, DJEBALI Kais, MABROUK Walid, HAFIANE Amor
CMTDE 2024_54	Monitoring and simulation of the puratory performances of the annaba step for safe use of purified water in agriculture KHERFANE Wahida, SEKIOU Omar, HAMMAR Yahia, BENSELHOUB Aissa
CMTDE 2024_55	Etiological survey on contaminations of thermal waters and disinfectant tests and purely natural flavorings DRIDI Mohamed Ali, KOLSI Fayçal, JAOUANI Atef
CMTDE 2024_56	Dynamics of Contaminants Transport under climate change patterns in Varied Soil Types at laboratory scale: Influence of water flow rate and temperature ABDELLI Sara#, MASTRODONATO Luigi, CALZA Paola, VIONE Davide, BRANDVOLL Øyvind, YASIN Vian, FERRANDO-CLIMENT Laura
CMTDE 2024_57	Study of the Parameters Influencing the Adsorption of Chromium (VI) on Bentonite. BELLACHE Dihia*, MOUSSACEB Karim, SAHNOUNE Rachid, TALHA Abir
CMTDE 2024_58	Study of the Adsorption Performance of Chrysoidine R by a Synthesized Nanocomposite. DOUINAT Oukacha, BOUCHERDOUD Ahmed, BESTANI Benaouda, BENZEKI BENALLOU Mokhtar, DOUARA Nadia, MEKIBESS Zohra, CHEMRAK Mohamed Amine
CMTDE 2024_59	Numerical Simulation of Mass and Heat Transfer in Humidifiers: Optimizing Efficiency in Water Treatment and Humidifier Performance RAHALI Nadia, ZOUAOUI Ahlem; ZILI-GHEDIRA Leila
CMTDE 2024_60	Kinetic study of the adsorption of dye from wastewater on Algerian activated clay JDIDI Marwa, BOUNACEUR Boumediene, SARDI Amina and BESBES Néji

CMTDE 2024_61	Innovative adsorbent based on bentonite clay-polymer composite for wastewater treatment JDIDI Marwa, BOUNACEUR Boumediene, SARDI Amina and BESBES Néji
CMTDE 2024_62	Improving the Operation of Softening Unit through Advanced Ion Exchange Resin Maintenance Methods LAMALI Aicha*, SABBA Nassila, BITAM Kamel
CMTDE 2024_63	Reduction of Total Dissolved Solids (TDS) in industrial water storage tanks while maximizing water resource recovery through reverse osmosis (RO) LAMALI Aicha, BITAM Kamel, SABBA Nassila
CMTDE 2024_64	Health Risk Assessment of Fluoride Removal from Drinking Water SHARIF Abubaker *, ELAZIBY Nader, SHENQIR Iman, TRABELSI Darine
CMTDE 2024_65	Optimization of the condensation and vacuum creation system for vacuum membrane distillation MILADI Rihab, FRIKHA Nader, GABSI Slimane
CMTDE 2024_66	Adsorption and Regeneration of iron pillared clay adsorbents for removal orange methyle SELLAM Randaa, ZERMANE Faizaa, CHAKNANE Omar
CMTDE 2024_67	Preparation and Characterization of a Thin-Film Composite Nanofiltration Membrane Based on Polyamide-Cellulose Acetate: Application for dyes removal OUNIFI Ibtissem*, ABED Badra, GUESMIYoussef, HAFIANE Amor
CMTDE 2024_68	Separation methods of terpenes BEN SALHA Ghada, ABDERRABBA Manef and LABIDI Jalel
CMTDE 2024_69	TiO_2-based nanocomposite for photocatalytic degradation of pharmaceutical pollutant TRIFI. B., NAHDI. A., KOUASS. S., TOUATI. F., DHAOUADI. H.
CMTDE 2024_70	Harnessing Power: Enhanced Power Density via Reverse Electrodialysis JOMAA Sarra, BESBES Sonia
CMTDE 2024_71	Ibuprofen adsorption onto natural Tunisian chert MAHJOUBI Najah, ARAISSI Manel, ELALOUI Elimame
CMTDE 2024_72	Innovative Method for Rare Earth Element Extraction: Development of a Novel Process and Comparison with Supported Liquid Membrane and Solvent Extraction Techniques BRAHMI Khaled*, JEBALI Raouf, BOUGUERRA Wided, and HAMROUNI Béchir
CMTDE 2024_73	Innovative Leaching Techniques for Sustainable and Efficient Recovery of Rare Earth Elements from Phosphogypsum BRAHMI Khaled*, JEBALI Raouf, BOUGUERRA Wided, and HAMROUNI Béchir

CMTDE 2024_74	Assessment of the microbiological quality of irrigation water and dispersal of antibiotic resistance genes JEBRI Sihem, DRIDI Rafik, MASMOUDI Ahmed Slaheddine, AMRI Islem and SAIDI Mouldi
CMTDE 2024_75	Adsorption of a Phenolic Compound by Activated Carbon Derived from Pinecones : Preparation, Characterization, and Thermodynamic Study. ATTOUTI Salima, TERMOUL Mourad, BENZEKRI BENALLOU Mokhtar, BENABED FATMA Baghdad, BENAOUDA Bestani, BENDERDOUCHE Noureddine
CMTDE 2024_76	Development of a Machine Learning Algorithm for Predicting User Engagement and Data Consumption in Popular Applications YAHYAOUI Amel* and EL MELKI Mohamed Nejib
CMTDE 2024_77	Effect of stibnite thickness on the degradation of methylene blue in aqueous solutions under visible light CHIHI Adel
CMTDE 2024_78	Technical-economic and comparative study of solar water desalination systems AIT NOUH Fatima*, LACHGUER Chaymae, BAHSINE Saida, BELLAZIZ Yassir, ELBARKAOUI Ayoub
CMTDE 2024_79	Mini-station for desalination based on the electromagnetic method EL GHOUL. Islam. N., LAKHDARI. A. E., LAKHDARI. R. , OUAMANE. A. T
CMTDE 2024_80	Desirability function and Box-Behnken design optimization for anionic and cationic dyes adsorption by activated Algerian Bentonite OUALI Kaouthar, HAMZA Wiem, FAKHFAKH Nadim, BENZINA Mourad
CMTDE 2024_81	Electrochemical Magnetization of Wastewater for Cleaner Production SASSI Wafa*, AMMAR Salah, HIHN Jean-Yves
CMTDE 2024_82	Impact of Wastewater on the Aquatic Plant Posidonia oceanica (L.) Delile 1813 in the Gulf of Annaba HABBECHE Amina*, HABBECHE Amira, BOUTABIA-TREA Saliha, HABBACHI Wafa
CMTDE 2024_83	Adsorption of methyl blue dye from aqueous solution by blend polymer based on PVC BENBELLAT Noura, AGAGUENA Amel, KHAOUA Oussama, BENDAIKH Tahar
CMTDE 2024_84	Application of statistical physics formalism for the modeling of adsorption isotherms of water molecules on the microalgae spirulina platensis AYACHI Fakher*, NAKBI Amel, SAKLY Abdellatif, PINTO Luiz. A. A and BEN LAMINE Abdelmottaleb
CMTDE 2024_85	Use Low-Cost Bio Adsorbents for Removal 2-Nitrophenol DJELLOULI Amir* BERREDJEM Yamina, HATTAB Zhour, GUESMIA Hadjer, MEHENI Mokthar, KECHAYE Mohamed

CMTDE 2024_86	Optimizing the Treatment of Medjerda River Water: The Potential of Moringa Seeds as an Eco-Friendly Adsorbent NAJAR Hanene, LAOUINIB Faten, WERFELLI Naima
CMTDE 2024_87	Advanced highly sensitive hybrid nanomaterials for heavy metal ions detection and water treatment ADDELI Ferdaous, WANNASSI Jacem, DHAFFOULI Afef, KAHRI Hamza, CHOUCHENE Fraj and BARHOUMI Houcine
CMTDE 2024_88	Development and Application of an LC-MS/MS Methodology for the Detection and Quantification of Pharmaceutical Residues in Wastewater MECHMECHE Hana, SERREAU Catherine, FERSI Chaima, SOUISSI Radhia, VULLIET Emmanuelle and ABDERRAZAK Houyem
CMTDE 2024_89	Elimination of Inorganic Micropollutants Present in Water by Bio adsorption: Optimization and Applications AL KHAZAALI Mohammed, HANNACHI Chiraz, HAMROUNI Bechir
CMTDE 2024_90	CFD Modelling of an Integrated Evaporative Cooling and Wind Catcher System for Poultry House Climate Control FEZAI Mariem, ELAKHDAR Mouna, EL MOUEDDEB Khaled
CMTDE 2024_91	Optimization of a forced convection solar dryer for food products HAMDI. C., ELAKHDAR ABOUDA. M., BEN FATHALLAH. B., KAIROUANI. L.
CMTDE 2024_92	A Solar Desalination System: Experimental study and comparaison with the theoretical results BAHSINE Saida, LACHGUER Chaymae, AIT NOUH Fatima, FRIKHA Nader, GABSI Slimane and ELBERKAOUI Ayoube
CMTDE 2024_93	Study of the Thermal and Mechanical Properties of a Phosphogypsum and date palm fiber composite GARBAYA Hela, JRABAA Abderraouf and ELIMAME Elaloui
CMTDE 2024_94	Adsorption of Malachite Green using a Magnetized Biosorbent BENMANSOUR Yasmine*, OUKEBDANE Khalil, FEDDANE Souad, SEFROU Zineb
CMTDE 2024_95	Methodology and Feasibility of Flood-Control Dams in Artificial Recharge through the Application of Modflow and PhreeqC: Case of the Large Algerian-Tunisian Transboundary Basin, Oued El Kebir. TATAR Mohamed Amine, RAMDANI Rayene Sirine, FEHDI Chemsedinne
CMTDE 2024_96	The utilization of pistachio shell powder as a cellulose producer and its impact on the development of a bio composite CHELBI Yosr, KALLEL Fatma, HADDAR Nader
CMTDE 2024_97	Adsorption of methylene bleu on effective Bio-sorbent from Almond Shell BAHROUNI Jamila, LARCHET Christian, ATTIA Afef, DAMMAK Lasâad, BEN AMAR Raja

CMTDE 2024_98	Industrial Wastewater Treatment Using Olive Seeds Powder and Aluminum Chloride Hybrid Coagulation UGURLU KARAAĞAÇ Sakine
CMTDE 2024_99	Critical Review of Artificial Rain Production Processes OUESLATI Adel, MEGRICHE Adel
CMTDE 2024_100	Innovations in Artificial RainProduction Processes: New Process for Local Rain Production OUESLATI Adel, MEGRICHE Adel
CMTDE 2024_101	Photocatalytic Degradation of Calcifying Organic Molecules in Aqueous Medium Using Synthesized Zinc Oxide: Characterization and Comparative Analysis of Photocatalytic Performance GHERBI Naima*, BOUAZIZ Aya, FIOL Nuria, FILALI Djihene, REBBADJ Sifeddine, BENZAGRI IKram
CMTDE 2024_102	NiO Nanoparticles from Green Chemistry: An Innovative Solution for Diclofenac Degradation in Aqueous Media CHIKHI Bilal, GOUASMI Meriem, SAADI Adel and BOUDJEMAA Amel
CMTDE 2024_103	Eco-Friendly Chromium Removal from Tannery Wastewater Using Electrocoagulation and Opuntia ficus indica Powder ELABBAS Saliha, JAOUAD Yasamine, ADJEROUD Nawel, LECLERC Jean pierre, MANDI Laila, OUAZZANI Naaila
CMTDE 2024_104	Photocatalytic Degradation of Anionic and Cationic Dyes Using Magnetic Iron-Doped Zinc Oxide Nanoparticles: A Green Chemistry Approach for Sustainable Water Treatment BOUAZIZ Aya, GHERBI Naima*, HADJAR Hafida
CMTDE 2024_105	Study of Reverse Osmosis Membrane Fouling CHANDOUL Belgacem*, KAIROUANI Lakdar
CMTDE 2024_106	Effect of thermal dispersion on mixed convection flow in non-Darcy porous medium filled by Das nanoliquid ALI AGHA Hamza*, BOUTALBI Nadir, RAHAL Soufiane
CMTDE 2024_107	Supported liquid membrane and polymer inclusion membranes for Nickel (II) transport OTHMEN Kemla, NCIB Sana, ALYANI Ibtissem, DAMMAK Lasaad, ELALOUI Elimem , BOUGUERRA Wided
CMTDE 2024_108	Development and Characterization of Zinc Oxide Quantum Dot-Based Fluorescent Probes for Heavy Metal Detection BEN KAMEL. K., HBAIEB. S., AMDOUNI. N.
CMTDE 2024_109	Hydrochemical Study and Groundwater Quality Assessment of Gafsa South-El-Guettar Shallow Aquifer HIDOURI Naima, MOUSSAOUI Zouhour, SLEIMI Noomene, HAMED Younes, HAMZAOUI-AZZAZA Fadoua
CMTDE 2024_110	Fluorescence Turn-On Mode via Europium Complexation for Sensitive Detection of Histamine in Food BEN KAMEL. K., BEN ISSA. A., CHEVALIER.Y., AMDOUNI. N., HBAIEB. S.

CMTDE 2024_111	Binary and ternary removal of cationic and anionic dyes by adsorption onto activated biosorbent: isotherm and kinetics studies BOUMAIZA Fatma, MARZOUK TRIFI Ikhlass, MNIF Amine, HAMROUNI Béchir
CMTDE 2024_112	Separation of Zn(II), Ni(II), and Cu(II) Ions using Polymer Inclusion Membranes MAHMOUD Hayet, NCIB Sana, OTHMEN Kemla, LARCHET Christian, DAMMAK Lasâad, BOUGUERRA Wided, ELALOUI Elimame
CMTDE 2024_113	Paradigm Shift: How desalination is changing water resources availability and management in Algeria HASSOUN NEDJAR Nizar, MRAD Dounia and DJEBBAR Yassine
CMTDE 2024_114	Emerging trends in textile wastewater treatment using cellulose nanofibrils : Optimization through Response Surface Methodology AZIZI Nedra, CHERNI Yasmin, DJEBALI Kais, KHIARI Ramzi, TRABELSI Ismail.
CMTDE 2024_115	Sythesis of nanometerial based sensor for heavy metals detection BENCHETTARA. A., KHENISSA. MI, BERRABAH. SE
CMTDE 2024_116	Osmotic Energy and Water Use in Electricity Generation (Application to the Waters of the Ouargla Region) BOUSSAADA Nawel *, HAMMAD Nabila
CMTDE 2024_117	Evaluation of Groundwater Hydrogeochemical Characteristics Using an Integrated Approach: Graphical and Statistical Methods Applied to the 'UZ' Maknessy Basin, Central Tunisia MOUSSAOUI Zouhour; HIDOURI Naima; BEN BRAHIM Fatma; YOUNES Hamed; BOURI Salem
CMTDE 2024_118	Determınatıon of Na lıgnosulfonate efficıency and performace as a natural coagulant ın textıle wastewater treatment ALHAMDAN Atheer Ali Awwad, UGURLU KARAAĞAÇ Sakine
CMTDE 2024_119	Study of the Corrosion Inhibitory Effects of Plants on Steel in Contact with Oilfield Produced Water RAISSI Sahar, BARBOUCHI Sonia, IBIDHI Maiem, YOUNES Mohamed Kadri
CMTDE 2024_120	Sustainable Solutions for Water Scarcity: Co-Current Humidifiers in Humidification-Dehumidification Systems RAHALI Nadia, ZOUAOUI Ahlem, ZILI-GHEDIRA Leila
CMTDE 2024_121	Preparation and characterization of membranes for membrane distillation: Application for water purification BEN ABED Rokaya, RUSSO Francesca, HANNACHI Chiraz, HAMROUNI Béchir, FIGOLI Alberto
CMTDE 2024_122	Photocatalytic degradation of pharmaceutical pollutants in water using BaMnO3 semiconductor DAHMANE. M., MZIR. T., TAB. A.

CMTDE 2024_123	Enhancing Rhodamine B Removal from Aqueous Solutions: A Comparative Study of Clinoptilolite and Fe_2O_3-Modified Clinoptilolite for Advanced Wastewater Treatment HAMMOUDI Hadda Aya*, NIBOU Djamel, AMOKRANE Samira
CMTDE 2024_124	Removal of emerging pollutants using gamma irradiation combined by nanofiltration GHAZOUANI Sabrine*, BOUJELBANE Faten, JELLOULI ENNIGROU Dorra, VAN DER BRUGGEN Bart and MZOUGHI Nadia
CMTDE 2024_125	Synthesis and optoelectronic study of TiO_2 nanotubes decorated with Palladium Pd nanoparticles for photocatalytic application. MEHDAOUI. A., HAJJAJI. A., MARI SOUCASE. B
CMTDE 2024_126	Thermally Activation of Persulfate for Brilliant Green degradation: Plackett-Burman Design and Response Surface Methodology BECHIRI Ouahiba, BENZIDOUNE Amel, HABACHE Naima
CMTDE 2024_127	Desalination in mud fluids GHANMI. H.
CMTDE 2024_128	Enhancement of a single slope solar still performance using an external reflector GRINE Sahar*, MADIOULI Jamel and HIDOURI Ammar
CMTDE 2024_129	Remediation of paracetamol as model emerging pollutant from aqueous medium using an inexpensive adsorbent: Adsorption Modelling AKACHA Imane*, MERZOUGUI Abdelkrim, BOUZID Khadidja
CMTDE 2024_130	Batch and fixed bed column studies for the removal of triphenylmethane dye by Algae root GUECHI El-Khamssa, HAOU Sana., SAOUDI Fethi
CMTDE 2024_131	Removal of Fuchsin basic dye with Ultrasonic-assisted and Conventional batch biosorption on Cattail leaves GUECHI El-Khamssa, HAOU Sana, BENABDESSELAM Soulef, HAMDAOUI Oualid
CMTDE 2024_132	Remediation of soils polluted by crude oil with anionic surfactants RAHAL Soufiane*, MOULAI-MOSTEFA Nadji, ALI AGHA Hamza
CMTDE 2024_133	Study of the inhibitory effect of nickel oxide nanoparticles on the corrosion of carbon steel X70 BOUGHERARA. S.*, CHERIK. .D., LECHEB. F., BELKHIR. M., SMAILI. S., AISSAT. F., DELECI. K., NEGGACHE. L., DREMCHI. A., BOUGHERARA. Saliha
CMTDE 2024_134	Adsorption Test of Lead by Two Natural Adsorbents: Thistle Stems (Scolymus maculatus) and Jujube (Ziziphus lotus) BOUGHERARA Saliha, MEDJDOUB Fatma, BOUZID Radia, ILLOULI Thileli, MOUHOUCHE Hanane, LECHEB Fatma, DELLECI Kamel, BELKHIR Meriem ; LOUHAB k.
CMTDE 2024_135	The Application of Donnan Dialysis for micropollutants removal MARZOUK TRIFI Ikhlass, DAMMAK Lasâad, HANNACHI Chiraz, HAMROUNI Béchir

CMTDE 2024_136	The removal of dyes by adsorption onto bioadsorbent from agricultural waste DJEMEL Amira, MARZOUK TRIFI Ikhlass, HANNACHI Chiraz and HAMROUNI Béchir
CMTDE 2024_137	pH measurement of seawater: State of the art for measurement of mean activity coefficients in saline aqueous matrices BEN ACHOUR Mounir*, GUESMI Fatma and HANNACHI Chiraz and HAMROUNI Béchir
CMTDE 2024_138	Highly porous biochars developed from orange, pomegranate, and watermelon peels as potential adsorbents for hexavalent chromium removal: Optimization by Response Surface Methodology AZAIEZ. S., BEN KHALIFA. E., MAGNACCA. G., CESANO. F., HAMROUNI. B.
CMTDE 2024_139	Rehabilitation study calco-carbonic equilibrium of water. LARBI .L., FERTIKH.N.
CMTDE 2024_140	Dyes removal from water by adsorption on coffee grounds GUESMI Fatma, HANNACHI Chiraz and HAMROUNI Béchir
CMTDE 2024_141	Application of response surface methodology for chromium removal by adsorption on date pits MAALAOUI IMEN, KHIARI Kaouther, GUESMI Fatma, HANNACHI Chiraz and HAMROUNI Béchir
CMTDE 2024_142	Preparation and characterization of PVDF flat sheet membranes using DMF solvent for the water treatment by membrane distillation HANNACHI Chiraz, BEN SIK ALI Mourad and HAMROUNI Béchir
CMTDE 2024_143	Water contaminated by Legionella pneumophila: Detection, Quantification and Typing of Strain BENABBOU Amina Amal, GUESMI Fatma, HANNACHI Chiraz, HAMROUNI Béchir
CMTDE 2024_144	Treatment of paper industrial wastewater by constructed wetlands system MAHMOUDI Amal, HANNACHI Chiraz, HAMROUNI Béchir
CMTDE 2024_145	New and Improved Design for the HDH Humidification-Dehumidification Desalination System GHEZAIEL Abir, BEN EZZINE Nizar*, SGHAIER Jalila, BELLAGI Ahmed
CMTDE 2024_146	Prevention of iron fouling of reverse osmosis desalination membrane MELLITI Emna, VAN DER BRUGGEN Bart, ELFIL Hamza
CMTDE 2024_147	Eco-friendly adsorption of Nitrates and Phosphates from Natural Waters by Oleander Leaves ZENDAH Houda, MARZOUK TRIFI Ikhlass

CMTDE 2024_148	$NiAl_2O_4$-NiO nanostructures as a new nanotechnology platform for detecting pesticides in natural water HAMMAMI Asma, BARDAOUI Afrah, MESSAOUD Olfa
CMTDE 2024_149	Modeling and performance analysis of membrane distillation coupled with thermo-solar for seawater desalination. MENASRI Rabah*, TRIKI Zakaria, MENASRI Yahia, OUNNAR Yasmine, HAMROUNI Béchir
CMTDE 2024_150	Effective Alzarin Red S dye adsorption and removal from aqueous solution onto artichoke waste biochar, synthesis, characterization, adsorption studies and optimization by Box-Behnken design TABASSI Dorra, BEN KHALIFA Eya, GUESMI Fatma, HANNACHI Chiraz, HAMROUNI Béchir
CMTDE 2024_151	Investigation on the Impact of Renovating Old Buildings on Energy Consumption and Greenhouse Gas Emissions: A Case Study of Single-Family Homes in France ZAALOUNI Yathreb , BEN ABID Taycir
CMTDE 2024_152	Numerical simulation of energy storage with phase change materials in building applications BHIRI S., TRABELSI S., SOUAI S., GARROURI S., SEDIKI E.
CMTDE 2024_153	Developement of Sustainable Polymer Inclusion Membranes for Effective Cobalt Ion Extraction and Recovery ALYANI Ibtissem; MAHMOUD Hayet, NCIB Sana, BOUGUEURRA Wided
CMTDE 2024_154	Enhancing Copper Recovery: The Impact of Voltage in Electromembrane Extraction with Supported Liquid Membranes GHABRI Chafik; NCIB Sana, JADLAOUI Chiraz, BOUGUEURRA Wided
CMTDE 2024_155	Synergistic Adsorption and Photocatalysis: A Bifunctional Approach for Efficient Dye Removal in Wastewater Treatment ABBES Maroua, ZEGHIOUD Hicham, KANE Abdoulaye, BOUGUERRA Wided, ELALOUI Elimame
CMTDE 2024_156	Optimization of Cadmium Extraction from Tunisian Phosphates via Vapometallurgy: An Experimental Design Approach MLAOUAH Marwa, MOUEDHEN Ghada, BOUGUERRA Wided
CMTDE 2024_157	Impact of Mining Activities on Soil Contamination: Assessment of Trace Elements: Cadmium in Phosphate transformation Sites of Mdhilla,Tunisia. MLAOUAH Marwa, CHIBANI Amel, BOUGUERRA Wided, ELALOUI Elimame
CMTDE 2024_158	Water Softening Optimization: Calcium and Magnesium Removal via Donnan Dialysis Using Cationic Fujifilm Membranes – A Doehlert Design Approach CHAABANI Nabila, DAMMAK Lassaad., LARCHET Christian, BOUGUERRA Wided, ELALOUI Elimam

CMTDE 2024_159	Optimization of Copper and Nickel Removal from Aqueous Solutions Using Donnan Dialysis with Fujifilm Cation-Exchange Membranes: A Response Surface Methodology Approach CHAABANI Nabila, DAMMAK Lassaad, LARCHET Christian, BOUGUERRA Wided, ELALOUI Elimam
CMTDE 2024_160	Development of Polymer Inclusion Membrane System for Selective Cadmium Removal from acidic media JADLAOUI Chiraz, NCIB Sana, BOUGUEURRA Wided, ELALOUI Elimam
CMTDE 2024_161	Nutrient Removal from Aqueous Solutions Using Wood-based Biochar : Adsorption Capacities, Kinetics, and Isotherm Analysis HADDOUK Amani, TRABELSI Ismail, WAHAB Mohamed Ali
CMTDE 2024_162	Optimization of dye removal from wastewater by adsorption onto raw and activated carbon obtained as a co-product from fast pyrolysis of sawdust RZIG Boutheina, BELLAKHAL Nizar
CMTDE 2024_163	Sorption-photocatalysis–enhanced effects of biochar-nanocomposite based on palm cellulose fibers MSAADI Radhia, SASSI Wafa, AMMAR Salah, CHEHIMI Mohamed M.
CMTDE 2024_164	Memo on Microprocessor Cooling AMARA Khaoula and ABDELJABAR Ridha
CMTDE 2024_165	Modeling predictions of soluble microbial product using integrate ASM1-SMP model and statistical analysis in a submerged membrane bioreactor for wastewater treatment under different COD/N ratios. BENALIOUCHE Hana, ABDESSEMED Djamal, BENALIOUCHE Fouad, LESAGE Goeffroyd, HERAN Marc
CMTDE 2024_166	A novel LiBr-H_2O Absorption Cooling System Incorporating a Turbo-Compressor SAHLI Haythem, HAMMEMI Rania, ELAKHDAR Mouna
CMTDE 2024_167	Using desalination brine on Halophyte Cultivation KALBOUSSI Nesrine*, AZEIZ Hajer, BEN HAMED Karim and ELFIL Hamza
CMTDE 2024_168	Effect of Demister Separation Efficiency on the Freshwater Purity in MSF-OT/TVC Desalination Process SELLAMI Ahlem, BEN ALI Mongi, KAIROUANI Lakdar
CMTDE 2024_169	Naturel tracer and Isotopic approach to describe groundwater behaviour: an example of the Sejnane Basin (North-Western Tunisia) KHOUATMIA Mohamed, AMIRI Chorouk
CMTDE 2024_170	Degradation of Aqueous Quinoline Yellow Solutions Induced by Gamma Irradiation BEN SALEM Malak*, ZAOUAK Amira and ABDERRAZAK Houyem
CMTDE 2024_171	Valorization of biomass in an efficient treatment process for oil wastewater FAKHFAKH Fatma, BARHOUMI Malek, BARBOUCHI Sonia

CMTDE 2024_172	An Innovative Strategy for Repurposing End-of-Life Desalination Membranes in Technical Textile Applications PAŞAOGLU Mehmet Emin
CMTDE 2024_173	Eco-Friendly and Cost-Effective Water Treatment: Degradation of Acid Green 25 via Fenton Process Using Fe/Perlite Catalyst AMRI Sondes, BOUMNIJEL Ibtissem, HDHIRI Rihab
CMTDE 2024_174	Synthesis and characterization of a novel eco-friendly bioflocculant: Perfomance study for treatement of real industriel effluent GHODBANI Zahwa, GAMOUDI Safa
CMTDE 2024_175	Solar photo-Fenton at neutral pH using Fe^{3+}-NTA as a novel tertiary treatment for microcontaminants removal MEJRI Amal, SORIANO-MOLINA Paula, MIRALLES-CUEVAS Sara, SÁNCHEZ PÉREZ José Antonio
CMTDE 2024_176	Cysticidal Activity of Trachyspermum ammi Essential Oil against Acanthamoeba Isolates from Dental Clinic and Hospital Water Networks HIKAL WAFAA M. * and A.H. SAID-AL AHL Hussein
CMTDE 2024_177	Bacteriological Evaluation of Treated Wastewater in Tunisia DHIB DRINE Soukeina
CMTDE 2024_178	Valorization and Development of a Polyester Polymer from Alfa Fiber LAIB Nouri*, BENYAHIA Azzedine,DEGHFEL Nadir, LEBID Mahmoud
CMTDE 2024_179	Study of the Salinity of Irrigation Water and Soil in Several Irrigated Plots in the Relizane Wilaya KOUADRI SAMEUT Moussa, MAKHALDI Youssouf Islam, BOUSSAID Oussama, ZAIRI Youcef, HARTANI Tariq
CMTDE 2024_180	Hydro-chemical diagnosis and quality of groundwater in the M'zab Valley following the effects of floods. Algeria BABA AMER Zohra, BOULAGHMEN Farida
CMTDE 2024_181	Validation of analytical method for the determination of pesticides residues in environmental matrix NASRAOUIA Nadia, BELLAZREG Wided, HARAKETI Manel, DALY Faten, and HAMDI Houyem

CMTDE 2024_1

Assessment and comparison of triazole pesticides in agricultural draining water from Tunisia

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Abstract

Modern agriculture is a sophisticated technological process that utilizes advanced science and engineering to produce crops from land, water, and energy resources. Pesticide-related surface water contamination is an important concern because it has a detrimental effect on ecosystems and human health. The surface water may be seriously threatened by overuse and persistent pollution. The purpose of this study is to examine the presence of triazole pesticides in draining water samples collected from two separate Tunisian locations. Triazole has been extracted from draining water using a liquid-liquid extraction (LLE) technique. Gas chromatography coupled to mass spectrometry (GC-MS) was used to analyze these substances. Triazole levels in eight draining water samples from the Kebili region were examined; they varied from ND to 13.84 ng L-1. The concentrations of triazole pesticides in four draining water samples collected from the Cap Bon area ranged from 14.64 to 41.59 ng L-1. The reuse of draining water for agricultural applications after a secondary treatment becomes allowed, because the concentration of triazole pesticides did not exceed the limitations set by the regulations controlling draining water.

Keywords : Triazole pesticides, distribution, draining water, Cap Bon, Kebili, GC-MS.

CMTDE 2024_2

Selective extraction of Co (II) and Ni (II) from sulfate medium by synergistic solvent extraction

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Abstract

The liquid-liquid extraction of cobalt (II) and nickel (II) from a medium sulfate with di-(2-ethylhexyl) phosphoric acid in chloroform at 20°C was studied, and their separation studied as a function of the following parameters: pH, extractant concentration and 1-octanol. The stoichiometry of the extracted complexes was determined by the slope method. The organometallic complexes extracted from cobalt (II) and nickel (II) in the organic phase are CoL22HL and NiL22HL respectively. Separation of these metals increases with D2EHPA concentration and the presence of 1-octanol, and the pH1/2 difference of each metal is calculated. The values of the extraction constants of the metal complexes in the absence of 1-octanol vary in the following order: >Co>Ni; on the other hand, in the presence of 1- octanol, they vary in the following order: >Ni>Co.

Keywords : selectivity, synergistic extraction, separation, cobalt and nickel.

CMTDE 2024_3

Elaboration and Characterization of Microfiltration Ceramic Membrane

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Abstract

Ceramic membranes exhibit significant advantages over their polymer counterparts in applications involving high temperatures, pressure, and aggressive environments. Typically, porous ceramic supports are required for membrane manufacturing. Indeed, the top layer (membrane) is intricately linked to its support. Moreover, the quality of the support is pivotal for the integrity of the membrane layers during subsequent preparation steps. The primary aim of this study is to develop cost-effective membrane supports. Accordingly, kaolin emerges as a popular choice for aluminosilicate-based ceramics due to its widespread availability. Consequently, traditional starting materials such as alumina, Ziconia, and cordierite are substituted with locally sourced kaolin to reduce fabrication costs [1-3]. The primary foreign oxides present in this kaolin include K_2O, MgO, TiO_2, and Fe_2O_3. This research outlines the development and characterization of porous ceramic membrane supports utilizing kaolin. The powders, combined with specific organic additives, are extruded to form a porous tubular configuration with highly uniform porous structures. Subsequently, the impact of sintering temperature on support porosity is investigated. It has been observed that the mean pore diameter, as measured by Hg porosimetry, is

approximately 4.1 µm, with a porosity of 51% after heat treatment at 1250°C for 1 hour. The preparation of the kaolin-based top layer is conducted using the slip casting method. A heating treatment at 1050°C results in an average pore size of 0.5 µm. This membrane demonstrates potential for crossflow microfiltration (MF), suggesting its suitability for wastewater treatment applications.

Keywords : Supports; Membrane; Microfiltration; Kaolin

CMTDE 2024_4

Synthesis, Characterization, and Photocatalytic Performance of $Bi_{12}CoO_{20}$, ZnO, and BCO/ZnO Nanomaterials

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Abstract

The pollution of wastewater by pharmaceutical pollutants is an increasing concern. Photocatalysis is a promising technique for the removal of these pollutants. In this study, a new photocatalyst, $Bi_{12}CoO_{20}$, was synthesized via the coprecipitation method, and a commercial zinc oxide (ZnO) was used for the formation of $Bi_{12}CoO_{20}$/ZnO nanocomposites. The synthesized nanomaterials were characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM). The photocatalytic activity of the heterojunction was studied for the degradation of Amoxil (AMX), a commonly used antibiotic. The degradation was carried out under natural light and optimized in terms of the mass ratio and the initial concentration of the pollutant (10 to 30 mg L-1). The results show that the $Bi_{12}CoO_{20}$/ZnO nanocomposites are effective for AMX degradation. The best degradation performance, around 85%, was achieved at an initial concentration of 10 mg L-1 at a pH of approximately 5.21, with a catalyst dose of 1 mg L-1 and a ratio of 75% $Bi_{12}CoO_{20}$ and 25% ZnO. This study demonstrates that $Bi_{12}CoO_{20}$/ZnO is an effective photocatalyst for the degradation of Amoxil. This discovery opens new prospects for the treatment of wastewater contaminated with pharmaceutical pollutants.

Keywords : Synthesis; Characterization; $Bi_{12}CoO_{20}$/ZnO; Photodegradation; Amoxil.

CMTDE 2024_5

Comparative Study of Violet Crystal Adsorption on Raw and Purified Nanomaterials

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Abstract

Industrial wastewater causes significant damage to the environment and public health. Among these discharges, dyes from the textile industry are particularly harmful. These dyes hinder photosynthesis and gradually degrade the health of living organisms. To address these issues, various treatment methods have been employed, with adsorption processes being among the most promising. In this context, we focused on the treatment of water contaminated with crystal violet, a dye known to be harmful and dangerous to both the environment and human health. This treatment is based on the use of an interesting adsorbent nanomaterial, namely raw and purified clay. The clay used in this study is Algerian bentonite. A comparative adsorption study of this dye on the two types of clay was conducted. The optimization of key parameters influencing adsorption, such as the pH of the initial solution, adsorbent mass, initial dye concentration, adsorption time, and temperature, was studied.

Keywords : Adsorption; Water Pollution; Basic Dyes; Nanomaterials; Clays.

CMTDE 2024_6

Physico-chemical study of wastewater discharged in the environment in the East-Algeria sector CGS LaBelle Annaba

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Abstract

Industrial wastewater treatment processes are practices dedicated to combating pollution on the environment, the economy and human health. This study aims to evaluate the performance and efficiency of the wastewater treatment plant (WWTP) of the Raffinerie Corps Gras Seybouse-LaBelle (CGS-LaBelle) located in Annaba by following the different phases of industrial

wastewater treatment as a Dissolved Air Flotation system (DAF) and biological systems such as Moving Bed Biofilm Reactor (MBBR). It is based on the determination of physico-chemical parameters, it is: the pH measurement by a pH-meter, the chemical oxygen demand (COD) which represents the amount of oxygen required for the chemical oxidation of organic materials, the biochemical oxygen demand (BOD5) that represents the amount of oxygen required for micro-organisms degrade organic matter in 5 days and finally suspended matter which represents the amount of solid particles suspended in water and their determination is done by centrifugation.

Our results showed a decrease in values after the raw water treatment process where the pH decreased with an average of (2.22), the temperature with an average of (1.16°C), ditto for COD and BOD5 levels which decreased with averages of (4121.6 mg/l) and (198.28 mg/l) respectively, finally a decrease for SS with an average of (386.8 mg/l).

In summary, the plant has satisfactory results and allows a good removal of organic matter that leads to a good quality of purification despite the certification of the effluent contamination at its entrance with a high degree of pollution.

Keywords : Wastewater, COD, BOD5, MSS, Wastewater treatment plant.

CMTDE 2024_7

Removal of emerging contaminants from desalination plane effluent by activated biowaste

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Abstract

Emerging contaminants (ECs) are pollutants that have emerged as a significant concern in recent times. They are mainly organic compounds, including pesticides, pharmaceuticals, hormones, plasticizers, food additives, and other organic compounds that have been found in natural wastewater streams generated by human and industrial activities. A majority of ECs do not have standard regulations in place, and they could lead to lethal effects on human and aquatic life even at small concentrations. Conventional water treatment methods are ineffective in removing these pollutants. Biosorption represents a promising method for the removal of emerging contaminants,

offering highly efficient removal with a simple operating design. This paper examines the issue of water pollution induced by the tetracycline (TC) antibiotic, which has attracted considerable global attention in recent years. This is due to the extensive use of TC, its long-lasting presence in the environment, and the potential harm it can cause to human health. The utilisation of activated thyme as a sorbent for the removal of tetracycline from aqueous environments has been identified as a promising approach.

Keywords : Emerging contaminants; Biosorption; Wastewater; Tetracycline

CMTDE 2024_8

Environmental impact study of reverse osmosis desalination plants

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Abstract

With the world's growing population and the industrial revolution, the demand for water is constantly increasing. Seawater desalination technology plays an important role in human life by solving the main problem of supplying water to areas suffering from water scarcity. The operation of reverse osmosis seawater desalination plants has a significant impact on marine ecosystems. However, the brine discharged has a negative impact on the marine environment and should therefore be reused, treated or properly discharged. The most serious impacts are concentrated around the discharge points of these plants. These discharges cause disturbances in local hydrographic dynamics and water quality in the receiving areas, which have a direct impact on the physiological processes of marine organisms, such as enzymatic activity, nutrition, reproduction, respiration and photosynthesis. A study carried out within a 5 metre radius of the brine discharge point of a small reverse osmosis desalination plant with a capacity of 5,000 cubic metres per day, where the brine is usually known as the reject water stream, with a salinity of over 55,000 mg/L TDS in the stream, showed a 50% reduction in the aquatic population in this area, as well as the appearance of new species that were not previously present due to changes in the receiving environment. The potential impact on estuarine communities results in various levels of invertebrate and fish mortality due to the loss of their defence mechanisms as they pass

through these systems. Many organisms die either by suffocation due to disruption of their gills, internal or external mechanical damage during passage through the systems, or exposure to additives. Mortality can be immediate or delayed. In addition, most eggs and larvae of invertebrates and fish are destroyed.

Keywords: Brine, Desalination plants, Impact, Marine organisms.

CMTDE 2024_9

Incorporation of a Nickel Into Polytungstic Matrix $(\alpha_2P_2W_{17})^{10-}$ Nanoparticles : A Green and Recyclable Catalyst for Dye Decolorization

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Abstract

In recent years, interest has focused on the synthesis of Nanocomposites and their applications in catalysis, Polyoxometalates (POMs) have attracted much attention as building blocks for functional composite materials because of their interesting nanometric structures. This property is exploited in green chemistry and in catalytic oxidation reactions for the degradation of organic compounds such as dyes. The Synthetic dyes contained in industrial effluents from textile, cosmetic, leather, paper and pharmaceutical… cause water pollution due to their toxicity, posing a serious threat to the environment and human health. These types of pollutants are ubiquitous and persistent; they are difficult to eliminate by conventional techniques. New technologies based on chemical oxidation have been developed to reduce these recalcitrant pollutants, those using strong oxidizing agents such as potassium permanganate, having a strong oxidizing potential. However, the catalysts used for these oxidation reactions may drive to a new pollution. The recyclable polyoxometalates (POMs) used as catalysts in the oxidation of dyes, may provide an alternative approach to solve this problem, due to their stable structure and to their oxydo-redox properties. For this reason, a nickel-substituted catalyst of Dawson type (α2P2W17Ni)8- is used in this study to accelerate the oxidation reaction of azo dye methyl orange (MO) by KMnO4 in aqueous solution. The optimization of parameters influencing the decolorization reaction of methyl orange has been studied. The discoloration efficiency reached is (90.75%). The recovery of the catalyst and its reuse in several cycles was also studied for the same reaction, without altering its catalytic properties.

Keywords : Oxidation catalysis, Nano-(POM)s, Water pollution, Green chemistry, Decolorization

CMTDE 2024_10

Study of the Adsorption Characteristics of Various Aqueous Substances Using a Local Adsorbent

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Abstract

This work focuses on the adsorption of the cationic dye basic fuchsin (BF) by a phytoadsorbent prepared in the laboratory. to clarify the fixation process of this product, batch experiments were conducted to study the effect of operating parameters on the adsorption process such as: equilibrium time, mass, pH, dose of adsorbent, and initial concentration of the dye. The experimental results showed that the adsorption of cationic dye basic fuchsin (BF) by prepared phytoadsorbent depends on the equilibrium time at 15 min, Preliminary batch studies indicate that pH 5 is the optimal solution pH and that the optimal mass is 4 g.L-1. To describe the adsorption equilibrium, the experimental data were illustrated, and the obtained data were applied to calculate the thermodynamic parameters. Specific rate constants for the processes were calculated by kinetic measurements, and pseudo-second-order adsorption kinetics were observed in each case. The use of these adsorption methods is both respectful and suitable for the environment. The materials and processes involved are designed to minimize environmental impact, making them an eco-friendly choice for industrial applications.

Keywords: Adsorption, Basic Fuchsin (BF), phytoadsorbent , Kinetic Measurements, Batch Experiments.

CMTDE 2024_11

Synthesis and Evaluation of Novel Spirooxypirimidine Derivatives as Antibacterial and Antioxidant Agents

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Abstract

A new class of compounds called spirooxypirimidine derivatives has been synthesized and tested for their antibacterial and antioxidant properties. The compounds were designed to have a specific molecular structure that could help them fight against bacteria. When tested against a range of bacteria, including some that are resistant to antibiotics, several of the compounds showed significant antibacterial activity. Additionally, they were found to have antioxidant properties, which could help them protect against cell damage and oxidative stress. The results suggest that these compounds could be useful in treating bacterial infections, particularly those that are resistant to antibiotics, and may also have other therapeutic applications. Further research is needed to fully understand how these compounds work and to explore their potential uses in medicine.

Keywords : Spirooxypirimidine derivatives, Antibacterial activity, Antioxidant activity, antibiotics

CMTDE 2024_12

Synthesis and characterization of composites-based zeolite Y/TiO_2 for the treatment of BB41 dye from synthetic solution.

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Abstract

Composites based zeolite Y and semiconductor TiO_2 with different mass percentages (2, 5 and 10 %) were synthesis by hydrothermally method and treated thermally at 600°C during 6 h. The textural properties of the samples were highlighted by X-ray diffraction (XRD), scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS). The results showed that the

Anatase TiO_2 phase was obtained, and these particles were dispersed on the surface of zeolite Y. The prepared composites were used in the treatment of textile BB41 dye solutions in dark and under solar irradiation. The results showed that the sample of composite with 5% of TiO_2 provides the best performance under solar irradiation. According to the results, a mechanism of photo catalysis reactions was proposed.

Keywords: Composites; Zeolite Y; TiO_2; Adsorption; Photo catalysis; BB41 dye

CMTDE 2024_13

Hydrogen gas production using semiconductors Fe_2O_3, CuO, ZnO and composites Clay/Fe_2O_3, Clay/CuO and Clay/ZnO by photo catalysis

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Abstract

In the present investigation, composites (Clay/Fe_2O_3, Clay/CuO and Clay/ZnO) were elaborated from Algerian clay and synthesized Fe_2O_3, CuO and ZnO oxides for hydrogen gas production. The oxides were hydrothermally synthesised from reactive reagents with a thermally treatment at 450°C during 6 h. All obtained samples were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS) for highlighted their textural properties. The results showed that the hematite α-Fe_2O_3, CuO and ZnO semiconductor phases were obtained successfully. Neutral and basic media were tested to produce Hydrogen by photo catalysis under UV-visible irradiation in presence of Na_2SO_4 as hole sensor. These experiments showed promote results in gas H_2 production using the synthesised composite Clay/Fe_2O_3, semiconductors α-Fe_2O_3, CuO and ZnO in neutral medium.

Keywords: Composites; Clay; Fe_2O_3; CuO; ZnO; Photo catalysis; Hydrogen

CMTDE 2024_14

Using Support vector machine optimized with Mosquito Swarm Algorithm to predict water productivity of a nanofluid-based solar still equipped with thermoelectric modules

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Abstract

The integration of nanofluids in desalination processes can lead to significant improvements in efficiency, cost-effectiveness, and sustainability, making them an attractive option in the search for innovative water treatment solutions. The growing complexity of contemporary engineering systems necessitates the use of optimization techniques to enhance performance and efficiency. Optimization, which aims to maximize effectiveness, is especially crucial in water productivity. While traditional algorithms like gradient descent and linear programming focus on precise solutions, they often face challenges with high-dimensional problems. In contrast, bio-inspired metaheuristics such as particle swarm optimization and grey wolf optimization provide viable solutions for intricate and non-linear issues. These bio-inspired algorithms are divided into categories like swarm intelligence, genetic, and physics-based approaches, each emulating natural processes such as animal behaviour, genetic evolution, or physical principles to identify optimal solutions. The proposed mosquito mating swarm algorithm merges the advantages of swarm intelligence with genetic algorithms. The data required are obtained from the experimental study carried out with [1]. The selected inputs include time, solar radiation, ambient temperature, glass temperature, water temperature, basin temperature under different fan powers and nanoparticle concentrations while water productivity was selected as an output. R^2, MAE and RMSE are used to measure the accuracy of the developed model and allow to make a comparison with those models developed in literature to validate our model [2, 3].

Keywords : Nanofluids, Desalination, Optimization, Bio-inspired algorithms, Water productivity

Wastewater treatment with activated carbon prepared from green residues

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Abstract

The objective of this work is the valorization of natural waste by preparation of an activated carbon and application to the elimination of organic pollutants by adsorption. The two dyes chosen are malachite green (VM) and methyl orange (MO) in aqueous solutions. Activated carbon has been prepared from waste materials which are natural residues by pyrolysis and activation of activated carbon with phosphoric acid (H_3PO_4). After determination of the PZC zero charge point, the latter showed us that the PZC of the activated carbon is 5. The study of the kinetics showed us that the pseudo first order model (PPO) better describes the adsorption process of the two dyes VM and MO. The efficiency values of these two are: 95.67% for CV and 97.86% for MO. The isothermal study shows us that the two models of Langmuir and Freundlich are privileged.

Keywords : activated carbon, dyes, adsorption, natural waste, depollution.

CMTDE 2024_16

Physicochemical and biochemical responses of apple cultivars during storage as induced by saline water irrigation

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Abstract

Apple is one of the most economically important fruits. This project aims to study the impact of pre -harvest treatments on the organoleptic and nutritional quality of apple fruits as well as the chilling injury symptoms of fruits during cold storage. Apple trees cvs. Golden and Gala grown in private orchards located in the region of Sbiba–Kasserine, were studied. Physicochemical parameters such as fruit weight, pH, titratable acidity, soluble solids content, ripening index, and colour were studied. The content of anthocyanins, flavonoids, total phenolics, vitamin C and antioxidant capacity were analyzed in peel and flesh fruits. Chilling injury symptoms (flesh

mealiness, browning, fruit weight loss and chilling injuryindex) were analyzed in fruits after 6 months of cold storage (4°C and 90% RH). The postharvest quality during cold storage showed a reduction in physicochemical parameters (fruit weight, size, firmness) and the antioxidant compounds in both peel and flesh fruits decreased. The peel of fruits presented a higher antioxidant activity than the flesh. The antioxidant activity of the cv. Gala was 485.56 and 289.60 µg Trolox/g of FW for peel and flesh fruit, respectively. Likewise, the cv. Golden presented a RAC value of 568.42 µg Trolox /g of FW for the peel and 325.65 µg Trolox /g of FW for the flesh of the fruit. The cold storage period increased the severity of chilling injury symptoms such as mealiness and browning.

Keywords : Apple, cold storage, antioxidants, chilling injury

CMTDE 2024_17

Study of the elimination of phenol from water with intensive and extensive processes.

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Abstract

In this work two photocatalytic processes for the degradation of phenol in water are presented. The first one is extensive (EP) which is carried out in a treatment chain of two steps allowing the adsorption of the pollutant by a natural activated carbon from the grapes. This operation is followed by a photocatalytic degradation of the residual phenol in the presence of TiO_2. The second process is intensive (IP) is realized in one step in the presence of a hybrid photocatalytic nano material prepared from a natural activated carbon and TiO_2.

The evaluation of the two processes, EP and IP, is based on the analytical monitoring of the initial and final parameters of the water to be treated, i.e., the phenol concentration by liquid phase

chromatography (HPLC) and total organic carbon (TOC). For both processes, the sampling was carried out every 10 min for 120 min of treatment time to measure the phenol concentrations.

The elimination and degradation rates in the case of the intensive process are better than the extensive process. In both processes, the catechol molecule was detected as an under-product of degradation. However, for the IP process, the concentration of this by-product of phenol was insignificant in the EP process.

Keywords : photocatalysis, extensive process, intensive process, phenol.

CMTDE 2024_18

Water treatment by Photo-catalytic Degradation using *Ruta* Extracts

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Abstract

Water pollution increase day by day and its impact on human health, aquatic-ecosystem, and biodiversity cause a serious threat. Industry represents the main cause of the contamination of water due to the various toxic chemicals, organic and inorganic substances like pesticides, pharmaceuticals and dyes.

Water treatment using environmentally friendly methods is currently the major consideration of researchers; in this context the Ruta extract is a natural product with a photo-sensitizer activity which can be used for the photo-degradation of methylen blue (MB) dye. Phytochemical screening of the petroleum ether extracts of Ruta montana L. and Ruta chalepensis L. leaves have been realized after its extraction using soxhlet method; after that the xanthotoxin was purified from the obtained extract and characterized using different spectroscopic methods. The obtained extracts rich in secondary metabolites and the pure xanthotoxin were tested for degradation of methylene blue dye using a photo-catalytic process. It is shown that the Ruta chalepensis extract exhibited better photo-degradation performance (24%) than Ruta montana extract with (18%) at a concentration of 20 mg/L, while the pure xanthotoxin at the same concentration showed the degradation of (33%) of dye, this efficiency increase with increasing the extract dose. The use of

the Xanthotoxin/ZnO hetero system caused an improvement of the photo-degradation ability to (91%); these results were confirmed by the study of the kinetic of the dye degradation, where the hetero system Xanthotoxin /ZnO represents the highest values of the rate constant (k) and the correlation coefficients (R^2).

Keywords : Ruta montana L., Ruta chalepensis L., photo-degradation, furocoumarins, methylen blue, ZnO.

CMTDE 2024_19

Optimization of the extraction parameters of bioactive compounds from leaves of the olive cultivar «Chemleli» as induced by saline water irrigation

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Abstract

In Tunisia, the olive cultivation and industry generate enormous quantities of olive leaves, which are generally underutilized. The present work aimed at optimizing the solvent, temperature, and time of the solid-liquid extraction of phenolic compounds from fresh and dry leaves of the olive cultivar Chemlali. This extraction was carried out with different solvents (70% ethanol, 70% methanol, distilled water) under different temperature treatments (0 °C, 50 °C, 100 °C) and time (0h, 12h, 24h). The quantification of phenolic compounds is commonly done through colorimetric methods. The anthocyanin content is determined by reading the optical density at 535 and 700 nm. The total phenolics content is determined by the Folin-Ciocalteu test. Flavonoids are quantified by the aluminium trichloride method. Antioxidant activity was determined by the method of DPPH (1,1-diphenyl-2-picrylhydrazyl). Likewise, for the chlorophyllin pigments, an optical density reading was taken at 452.2 and 633 nm and 644 nm. Results showed that the ethanolic extracts at a temperature of 100 °C after 24 hours of incubation provide the highest yield of phenolic compounds (anthocyanins, flavonoids, total phenols, chlorophyll pigments and antioxidant capacity) followed by the methanolic extract. At these extraction conditions the anthocyanins content was 6.82 mg C3GE/kg of FW. The flavonoids content was 15.43 ± 5.77 mg CE/100g of FW. Total phenolics were 108 mg GAE/100g of FW. The chlorophyll pigment content was19 ± 1 mg/g of FW. The antioxidant capacity was 132 ug TE/g of FW.

Keywords : olive leaves, extraction, phenolic compounds

CMTDE 2024_20

Development of a novel antimicrobial and optimization for future application in poultry farming

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Abstract

Chicken farming is an important economic field in arid and semi-arid climate countries, but it remains very sensitive to bacterial infections, with mortality exceeding 70% in some cases in some farms. Salmonella is a major contaminant for poultry, with an increasing prevalence of resistance to conventional antibiotics, more merits are being demonstrated for an alternative proposal. Through this multidimensional approach, we have identified the optimal conditions to maximize phage activity while exploring the complex interactions between the different elements of our system. This work led to finding substrates favorable to phage growth and reducing the multiplication of Salmonella bacteria. The combination of magnesium and copper or copper considered alone has a negative effect on bacterial growth and no effect on phages enhancement. In addition, temperature and pH inhibit phage multiplication. Chia and probiotics are stimulating substrates. This study will help to shed light on the underlying mechanisms of phage therapy and guide the development of new therapeutic strategies.

Keywords : bacteriophages, antimicrobials, poultry, Salmonella.

CMTDE 2024_21

Adsorption of heavy metals using synthetic biomaterial: application to marine environment

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Abstract

The impact of climate change and coastal eutrophication, particularly due to metal pollution, has significant environmental consequences, affecting ecosystem quality, marine species, and human health through bioaccumulation in the marine food chain. This study aims to characterize the concentration levels of heavy metals in seawater from the old port of the Bizerta region. Adsorption is an innovative strategy used for environmental remediation, but chemical adsorbents can be costly and have negative ecological impacts. Organic waste, such as orange peels, presents a more eco-friendly and cost-effective alternative. Orange peels were optimized to enhance their heavy metal adsorption capacities, and the impact of probiotic bacteria combined with orange peels was also investigated. Six bacterial strains were activated, with *Terribacillus halophilus* (E11) showing the most significant biomass. The results showed that a concentration of 1 g/L of orange peel powder was optimal for forming an effective biomaterial. Eight biomaterials were synthesized and characterized, with M3' (composed of distilled water, probiotics, and calcined orange peel powder) demonstrating the best performance in terms of heavy metal adsorption. Infrared analysis revealed key functional groups such as C-N, aromatic C=C, and OH. The adsorption efficiency was evaluated for iron (Fe), copper (Cu), and magnesium (Mg), with biomaterials M3', M5, and M6 showing significant retention for iron and copper. M3' also absorbed all the magnesium present. The results highlight the potential of orange peel-based biomaterials to mitigate metal pollution, offering sustainable solutions to reduce the ecological footprint in coastal regions.

Keywords : Synthesis of materials, biovalorization of organic residues, heavy metal depollution.

CMTDE 2024_22

Effect of the mass ratio of phosphoric acid on the chemical impregnation of a vegetal waste for the preparation of a porous material

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Abstract

This study focused on synthesizing several activated carbons from a commonly available vegetal waste in North Africa. The mass ratio of orthophosphoric acid (H_3PO_4) used as a chemical activation agent was varied, while keeping other preparation parameters constant. The objective was to evaluate the influence of different H_3PO_4 ratios on the properties of the resulting activated

carbon aiming to use the material for the adsorption of organic dyes in water treatment applications, thus contributing to environmental protection. To achieve this, we impregnated four samples of cypress cones of equal mass, in acid solutions with a concentration of 60%, prepared from a base solution at 85%, with varying impregnation ratios (1:1, 1:2, 1:3, 1:4). The four systems (raw material + acid solution) were subjected to ultrasonic treatment for one hour, then dried in an oven for 24 hours. Subsequently, the samples were carbonized in a microwave oven with fixed irradiation parameters in terms of power and duration. After washing to obtain a neutral pH and drying, the resulting activated carbons were characterized by FTIR, XRD, and methylene blue index (MBI). FTIR analyses revealed that the obtained materials are rich in oxygenated functional groups, such as hydroxyl groups (OH), ethers (C-O-C), and carbonyls (C=O). These functional groups influence the chemical and physicochemical properties of the material, as well as its interactions with various organic and inorganic substances. The methylene blue index (MBI), which reflects the adsorption capacity of medium-sized molecules, is used to assess the presence of mesopores and macropores. The optimal MBI, measured by UV-visible analysis, is 620.56 mg/g, corresponding to a mass impregnation ratio of phosphoric acid of 1:3. This high value indicates a strong affinity of the material for certain chemical compounds, suggesting a significant adsorption capacity. These results demonstrate that the activated carbon obtained from lignocellulosic biomass can be effectively used in various applications, particularly for the purification and separation of undesirable substances present in water, especially organic dyes.

Keywords : Preparation, chemical activation, phosphoric acid, mass ratio, activated carbon, vegetable waste.

CMTDE 2024_23

Facile biosynthesis of Fe_3O_4 nanoparticles and their use for rapid removal of a toxic cationic dye “Methyl Violet” from wastewater

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Abstract

Methyl violet (MV) is a highly toxic dye, easily soluble in water. May cause severe eye damage, very toxic to aquatic organisms, may cause long-term adverse effects, may cause cancer. That's why the aim of this study was to eliminate this toxic dye by adsorption to avoid water pollution. This study involves combining magnetic nanoparticles (Fe_3O_4 NPs) capacities with charcoal from castor stems (CCS) to enhance the efficiency of MV adsorption from an aqueous solution. Characterization of the biosorbent (CCS-Fe_3O_4 NPs) was analyzed by FTIR, SEM, DRX and pH_z. After determining the effect of various factors affecting adsorption, such as (CCS-Fe_3O_4 NPs) mass, MV concentration, pH and temperature, a study of isotherms and adsorption kinetics was carried out. Optimum adsorption efficiency was obtained for a pH of 10 and a contact time of 70 minutes. The maximum adsorption capacity of 35 mg/g was determined using the Langmuir model. In addition, a study of adsorption kinetics proved that the second-order kinetic model could best describe the adsorption mechanism (R^2=0.99). According to thermodynamic results, the sorption phenomenon is endothermic and spontaneous. The reuse of (CCS-Fe_3O_4 NPs) was examined and the results indicated that it was

possible to reuse the biosorbent (CCS-Fe_3O_4 NPs) prepared for several adsorption-desorption cycles. The results of this study prove that this less expensive biosorbent (CCS-Fe_3O_4 NPs) is highly cost-effective for wastewater treatment and MV dye removal.

Keywords : Depollution, Methyl violet, Nanoparticles, Kinetics, Isotherm, Green chemistry

CMTDE 2024_24

Optimization and kinetic studies for real industrial liquid waste treatment using combined electrochemical processes

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Abstract

The objective of this study is to exhibit the effectiveness of electrocoagulation, Electro-Fenton and a combined EC-EF approach, in the degradation of an industrial wastewater, where on the one

hand the optimal conditions for the EC process were determined with an applied current density of 480 mA/cm² for 13 minutes. On the other hand, the EF process achieved its peak performance at a current density of 350 mA/cm² over 147 minutes. It is essential to note that the NaCl concentration maintained was 3.3 g/L for both treatments. Under these optimized conditions, the EC process demonstrated superior efficiency in Total Suspended Solids (TSS) removal, achieving an impressive removal rate of 82.87%, while the EF process yielded a more moderate 41.41%. Conversely, the EF process proved to be more effective in organic compound removal, achieving an exceptional removal rate of 96.83% compared to 53.21% for the EC treatment. Significantly, the sequential application of EC and EF processes resulted in complete elimination of TSS and organic matter, reducing the Chemical Oxygen Demand (COD) to zero. Biological tests confirmed the efficacy of the combined treatment, ensuring that the water was sterilized to 100% and thus suitable for irrigation and human consumption.

Keywords : Electrocoagulation, Electro-Fenton, CCD model, kinetic, Bacteriology

CMTDE 2024_25

Preparation of novel porous ceramic membrane supports based on silicon carbide/bentonite mixtures at very low- sintering temperature

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Abstract

Due to their excellent attributes of high water permeance, good chemical, thermal stability and antifouling properties, silicon carbide (SiC) ceramic membrane allow a durable, reliable and cost-effective treatment with removal of total suspended solids, turbidity, dissolved organics and algae

whether for reverse osmosis pre-treatment or direct drinking water consumption. However, SiC is a compound with strong covalent bond, their high sintering temperature during the sintering process is high which leads to high energy consumption restricts the commercialization and large-scale applications of the SiC membranes. In this study, a SiC ceramic membrane support was prepared at a low sintering temperature of 800°C in air without inert gas protection. α-SiC powder (*average particle size: 2.848, 5.64542 and 8.77952 μm*) was used as raw material to fabricate SiC membrane supports. The support based SiC/bentonite mixtures were prepared by the sintering process in liquid phase by adding low melting-point sintering aids. 75 wt% of SiC powder was mixed with small amounts of sodium silicate and boric acid as a mineral binder, carboxy-methyl cellulose (CMC) as organic binder, *Amigel* as pore forming agent and 15 wt% of bentonite was introduced into the SiC matrix. By using the natural bentonite as a new type of low-cost sintering aids, SiC ceramic supports with the configuration of flat disks and single channel tubes were fabricated successfully at 800°C for 5h. For a SiC particle size of 7 μm, 5 wt % of CMC and 15 wt % of bentonites, the SiC support presented a dense structure, a mechanical strength of 20,28 MPa, an average pore diameter of 1.1μm, and porosity of 41.65%. The introduction of organic binder (CMC) can promote the extrusion process and thus improve the homogeneity of the extruded green body. Due to the improved open porosity and average pore size, the single-channel tube presented higher pure water permeance than that of the flat disks. The high pure water permeance of 65 and 70 $m^3 \cdot m^{-2} \cdot h^{-1} \cdot bar^{-1}$ was obtained in the disk and single channel tubes, respectively.

Keywords : SiC, bentonite, low-temperature sintering, ceramic membrane, recycling

CMTDE 2024_26

Experimental Investigation of Desalination and Brine Concentration Using Membrane Distillation on a Pilot Scale

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Abstract

Experimental investigation of desalination and brine concentration using emerging membrane and thermal processes is important to reduce energy consumption and operating expenses in the

desalination industry. Emerging technologies such as forward osmosis (FO), osmotically assisted forward osmosis (OAFO), pressure assisted forward osmosis (PAFO), electrodialysis (ED), membrane distillation (MD), and non-membrane solvent extraction desalination (SED) have shown promising results at the laboratory and pilot scale levels for desalination and brine concentration applications. However, these technologies are currently not available for commercial use and are still in the developmental stage due to operational, technical challenges, and economic feasibility. In our study, we chose to use MD to experimentally investigate desalination performance using different saline feeds. The study on desalination performance was carried out using electrical heating and solar heating modes. Experiments were conducted using fresh water, brackish water, seawater, and desalination brine collected from various locations in Kuwait. The experimental results indicated that the water flux was higher for low saline brackish water compared to seawater and brine feed. Salt rejection was not significantly affected by an increase in feed salinity, and energy consumption was directly dependent on feed quantity rather than salinity level. The study on solar desalination and brine concentration demonstrated the practical applicability of the MD process in remote locations and small-scale industrial waste treatment.

Keywords : membrane distillation, dessalination, brine concentration, solar desalination.

CMTDE 2024_27

Characterization of the Removal of a Tanning Dye by Adsorption on Gibbsite.

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Abstract

Tanning transforms raw, perishable hides and skins into valuable, non-perishable leather, but it generates enormous pollutants. During the post-tanning process, various chemicals, such as synthetic tanning agents, oil emulsions, and dyes, are used. Consequently, large quantities of water

are consumed during all transformation operations, and the discharge of untreated effluents leads to severe environmental problems, particularly affecting water quality and human health. Tanning is one of the main pollutants negatively impacting ecological balance. In this study, we focus on the removal of Acid Black 210, a tanning dye, through adsorption on gibbsite in the absence and presence of Cr (III) ions. Batch tests were conducted to assess the effects of pH, contact time, and the initial dye concentration. Kinetic and equilibrium studies were carried out, and several kinetic and isotherm models were tested. The results show that the removal of Acid Black 210 by gibbsite is maximal at a very acidic pH (pH = 2.7), with slow kinetics; equilibrium is reached after 3 hours. In the presence of Cr (III) ions, a significant improvement in removal efficiency was observed. The removal process became faster (equilibrium = 10 minutes) and maximally across a wide pH range (pH ≤ 6.5). The maximum removal capacity calculated using the Langmuir equation in the presence of Cr (III) ions was nearly twice that calculated in their absence. With a removal capacity of 175 mg/g, gibbsite can be considered a good adsorbent for the removal of Acid Black 210 in tanning wastewater.

Keywords : Acid Black 210; Chromium (III); Gibbsite; Adsorption; Water Treatment

CMTDE 2024_28

Activated Carbon Derived from Sawdust Combined with Ultrafiltration as a Pretreatment of Textile RO Brine: Impact on Water Quality and UF Fouling

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Abstract

Reverse osmosis brine is one of the major drawbacks in membrane treatment technologies specifically due to the scale-forming ions. It is important to remove these ions from this

concentrate to enhance total water recovery and reuse in the textile industry that is the largest water consumer and polluter industry. In this study, the efficacy of activated carbon derived from sawdust (ACs) at removing COD and dye from textile RO brine was assessed by both batch adsorption and hybrid treatment combining adsorption and ultrafiltration (UF) processes. During the adsorption, the effect of different parameters on COD and color removal such as dose of ACs, contact time and pH were studied. At pH 7, an optimized dose of ACs (400 mg/L) removed 90% of color and 62% of COD in 60 min. The adsorption of COD and color by ACs followed the pseudo-second-order kinetics. Desorption studies identified 0.1 M NaOH as the most effective agent for regenerating used ACs, demonstrating its potential for long-term reusability. When a hybrid process was applied, a higher removal of COD and color capacity was obtained with a lower dose of ACs (150 mg/L) compared to the case of the batch adsorption process. In addition, the presence of ACs has been found to reduce UF membrane fouling. The synergy between adsorption and membrane filtration offers a robust and effective solution for treating complex textile brine, providing both economic and environmental benefits.

Keywords : Activated Carbon, Ultrafiltration, Pretreatment, Textile RO Brine, Fouling

CMTDE 2024_29

Water treatment facility maintenance of flash evaporators

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Abstract

The rapid growth of industry and tourism in areas of the world where potable water is in short supply has stimulated the development and application of water desalting equipment. The multistage flash evaporator has seen widespread application when seawater or heavily saline water

sources must be used. All these processes require careful operation and maintenance to function efficiently and attain reasonable life. Unfortunately, several plants exist which are costly examples of the failure to recognize this fact. The purpose of this study is to set the maintenance requirements of these processes. It must be recognized that the design details of each equipment manufacturer's system vary somewhat, so the approach to the subject must be somewhat general.

Keywords : Equipment, multistage flash evaporator, design, maintenance strategy, esalting, operation.

CMTDE 2024_30

Synthesis of an organic-inorganic nanohybrid composite for dye removal

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Abstract

The rapid increase in toxic dye wastewater generated from various industries remains a severe public health issue and prime environmental protection concern. So far, various physical and chemical treatment methods have been reviewed for the removal of dyes, such as biological degradation, ion exchange, chemical precipitation, reverse osmosis, coagulation, flocculation, etc. Among them, adsorption is the most efficient due to its high removal efficiency, easy operation, cost-effectiveness, and recyclability of the adsorbents. Considering this, the present work focused on removing methylene blue from water using an organic–inorganic nanohybrid adsorbent. This adsorbent was prepared by incorporation of iron oxide into the cellulosic framework of active black cumin seed powder using the co-precipitation method. The morphology and structure of the prepared material were examined using N_2 physisorption, FTIR spectroscopy, SEM, pH_{PZC}, XRD, and EDX spectroscopy. The effects of several critical factors, such as initial dye concentration, solution pH, temperature, contact time, and adsorbent dose on the dye adsorption performance are also optimized in batch mode. The obtained results showed an excellent removal capability of this adsorbent for Methylene Blue, which reaches 95%.

CMTDE 2024_31

Degradation of Textile Dyes from Wastewater Discharges Using Zeolite Catalysts

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Abstract

The textile industry is one of the largest consumers of water globally and contributes significantly to water pollution, primarily through the discharge of wastewater contaminated with recalcitrant organic compounds, such as textile dyes. This study aims to investigate the treatment and degradation of textile dyes and organic pollutants in industrial wastewater using advanced oxidation processes (AOPs) and zeolite catalysts. The research was conducted at the wastewater treatment plant (WWTP) of the "EATIT" textile complex in Sebdou, Algeria, and is divided into two main parts. The first part involved assessing the performance of the WWTP through a series of analyses on key water quality parameters (temperature, pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), sedimentation, alkalinity, and hydrometric title) at the inlet and outlet of the plant over a one-month period. The results showed that the effluent met the required environmental standards. In the second part, the study focused on the degradation of organic pollutants in treated wastewater using AOPs, specifically photocatalysis and the photo-Fenton process, under solar radiation. The findings revealed that photocatalysis achieved the highest degradation rates, improving the quality of the treated water. In contrast, the photo-Fenton process showed limited degradation, likely due to the excess use of the oxidant H2O2. Additionally, mesoporous TiSM catalysts exhibited lower catalytic activity compared to FSM catalysts, attributed to the higher content of active iron species in FSM. These results demonstrate the potential of AOPs and zeolite catalysts in enhancing the treatment of industrial wastewater from the textile sector.

Keywords : Textile wastewater, Advanced Oxidation Processes, Photocatalysis, Zeolite

CMTDE 2024_32

Characterization of water polluted by wastewater and impacts on the quality of irrigated soil in the short term

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Abstract

In Tunisia, irrigation is the most water-intensive activity, accounting for 75.5% of available water resources. The reuse of these treated waters for irrigation raises major issues in terms of public health, environmental preservation and efficiency of agricultural practices. The microbiological and chemical risks associated with this reuse require thorough and regular assessment to ensure crop, soil and population safety. In this context, our study aimed to analyze the physical-chemical and microbiological treatment of the sewage produced by the Mornag treatment plant and discharged into the water, which is then used by direct pumping to irrigate for the first time a plot of 2.5 ha of pears for a short period of six months. Analysis of samples E1, E2, E3 (water mixed with treated wastewater) E4 (water taken from the water table), showed electrical conductivity (EC) below the limit recommended by the national standard file for FSNR releases (7,000.0 µS/cm) for all waters. Site E1 showed the highest values expressed in mg/l, especially in terms of BOD5 (82.2 mg/L). Similarly, for COD (241 mg/L); E2 was the least polluted site in terms of MES, BOD5 and COD concentrations reported below the standards required by the DPM and DPH. The site E1 closest to the point of sewage discharge showed the highest values expressed in mg/l of nitrogen Kjeldahl Nkj (74 mg/L), NO3 (18.6 mg/L), NO2 (2.4 mg/L), K (47 mg/L). Also, E3 recorded the highest PO4 value of 256 mg/L, these results also suggested that for all water sampled, levels were well above the maximum allowable concentrations except for K (50 mg/L). Total organic carbon TOC for sites E2, E3 and E4 indicated a concentration greater than 2 mg/L, the recorded anion and cation concentrations are above the limits recommended by the NSRF. Results suggested a pollution concentration at E2 level that may be due to overexploitation of the groundwater, and too high salinity for all sampled points. Low metal content was found in samples, except for Iron at all sites.

Keywords : Wastewater, soil, REUT, irrigation, physicochemical analysis, microbiological analysis.

CMTDE 2024_33

Hydrochemical and Hydrogeological Characteristics of the Upper Visean Aquifer of Hassi Abdallah, Tindouf Saoura Watershed (Southwest Algeria)

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Abstract

Our study focuses on the largest water reservoir in the region located south of the city of Tindouf, which is the main source of water supply for the city. It is an artesian aquifer that flows through fractured dolomitic limestones. In the Hassi Abdallah area, it is artesian, and the water level can rise up to 5 meters above the ground surface. The results from the piezometric measurements of the Upper Visean aquifer indicate overexploitation. The waters from this aquifer present serious physicochemical quality issues, as they are highly mineralized and very hard. Our sampling covered nine water points: SA3, SA6, SA7, SA8, SA9, NHT106, Daia el Khadra, and 75/B. According to the Schöeller-Berkaloff diagram, the waters can be classified into the following facies: Sodium Chloride: SA2, SA3, SA5, SA6, SA7, SA8, and N.TH106; Sodium Sulfate: SA9; Magnesium Sulfate: Daia el Khadra; Magnesium Chloride: 75/B. Hydrochemically, the analysis and interpretation of the results revealed that all the waters in the study area are hard, with hardness reaching 110°F. The waters from the Upper Visean aquifer are characterized by very high conductivity, with total dissolved solids reaching 2851 mg/L. The piezometric map is a key document for analyzing the hydrodynamic behavior of the studied aquifer and serves as the most important synthesis of a hydrogeological study. The analysis of this map primarily provided insights into the direction of flow.

Keywords : Tindouf ; Nappe Viséen supérieur ; physico-chimique ; piézométrique ; hydrogéologique.

CMTDE 2024_34

Adsorption capability of sugar scum as industrial waste for cationic dye removal: experimental and advanced statistical physics modeling

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Abstract

Recycling solid industrial waste into sustainable resources is one of the most critical aspects of waste management. Herein, for detoxification poisonous crystal violet dye (CV) in aqueous medium, sugar scum (SS) as an untapped industrial discard has been tested as a potential adsorbent. The SS was extensively characterized before and after the adsorption process through several characterization methods. Several operational factors, including pH, biosorbent dosage, dye concentration, and temperature, were optimized, leading to 24 $mg.g^{-1}$ at (pH 10, 2 $g.L^{-1}$ of SS, 10 $mg.L^{-1}$ of CV and 25 °C). The adsorbent efficiency was assessed through a range of studies involving kinetic, equilibrium (through both conventional and statistical physics models), and thermodynamic investigations. Based on the findings, the equilibrium curves well fit the Freundlich model, meaning that multilayer adsorption occurs on a heterogeneous active site surface. The statistical physics models provided in-depth physiochemical insights, the double-layer with two energies model described the data, with a high saturation capability of 371 $mg.g^{-1}$). The SS durability was evaluated, showing encouraging durability with a slight fall in efficiency (~7 %) after 5 sequential runs. In sum, this study makes a substantial contribution to the promotion of ecological water treatment strategies, which emphasizes the value of considering SS as an environmental alternative to water pollution eradication.

Keywords : Sugar scum; Crystal violet; Adsorption; Statistical physics models; Adsorption mechanism.

CMTDE 2024_35

Recovery of Ni (II) from Aqueous Sulphate Solution Using Di (2-Ethylhexyl) Phosphoric Acid & 1-octanol

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Abstract

The liquid-liquid extraction of nickel (II) from a sulfated medium by di-(2-ethylhexyl) phosphoric acid in chloroform at 20°C is studied with the following two parameters: pH and extractant concentration in the presence and absence of the synergistic agent 1-octanol. The stoichiometry of the extracted complexes was determined by the slope method. The organometallic complex extracted from nickel (II) in the organic phase is $NiL_2 2HL$. Extraction efficiency increased with increasing pH and extractant concentration. UV-VIS data in the presence and absence of 1-octanol confirm that the geometry of the extracted species is tetrahedral.

Keywords : liquid-liquid extraction, synergy, nickel (II), di(2-ethylhexyl) phosphoric acid.

CMTDE 2024_36

Wind direction effect on the thermal performance of the single-slope solar still

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Abstract

Wind direction is a critical parameter to consider when examining the thermal performance of solar-based systems. However, the impact of wind direction on the performance of solar stills has been neglected, as most wind-induced heat transfer correlations have been developed based only on wind speed. In this study, the effect of wind direction on the single-slope solar still (CSS)

performance was experimentally investigated. A series of indoor experiments were conducted to evaluate the wind-induced heat transfer coefficient (h_w) on the still's glass cover. Three main directions of wind flow were considered (Front winds, side winds, and rear winds). For each direction, the wind speed was maintained at 1, 2, and 3 m/s. Based on the experimental data, the h_w was expressed/correlated as a function of wind speed and direction. Results show that the wind direction highly affects the distiller's thermal behavior and productivity. The wind-induced heat transfer strongly depends on wind speed, and wind direction has a notable effect. The h_w is highest when the wind is facing the still. When the wind blows from the side and behind the still, the h_w decreases by about 6% and 45%, respectively.

Keywords : Solar still, indoor experiment, wind direction, wind speed, wind-induced heat transfer coefficient.

CMTDE 2024_37

Study of a Building-Integrated Solar Still

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Abstract

According to the UNISCO World Water Report published in 2022, water consumption is expected to increase by 1% per year over the next thirty years. Desalination of sea/brackish water is among the solutions. This desalination process requires a lot of energy, while the world is going through an energy crisis during this period. Solar energy seems to be a good solution to meet this need, as it is sustainable, economical and clean. In this context, we were interested in desalination of sea/brackish water by solar energy, and due to the lack of land for the installation of solar stills, we integrated it into the building.

The proposed device is integrated into the building and on any floor, which allows to exploit the dead (unused) surfaces of the house for a gain of space on the one hand, and to make use of this device by a large number of families, which transforms the families behavior from consuming water to producing it on the other hand. To achieve this objective an experimental study was conducted at M'sila University in Algeria during the month of May. The ambient temperature, solar radiation, wind speed, temperatures of the solar still components and their production are recorded and presented. The results show that weather conditions play a crucial role in the

distillation process, performance and efficiency of the building-integrated solar still (BISS). It also allows us to determine the adjustments or modifications needed to optimize the solar still performances according to local climatic conditions in different seasons or regions.

Keywords : Solar still, Building-integrated, Desalination, Water, Temperature.

CMTDE 2024_38

Performance analysis of a hybrid forward osmosis-membrane distillation system for seawater desalination

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Abstract

The growing global demand for potable water, coupled with the depletion of freshwater resources, has intensified the need for advanced desalination technologies. This study focuses on the performance analysis of a hybrid forward osmosis (FO)-membrane distillation (MD) system designed to enhance seawater desalination efficiency. The hybrid approach leverages the low-energy requirements of FO and the thermal-driven separation capability of MD to achieve higher water recovery rates with reduced energy consumption. A comprehensive mathematical model was developed to simulate the integrated process, evaluating the effects of key parameters such as feed concentration, temperature gradient, flow rates, and membrane properties on system performance. Results demonstrate that the hybrid FO-MD configuration significantly outperforms standalone desalination methods, offering improved water flux, reduced fouling tendencies, and lower operational costs. The study also explores the potential for scaling the process in practical desalination applications, highlighting its sustainability and economic feasibility. By optimizing the synergistic effects of the FO and MD processes, this research provides a promising solution to the challenges of seawater desalination, offering valuable insights into future developments in the field. The findings underscore the hybrid system's potential to address global water scarcity while reducing environmental impacts.

Keywords : Forward osmosis, Membrane distillation, Seawater desalination, Water recovery, Hybrid system.

CMTDE 2024_39

Structural Analysis and Biological Assessment of a Novel Zwitterionic Cadmium Complex with Antioxidant, Antidiabetic, and Anti-inflammatory Activities

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Abstract

A new hybrid material combining organic and inorganic components, $C_5H_{13}N_2CdBr_3$ (1), was made at room temperature, and its structure was determined. The material crystallizes in the orthorhombic space group $P2_12_12_1$, with the following parameters: a = 8,8493 (5) Å, b = 10,5402 (9) Å, c = 12,8960 (12) Å and Z = 4. The crystal structure features one-dimensional polymeric chains of edge-sharing distorted $CdBr_3N$ tetrahedra. These chains form layers parallel to the (b, c) plane due to their attachment together by N-H···Br hydrogen bonds. To explore the various intermolecular interactions, Hirshfeld surface analysis was conducted. The structural composition of the complex was confirmed via infrared spectroscopy and to assess its vibrational properties. Tauc's formula was applied to determine the optical band gap, showing that the direct and indirect band gap values were, respectively, 4.58 eV and 4.44 eV. The compound (1) exhibits notable antioxidant, antibacterial, and enzyme inhibition properties. Additionally, (1) showed moderate inhibition of alpha-amylase activity and anti-inflammatory effects, making it a promising candidate for further medicinal chemistry research.

CMTDE 2024_40

Synthesis and characterization of modified activated carbon (Iron Oxide/AC) for cationic dye adsorption: equilibrium isotherm and kinetic studies

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Abstract

Numerous sectors, including textile, stationery, plastic, food, and others, utilize a lot of water and color their goods with soluble or pigment-based organic dyes. These dyes give water its color, but they are also harmful. The majority of these dyes are not biodegradable and can be a health hazard and environmental nuisance. It is essential to limit these pollutants by implementing an appropriate treatment process. In this study, iron oxide/activated carbon (Fe3O4/AC) was fabricated by co-precipitation method to remove cationic dye (Methy violet 2B) from an aqueous solution in a batch model. The Methyl violet 2B (MV2B) dye adsorption potential of Fe3O4/AC was compared with the raw activated carbon (RAC) prepared from waste Coffee. The RAC and Fe_3O_4/AC nanoparticles composite were characterized by BET, FTIR, XRD, and SEM analysis. The effects of adsorption parameters (T°, time, initial dye concentration…) were studied. The optimum conditions for organic dye removal were: Nanoparticle dose 0.3 initial dye concentration 50 mg/L, and Temperature 25°C. The MV2B removal efficiency of AC and Fe3O4/AC were 80.6 and 97.5%, respectively under optimum operational conditions. Furthermore, the adsorption mechanism followed the Langmuir isotherm (R^2 0.9935) and adsorption kinetics fitted by the pseudo-second-order model (R^2 0.9967). Ultimately, our findings imply that the produced Fe3O4/ AC is a viable and effective material for treating dye wastewater.

Keywords : activated carbon, adsorption, Cationic dye , Iron oxide, waste coffee

CMTDE 2024_41

Optimization of a Hybrid PV/Wind/Diesel/Battery Energy System for Isolated Military Sites in Tunisia Using PSO and HOMER Software

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Abstract

This study focuses on the modelling and optimization of a hybrid energy system combining photovoltaic (PV), wind, diesel, and battery technologies for two isolated military sites in Tunisia. Initially, hourly meteorological data (solar radiation, wind speed, and temperature) and load profiles over a one-year period were collected and analyzed. Subsequently, mathematical models for each component of the system were developed using MATLAB. The Particle Swarm Optimization (PSO) technique was then employed to determine the optimal configuration for both sites, aiming to minimize the Net Present Cost (NPC) while ensuring high reliability and reducing annual fuel consumption (FC). Reliability was quantified using the Loss of Power Supply Probability (LPSP), which must be maintained at zero for military applications. Finally, the results obtained from the PSO technique were compared with those generated by HOMER software, highlighting the effectiveness and efficiency of the proposed approach.

CMTDE 2024_42

Comparative evaluation of the effects of ethanol and isooctane addition on the performance and NOx emissions of a spark-ignition engine using commercial unleaded gasoline

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Abstract

This article presents a comprehensive study on specific fuel blends created by carefully combining ethanol and isooctane, two additives recognized for their potential as alternative fuels to commercial unleaded gasoline. These blends were subjected to rigorous testing on a BEMP 301 engine test bench. The engine used in this study is a single-cylinder, four-stroke model, capable of producing 2 kW of power at 4200 rpm. The tests were conducted according to the strict protocols established by the DIN 70020 standard at full load, ensuring the consistency and reproducibility of the data. In parallel, an in-depth numerical analysis was carried out using Diesel-RK simulation software, which helped refine our understanding of the underlying mechanisms. A detailed parametric study was also undertaken to assess how variations in the blending ratio of isooctane (Ix) and ethanol (Ex) influence the engine's performance and emissions. The experimental results revealed significant trends for I10 (10% isooctane + 90% gasoline) and E10 (10% ethanol + 90% gasoline), with notable variations in maximum brake mean effective pressure (BMEP) ranging from 5.496 to 4 bars, as well as an overall efficiency ranging from 30% to 20%. Additionally,

these blends resulted in a significant reduction in NO_x emissions, with reductions of 5% and 7.5%, respectively. Compared to conventional gasoline usage, numerical simulations showed an increase in peak pressure and heat release when using alternative blends. Furthermore, an interesting correlation was observed between the use of I20 (20% isooctane + 80% gasoline) and E20 (20% ethanol + 80% gasoline) blends and certain key engine performances, with a reduction in NO_x emissions of about 3.5%. To validate the reliability and accuracy of our results, they were compared and corroborated with previous studies by other researchers, demonstrating consistency in our findings. Finally, from an economic perspective, the E20 option appears promising, positioning itself favorably between traditional fuels like SP95 and SP96, offering interesting prospects for more sustainable mobility.

CMTDE 2024_43

Potential elimination of diclofenac sodium (DCF) from aqueous solution by adsorption using orange peel solid waste-based activated carbon

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Abstract

In the environment, residual pharmaceuticals are a type of developing pollutants that damage human health. One of the most widely produced and used anti-inflammatory drugs globally is diclofenac sodium (DCF), which is commonly found in water bodies. Among the water treatment processes, adsorption is an easy and efficient process. Recently, bio-based carbons obtained from eco-friendly biomass materials have received considerable attention. In the current work, a novel Orange peels activated carbon (OPAC) was prepared and examined as an adsorbent to eliminate DCF from an aqueous solution. Initially, OPAC was characterized by determining its physio-chemical properties. It is clear that OPAC exhibited notable characteristics like high specific surface area of 779.05 m^2/g, mesoporous structure and acidic properties. During adsorption procedure, the best operating conditions for DCF elimination by OPAC were pH 6, contact time of 25 min, temperature of 25 °C, biosorbent dose of 0.2 $g.L^{-1}$ and initial concentration of 25 $mg.L^{-1}$. The Langmuir isotherm model fitted better the experimental data than the Freundlich model. The adsorption capacity determined by the Langmuir model was q_e = 86.68 mg g^{-1}. The

DCF adsorption presented a pseudo-second order kinetics and the study of thermodynamic parameters revealed that the adsorption of DCF on OPAC is endothermic and spontaneous.

Keywords : Biosorbent, Orange peels, Adsorption, Diclofenac removal, Activated carbon.

CMTDE 2024_44

Experimental and Numerical Study of the Performance and NOx Emissions of a Spark Ignition Engine Operating with an Ethanol-Unleaded Gasoline Mixture.

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Abstract

Despite the continuous rise in oil prices and the depletion of fossil fuel reserves, gasoline-powered vehicles remain predominant in the transportation sector. This situation has sparked growing interest in renewable alternative fuels, which could offer more sustainable solutions. In this context, an experimental and numerical study was conducted to assess the impact of adding various oxygenated fuels to gasoline on engine performance and pollutant emissions. The experiment involved testing ethanol, an oxygenated fuel, mixed with unleaded gasoline at different volumetric concentrations (10%, 20%, 30%, and 40%) in a gasoline engine. The results showed that combustion stability was only slightly affected. Furthermore, the addition of oxygenated fuels led to a significant reduction in NOx emissions, with a 7.5% decrease observed for the E10 mixture (10% ethanol + 90% unleaded gasoline). The incorporation of the E10 mixture resulted in a notable increase in brake mean effective pressure (BMEP), while the other mixtures led to a decrease in BMEP compared to commercial gasoline, with a maximum value of 5.497 bar. Among the tested mixtures, E10 proved to be the one that most improved the engine's overall efficiency (OE). A numerical analysis validated the experimental results regarding BMEP and overall efficiency. The DIESEL-RK software, known for its many features, was used to evaluate the impact of the chemical composition of the fuels on NOx emissions, particularly for ethanol-based mixtures. The

numerical analysis confirmed the trends observed experimentally for the E10, E20, E30, and E40 mixtures, with an average divergence ranging from 0.48% to 7.28%.

Keywords : Spark Ignition Gasoline Engine, Ethanol, Performance (BMEP), Overall Efficiency (OE), NOx Emissions, DIESEL-RK.

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Bio-based ceramic membrane preparation and application to textile wastewater treatment for color removal

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Abstract

Ceramic membrane technology plays an important role in water and wastewater treatment. The strategic sourcing of various natural mineral resources has contributed to the development of low-cost ceramic membranes. The combination with calcination of inorganic and organic wastes from domestic and agricultural activities results in fully sustainable ceramic membrane materials. In this work, ceramic membranes were developed using 96% clay, 2% almond shells and 2% Lime. Sintering at 900,950 and 1000°C enabled membranes (MK900, MK950 and MK1000) to be produced cleanly, simply and cost-effectively. Average pore diameter and porosity decreased slightly from 44 to 42 nm and about 30 to 26 % by increasing the sintering temperature, while the flexural strengths increased from 25 to 40 MPa. The membranes obtained showed very good chemical resistance, with a weight loss of less than 3% in both acidic (pH 3) and basic (pH 12) media. Pure water permeability was of 68 and 59 $L \cdot h^{-1} \cdot m^{-2} \cdot bar$ for MK-900 and MK-950, respectively. Effective color (as Indigo blue) removal of 78% and 92 % was observed for MK900 and MK950 with flux recovery ratios of 86% and 79% after backwashing with pure water, indicating good fouling resistance of the prepared membranes.

Keywords : bio-based ceramic membranes; kaolin; almond shells; textile wastewater discoloration; indigo blue dye.

CMTDE 2024_46

Effects of nanoparticles on the performance of a solar distiller

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Abstract

As the international demand for drinking water continues to increase to meet the water needs of individuals on the one hand and those of industries and the lack of natural water resources on the other hand, the use of solar distillers seems to be an effective way to address this problem. Solar distillers are machines that transform wastewater and salt water into distilled water. Several theoretical and experimental studies aimed at improving the performance of distillers have been conducted. Among the ways to improve the performance of solar distillers, we cite the use of the addition of nanoparticles. The effects of nanoparticles on the overall and internal efficiencies, and the production of distilled water, were studied and presented by means of numerical simulation. The results obtained made it possible to demonstrate the positive effects of the addition of nanoparticles and consequently on the overall and internal efficiencies and the quantity of distilled water produced.

Keywords : Distiller, solar, nanoparticles.

CMTDE 2024_47

Study of the influence of climatic parameters on the water rate evaporation from a free surface

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Keywords: evaporation rate, free surface, climatic conditions.

Abstract

Evaporation, the phenomenon by which a liquid is transformed into gas (vapor), plays an important role in several environmental processes including desalination and water treatment processes. This

phenomenon is responsible for the loss of large quantities of water from free surfaces (basins, rivers, lakes, ponds, dams, etc.). Dalton's work in 1802 [1] was the first to address this question. He concluded that the intensity of evaporation is proportional to the difference in partial pressure between the surface of the liquid and the main mass of air and to the air flow velocity. Understanding the evaporation rate, the amount of water that evaporates from a water surface per unit of time, is essential to optimize the evaporation process and/or limit its effects. However, the evaporation rate, despite its importance on the water balance, is often determined in an approximate manner or a correlation that does not consider all the factors involved. Several empirical and theoretical equations estimating and calculating the evaporation rate from large open water surfaces have been proposed in the literature [2-4]. The evaporation rate is influenced by several factors including: The intensity of solar radiation, The ambient temperature, The humidity of the air, The wind velocity This work is a contribution to the evaluation of water rate evaporation from a free surface considering certain influencing factors. The intended application is the more precise determination of the quantity of water in a dam basin and the proposal of solutions to reduce water losses through evaporation.

CMTDE 2024_48

Evaluating Seawater Intrusion Vulnerability in a coastal Aquifer: Application of the Modified GALDIT Model in the Northeast Tunisia Region

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Abstract

This study applies an adapted GALDIT model to assess the vulnerability of the coastal aquifer system in northeastern Tunisia to seawater intrusion, considering the impact of intensive groundwater exploitation. The GALDIT model introduces a novel parameter (E) to account for groundwater extraction via artesian wells, enhancing the traditional GALDIT model's sensitivity to human-induced pressures. Situated near the Mediterranean and bounded by agricultural land, the Aoussja Ghar El Melh region exhibits high vulnerability due to its semi- arid climate, low topographic slopes and intensive groundwater usage, which has nearly doubled renewable resources. By incorporating parameters such as aquifer type, hydraulic conductivity, proximity to the coast, and groundwater extraction rates, this study evaluates intrusion risks across varied zones,

with transmissivity data revealing significant impact zones. Results highlight critical areas near the Medjerda wadi and Ghar El Melh lagoon, with sensitivity analysis underscoring the parameter (E) as a key influence on vulnerability assessment accuracy. The findings provide actionable insights for sustainable groundwater management and underscore the need to integrate human exploitation affects in coastal aquifer assessments globally, especially for semi-arid regions facing increasing seawater intrusion risks.

Keywords : Coastal Aquifer; GALDIT Model; Seawater intrusion; vulnerability; hydrochemical indicators

CMTDE 2024_49

Bacteriological Quality of Seawater in the Bousmail Region (Tipaza Province).

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Abstract

Available data on water quality reveal that most of the water resources in Algeria are polluted by uncontrolled discharges of municipal wastewater and untreated industrial effluents. The Bousmail region faces similar challenges, as it receives both continental inputs and untreated urban and industrial discharges from an urbanized city. This region experiences the same environmental issues as the rest of the Algerian coastline. A work plan was adopted to evaluate the bacteriological quality of the beach waters. This involved water sampling at five stations, conducted throughout 2017. Using standardized methods, various physicochemical variables and bacteriological parameters were monitored. During our study, we concluded that the water can be contaminated. The results of our bacteriological analysis revealed recent fecal contamination of animal origin (total coliforms, fecal coliforms, fecal streptococci). Thus, for effective water management and to fully address the pollution issue at this level, it is necessary to enforce regulations regarding industrial and thermal discharges and to establish proper bio surveillance of these ecosystems.

Keywords : bacteriological quality, water, pollution.

CMTDE 2024_50

Urban wastewater Treatment by infiltration percolation using a filter bed intended for composting: crushed dry palms and smectitic clays

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Abstract

The palm leaves waste can serve as a filtering medium that can be used, after treatment by infiltration-percolation, as a composting product for organic amendment in arid oasis. Laboratory column trials were carried out to treat wastewater from El Hamma treatment plant (urban and geothermal wastewater) which is reused by farmers in the Bechima area in the irrigation of fodder crops and arboriculture. Three PVC columns, 20 cm in diameter and 130 cm in length, were installed on a mobile open-air support filled with different thicknesses of raw palm leaves waste and mixed with different doses of smectic clay from Jbel Aidoudi. The thickness of the filtration mixture is 60 cm for the first column (C1), 90 cm for the second column (C2) and 120 cm for the third column (C3). The analyses results of the filtered wastewater through the columns showed that the purifying performance of the raw palm leaves waste is weak. The optimization of the purifying efficiency of our treatment system requires the addition of an adsorbent material (swelling clay) facilitating the retention of the pollutant load and increasing the residence time of the water in the columns. Significant quality improvement of the filtrates was observed by the addition of the smectic clay with yields up to 87 % for SS, 95 % in NTK, 99 % in NH_4^+ and 71 % in COD for the C3 column containing 20 % clay. While the purifying power of the raw crushed dry palm was in the order of 77 % in SS, 41% in NH_4–N and 38 % in COD. And even the addition of 10 % clay did not result in satisfactory yields for the three columns.

Keywords : Wastewater treatment, Infiltration-percolation, palm leaves waste, montmorillonite clay, composting.

Design and Study of a Plate Heat Exchanger with Phase Change Materials for HDH Desalination

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Abstract

This study investigates the design and analysis of a plate heat exchanger integrated with phase change materials (PCM) to optimize the performance of a humidification-dehumidification (HDH) desalination process. The exchanger recovers latent heat from condensed water vapor, which is then used to heat the circulating fluid. By incorporating PCM technology, the system improves thermal energy storage, stabilizes operational conditions, and enhances overall energy efficiency in the desalination process. A theoretical analysis determined key design parameters, such as PCM mass, number of plates, and outlet temperature. Paraffin wax was selected for its favorable thermal properties. The heat exchanger, with dimensions of 0.5 m x 0.3 m x 0.2 m and 10.33 kg of PCM, was optimized using SolidWorks to enhance heat transfer. A parametric study assessed the impact of operational parameters like fluid velocity, PCM heat capacity, and latent heat of fusion, as well as compared three types of PCM. The study also compared three types of PCM to evaluate their effect on temperature changes over time, with the goal of identifying the most suitable material for the HDH desalination processThe use of PCM in the heat exchanger improves temperature stability, reduces heat storage volume, and enhances energy recovery. However, PCM's low thermal conductivity limits heat transfer rates. To address this, the design was optimized with turbulence-enhancing baffles to improve thermal performance. Future experimental work is planned to validate the theoretical findings and assess the exchanger's performance in real-world HDH desalination applications

Keywords : Phase change materials, HDH desalination, Energy storage, Latent heat, Heat capacity, Thermal efficiency.

Experimental study of a vacuum membrane distillation system comprising an immersed hollow fiber module

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Abstract

Vacuum membrane distillation (VMD) is a promising technology, but its efficiency is often hindered by significant resistances to heat and mass transfer. In this study, we designed a laboratory-scale VMD unit featuring a hollow fiber module, using a PVDF membrane immersed in a saline solution. The aim was to investigate two key factors to enhance performance: the effect of immersing the module in the saline solution and the impact of agitation on membrane efficiency. The study primarily focused on the influence of immersion and agitation on the permeate flux. To this end, we compared system performance with and without agitation by measuring the permeate flux over time. Agitation was introduced to generate turbulence around the hollow fibers, aiming to reduce the effects of thermal and concentration polarization, both of which can impede heat and mass transfer. The experimental results showed that immersing the hollow fiber module in the saline solution more than doubled the permeate flux. Agitation, meanwhile, proved to be an effective method for further improving performance, increasing the permeate flux by 30% compared to the non-agitated configuration. During the first hour of operation, the flux without agitation was less than 4.8 kg/h.m², while with agitation it exceeded 6 kg/h.m². This improvement became even more pronounced over time: after five hours, production was quadrupled in the presence of agitation. However, a gradual decline in the permeate flux was observed over time, attributed to the accumulation of salts on the membrane surface. This buildup created additional resistance to both mass and heat transfer. The accumulation also lowered the temperature at the membrane interface compared to a clean membrane, which in turn reduced the pressure difference across the membrane, ultimately decreasing the permeate flux. In conclusion, this study demonstrates that combining membrane immersion in a saline solution with controlled agitation is an effective strategy for improving the performance of VMD systems. Agitation reduces polarization effects and fouling, thus optimizing the overall performance of the hollow fiber module.

Keywords : vacuum membrane distillation, hollow fibers, submerged module.

CMTDE 2024_53

Investigation of methylene blue Adsorption by Fe_3O_4 Nanoparticles : An Optimization Study Using Response Surface Methodology

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Abstract

Water coloring agents, such as methylene blue (MB), pose significant environmental and health risks due to their toxicity, mutagenic, and carcinogenic properties. Various techniques, are used to remove MB from wastewater, with adsorption being the most widely studied due to its simplicity, cost-effectiveness, and high efficiency. This study aims to model and optimize the adsorption of MB using a low-cost, magnetic adsorbent, Fe3O4. The parameters evaluated for adsorption are the adsorbent dosage, pH, contact time, and temperature using the response surface methodology. The principal variables affecting MB removal were pH (3–11), catalyst dosage (0.01–0.3 g), contact duration (10–180 min), and temperature (25–55 °C). To select an experimental domain, a preliminary study was performed first. The results showed that at pH 10, 1.4 g L−1 Fe3O4 - nanoparticles (NPs) had the highest removal efficiency of cationic dye MB (20 ppm) from aqueous solutions by batch adsorption technique. The pseudo-second order (PSO) kinetic models and the Langmuir isotherm provided the best fit for the adoption of MB. To determine the effect of the investigated variables and their interaction on the adsorption process, a Box–Behnken design was used. The performance of the model equation verified the experimental observation with just a slight divergence. According to the numerical optimization, 98.61 % is the optimal elimination efficiency for MB adsorption. These results suggest that an adsorption process utilizing Fe3O4 NPs is efficient in environmental remediation.

CMTDE 2024_54

Monitoring and simulation of the puratory performances of the annaba step for safe use of purified water in agriculture

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Abstract

The discharge of untreated wastewater severely pollutes biodiversity and water resources, highlighting the need for effective treatment and reuse, yet in Algeria, sanitation services are less prioritized than water supply and purification. In fact, only 20% of wastewater collected in Algeria is treated, compared to coverage of the sanitation network of around 85%. According to a report published by the National Sanitation Office (ONA) in January 2019, Algeria has 153 wastewater treatment plants which produce a volume of 21 million cubic meters per month of purified wastewater. The wastewater treatment plant in the town of Annaba, commissioned in June 2010. The average volume of wastewater treated annually is around 2,000,000 m^3/year. The MES results shows that the MES concentrations at the STEP outlet obtained by the analyses vary between a minimum value of 9.60 (mg/l) and a maximum value of 118.75 (mg/l), while the simulated MES concentrations by GPS-X vary between 9.47 (mg/l) and 21.8 (mg/l), These results comply with the rejection standard applied in Algeria (30-35 mg/l). The COD concentration values at STEP outlet obtained by the analyses during the month of May 2022 vary between 62.90 (mg/l) and 90 (mg/l), while the concentration values of COD simulated by GPS-X during the same period vary between 39.4 (mg/l) and 44 (mg/l), these values meet the Algerian discharge standards (120 mg/l). The BOD5 results concentration values of the WWTP treated water vary between a minimum of 8.80 (mg/l) and a maximum of 13 (mg/l), while the BOD5 concentration values simulated by GPS-X vary between 13 (mg/l) and 13.5 (mg/l), these simulation results meet the Algerian discharge standard which sets the BOD5 at 35 (mg/l). Our study showed that the values found respect the discharge standards at the outlet of the WWTP, except for the first days when we notice that the discharges exceed the standards; this is explained by the difficulty of regulating the biological process of the microorganisms. to the physical parameters of the station's structures. This observation is made because the calibration is obtained after several changes in the sludge recirculation flow rate. The Annaba plant gives good purification performance, but we recommend taking certain measures at the operating level (aeration management) to maintain good operation and longevity at the STEP.

CMTDE 2024_55

Etiological survey on contaminations of thermal waters and disinfectant tests and purely natural flavorings

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Aims of the work :

- Yearly survey of eventual contaminations of thermal water.

-Trials of disinfection using medical and flavouring plants essential extracts and hydrolates.

Methods: Water analysis using membrane filter technique that is an effective, accepted technique for testing fluid samples for microbiological contamination which allow the isolation and enumeration of microorganisms. Screening of antimicrobial activity of some medicinal plant extracts and hydrolates using disc diffusion assay and the minimum inhibitory concentration (MIC) method were used to investigate the antibacterial effects of selected plant extract.

Results: Water quality is affected by a wide range of natural and human influences. The most important of the natural influences are geological, hydrological and climatic, since these affect the quality of water available. The result of the survey indicates that the most contaminants found in thermal water are *Enterococcus spp*. and *Pseudomonas aeroginosa*.

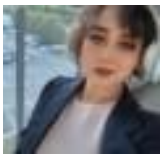
There is usually a delay between a pollution incident and detection of the contaminant at the point of water abstraction. The plant extracts that had a better inhibition zone were selected and used for MIC test. Plant extracts exhibited a remarkable activity against bacterial development.

Conclusion : The results obtained in this survey demonstrate that there is a lot of contamination in thermal water which remains a threat for users. Antimicrobial activity of plant extract suggests feasibility to be used in disinfection methods.

Keywords : Survey, antimicrobial, plant extract, contaminant, disinfection.

CMTDE 2024_56

Dynamics of Contaminants Transport under climate change patterns in Varied Soil Types at laboratory scale: Influence of water flow rate and temperature



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Abstract

The European Environmental Agency (EEA) indicates that pollutants are dispersing through air, soil, and water, accumulating in soil and water compartments (surface water, groundwater) above critical thresholds, threatening soil and water health. The transport and behavior of these contaminants are crucial for environmental protection, as they can reach sensitive areas like groundwater and drinking water reservoirs. Recently, extreme events are occurring across the world provoking high ground temperatures (up to 60 Celsius degrees were registered in non-desertic regions) and severe droughts/over floods. These events can accelerate the spread of pollution from hot spots of contamination (i.e. landfills, wastewater effluents, etc), altering the mobility of pollutants, which may become accessible and movable from contaminated sites to sensitive areas or more retained to the soil. Therefore, it is needed to understand the transport of contaminants under these climatic patterns. This study investigates the dynamics of selected contaminants (i.e. Caffeine, sulfamethoxazole, ciprofloxacin, PFA, estradiol, dimethyl phthalate) in various soil types (soils from subarctic and hot-semi arid regions, including agricultural soils) under controlled laboratory conditions. The experiments simulated two main parameters: i) rainfall flows, low (0.11 mL/min) and high (0.30 mL/min), and ii) large set of temperatures (5, 15, 35, 50 Celsius degrees). The study investigated the behavior of contaminants in soil using fixed-bed packed columns inside climatic chambers connected to a pump system and autosampler. Over one week, a mixture of contaminants at 1 ppm concentration was passed through the columns. Afterward, the columns were washed for another week to assess the mobility (sorption/desorption) of the pollutants. Samples were analyzed using an in-house UPLC-HRMS method to track target contaminants. The study also examined potential transformation products and aimed to understand the environmental fate of these substances under climate change scenarios.

Study of the Parameters Influencing the Adsorption of Chromium (VI) on Bentonite.

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Abstract

In Algeria, oil fields produce significant amounts of wastewater daily. These wastewater streams are often contaminated with hydrocarbons and heavy metals, with concentrations exceeding the current regulatory standards. Addressing this issue to prevent environmental pollution is one of the main objectives of our study. In this research, we aim to assess the pollution level of purge water from an oil station by analyzing various physicochemical parameters. This study revealed a high concentration of chromium (VI) in the purge water. To mitigate this, we propose the use of bentonite adsorption as a method to reduce the concentration of chromium (VI) ions in the purge water. The results obtained after treatment by adsorption indicate that the amount of Cr(VI) ions adsorbed by bentonite increases with the initial concentration of Cr(VI) ions and contact time. The agitation speed did not affect the amount of Cr(VI) ions adsorbed beyond 400 rpm. The removal rate of Cr(VI) ions increased with the mass of the adsorbent used. The study of temperature influence on adsorption showed that an increase in temperature significantly enhanced adsorption capacity, but the process became less effective beyond 45°C.

Keywords : Water, Pollution, Chromium, Bentonite, Adsorption.

Study of the Adsorption Performance of Chrysoidine R by a Synthesized Nanocomposite.

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Abstract

The pollution of wastewater by synthetic dyes is a persistent problem. Among the most effective techniques, adsorption of micropollutants by nanomaterials stands out. The preparation of nanocomposites from plant waste is particularly attractive from an economic perspective, as it allows for simple transformations and direct applications of these materials.

The objective of our study is to prepare a nanocomposite from plant waste rich in cellulose and apply it to remove an organic micropollutant, such as Chrysoidine R, from wastewater using the adsorption technique. The study of several parameters influencing the adsorption capacity, such as contact time, adsorbent dose, solution pH, and temperature, confirmed that the prepared nanocomposite is capable of efficiently adsorbing the micropollutant "Rosaniline Base."

Thermodynamic parameter analysis indicates the spontaneity of the adsorption process ($\Delta G<0$). Furthermore, the negative values of ΔH reveal the exothermic nature of the adsorption process. Based on the experimental results, it can be concluded that the prepared nanocomposite is effective in removing Chrysoidine R and could serve as an interesting alternative nanoadsorbent.

Keywords : Wastewater, Adsorption, Nanocomposite, Chrysoidine R.

CMTDE 2024_59

Numerical Simulation of Mass and Heat Transfer in Humidifiers: Optimizing Efficiency in Water Treatment and Humidifier Performance

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Abstract

Water desalination is vital for addressing global water scarcity and supporting sustainable development. It transforms seawater into potable water, enabling reliable freshwater supplies in arid regions. Humidifiers enhance air quality and support various industrial processes, while innovative treatment technologies ensure efficient and affordable solutions for critical water demands worldwide. This paper explores the numerical simulation of mass and heat transfers in humidifiers while predicting their value rates based on thermophysical properties, water-air exchange surfaces, and flow rate parameters. By modeling these factors, we assess the efficiency of humidifiers in real-world applications, providing a robust tool for optimizing design and operational strategies in water treatment and industrial cooling. The study demonstrates that humidifiers with structured packing materials, such as aluminum and copper, achieve slightly higher evaporation rates due to their superior thermal conductivities. Results indicate that water outlet temperatures decrease with increased airflow rates or reduced water flow, leading to enhanced evaporation efficiency. Increasing the air-water exchange surface also boosts evaporation rates, although a saturation threshold eventually limits further gains. The validated numerical simulation, which had a maximum relative error of 2.16 percent compared to experimental data, accurately predicts the mass and heat transfer rates. This gives us helpful information for improving the performance of humidifiers in various industrial and environmental settings.

Keywords : Water; Humidifiers; numerical simulation; Mass transfer; Heat transfer.

CMTDE 2024_60

Kinetic study of the adsorption of dye from wastewater on Algerian activated clay

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Abstract

Pollution refers to the introduction of harmful contaminants into the environment, which can cause adverse effects on ecosystems, human health and well-being. Indeed, dyes have polluted waterways from rapidly growing industrial activities. The polluted water then becomes a danger to the public since the dyes can inflict life-threatening diseases and devalue the aesthetic nature of the water bodies, leading to abnormal variations in the aquatic environment. This work focuses on the removal of dyes from rainwater using Algerian activated clay. Batch adsorption experiments are carried out by adding a known amount of adsorbent namely Algerian Maghnite-H^+ to a liquid solution at a known initial concentration and following the evolution in time of the concentration of the adsorbate. The effects of solution pH, temperature, initial concentration and contact time were investigated. Results showed that the maximum adsorption capacity was 350 mg/g. Furthermore, the adsorption kinetics illustrated the suitability of employing the pseudo-second-order kinetic model. The equilibrium adsorption data fitted the Langmuir isotherm well.

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

CMTDE 2024_61

Innovative adsorbent based on bentonite clay-polymer composite for wastewater treatment

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Abstract

In the last century, environmental protection was a major concern, so it's only natural that wastewater treatment should be one of our responsibilities. Industrial wastewater includes all water that is normally discharged from the plant to the outside environment after contributing to

manufacturing, cleaning, transportation and cooling. The composition and concentration of industrial effluents vary greatly according to the type of industry and stage of the industrial process. Today, color removal from wastewater has been a matter of concern both in the aesthetic sense and health point of view. The main physical characteristics of industrial wastewater are solid content, pH, salinity, color, odor and temperature while the main chemical characteristics, one can note organic matter (chemical oxygen demand (COD), biological oxygen demand (BOD_5), total organic carbon (TOC), nitrogen (ammonia, organic, nitrite, nitrate), phosphorus (organic and inorganic). In this context, this research evaluated the performance of Algeria modified (Maghnite H^+) clay, and was investigated for the availability of methylene Blue (MB) dye removal. It has been the subject of much research. At the beginning, surfaces of bentonite clays were activated by an acid solution of selected concentration. Then, activated bentonite was modified using intercalation of surfactants cationic (Hexadecyltrimethylammonium bromide (HTAB) by an exchange reaction. The next step, the intercalation of poly (vinyl alcohol) (PVA). Besides, the structural, textural and surface properties of clays before and after modification have been characterized by X-ray diffraction (DRX) and infrared spectroscopy (IR). Finally, the results indicate that the synthesized composite is low-cost material for the removal of dyes from wastewater: excellent adsorbent for cationic dyes.

Keywords : Algerian bentonite, Acid activation, surfactant, composite, wastewater

CMTDE 2024_62

Improving the Operation of Softening Unit through Advanced Ion Exchange Resin Maintenance Methods

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Abstract

The treatment of raw water through softening is crucial for obtaining soft water, thereby reducing the formation of scale deposits in equipment, particularly in boilers and cooling towers. However, the accelerated saturation of ion exchange resins in the plant's softener, observed after ten years of operation, compromises the effectiveness of the softening unit in the water treatment plant. In this context, a study was conducted to improve the performance of the softener by designing and analyzing new ion exchange resin regeneration practices. This innovative approach includes

optimized daily maintenance. The effectiveness of the proposed modifications was evaluated through total hardness (TH) tests of the water exiting the unit. A key parameter examined in this study is the resin saturation volume. By adjusting the regeneration practices and proposing various improvements, a significant increase in performance was achieved, raising the efficiency from **52%** to **80%** on-site and to **94%** in the laboratory. This led to a substantial reduction in the frequency of regenerations, with the regeneration volume decreasing from 21 m^3 to 15 m^3, resulting in a **reduction** of rejected water by **1693 m^3** per month and a **decrease** in salt consumption by 28 895 kg per month. Furthermore, it has been demonstrated that the lifespan of the resins can be extended up to 15 years, compared to the 5 years recommended by suppliers. These results highlight the effectiveness of the sustainable practices implemented, which could be applied to other water treatment facilities. This reinforces the commitment to environmental responsibility and contributes to the fight against climate change.

Keywords : Water treatment plants, Ion exchange resins, Sustainable practices, Water efficiency.

CMTDE 2024_63

Reduction of Total Dissolved Solids (TDS) in industrial water storage tanks while maximizing water resource recovery through reverse osmosis (RO)

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Abstract

The valorisation of highly mineralized water from the equipment of the potable water treatment station, such as rejects water from reverse osmosis systems, regeneration waste from softeners, and bottle washers, represents a key approach for the sustainable management of water resources in response to increasing pressure on freshwater reserves, exacerbated by climate change. The objective is to recycle this water to reduce the concentration of dissolved salts in the industrial water storage tanks supplying the station, while recovering a significant amount of reusable water. In this context, a study was conducted using specialized simulation software after sizing, employing reverse osmosis (RO) technology to ensure the quality of the produced water and explore various configurations to optimize the process performance. The simulation results demonstrated a very significant reduction in Total Dissolved Solids (TDS), achieving a **98.85%**

removal rate, with a water recovery rate of **62%**, equating to a recovery of **8 790 m³** of water per month. These results highlight not only the effectiveness of the solution in treating excess dissolved salts in the tanks but also its potential for integrated and sustainable water resource management. The implementation of these innovative solutions prevents premature fouling of equipment, reducing the frequency of cleaning operations and the use of chemicals at the treatment stations. The efficiency demonstrated by these sustainable practices could be extended to other water treatment facilities, further strengthening the commitment to environmental responsibility and actively contributing to the fight against climate change.

Keywords : Water treatment plants, Reverse osmosis, Sustainable practices, Valorization, Recovery.

CMTDE 2024_64

Health Risk Assessment of Fluoride Removal from Drinking Water

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Introduction

Fluoride is a naturally occurring mineral that can be found in various water sources, including groundwater and surface water. In controlled amounts, fluoride has been proven to have dental benefits, preventing tooth decay and strengthening tooth enamel. Reverse Osmosis (RO) is a method used to separate and extract dissolved solids, organics, and bacteria from water. This study aimed to assess the health risks associated with fluoride removal from drinking water in Tripoli, the Capital city of Libya by using purification systems.

Materials and Methods: Forty water samples were collected before and after the desalination process in different areas of Tripoli. Water Samples (groundwater, water distribution network and desalinated) were coded from 1 to 20 based on the source type. Samples were analyzed using DR3900 Laboratory VIS Spectrophotometer.

Results : Mean difference concentration of fluoride in the collected baseline water samples (before RO filtration) were found to vary between 0.08 and 1.16 mg/L. All of the water samples showed a complete reduction in fluoride content by 100% after passing through various RO filters.

Conclusions : The results of the study showed that the use of reverse osmosis water filtration technologies has a substantial effect in reducing the fluoride levels in drinking water within unacceptable limits set by the World Health Organization (WHO) and the Environmental Protection Agency (EPA).

CMTDE 2024_65

Optimization of the condensation and vacuum creation system for vacuum membrane distillation

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Abstract

Today, humanity faces significant challenges related to energy, economy, and environment. With increasing demand for fresh water due to population growth and changing weather conditions, desalination has become a critical solution. Solar energy coupled with membrane distillation (MD) offers a promising approach for producing drinking water. MD is a hybrid process combining distillation and membrane separation, operating at lower temperatures (60-80°C) than conventional distillation, making it ideal for integration with solar thermal collectors. This study focuses on vacuum membrane distillation (VMD), an evaporative process utilizing a hydrophobic porous membrane to separate liquid from gas. Key to VMD performance is the choice of vacuum and condensation systems. Three solutions were considered to achieve condensation and vacuum creation on the permeate side of the membrane: Condenser coupled with a vacuum pump, a liquid ring pump or a heat pump coupled with a vacuum pump. The three proposals were studied from the point of view of distilled water production, specific energy consumption, energy efficiency and unit cost. The results proved that the approach of using a heat pump coupled with a vacuum pump allows the best production of 911 kg/day, while the first and second approaches give 694 kg/day and 612 kg/day respectively. While from the point of view of specific energy consumption the approach of condenser coupled with a vacuum pump allows the lowest energy consumption since the second approach is low in terms of energy recovery and the third approach consumes a large amount of energy during the compression step. However, it was proved that the liquid ring pump is characterized by a low electrical energy. Although from the energy efficiency point of

view the heat pump approach coupled with a vacuum pump occupies first place with 74.88% against 66.94% and 59.58% for the first and second approaches respectively. This is explained by the capacity of the heat pump approach to recover lost energy. Also from the unit cost point of view the first approach gives a cost of 17 $/m^3 via 12.3 $/m^3 for the liquid ring pump approach and 46 $/m^3 for the heat pump approach coupled with a vacuum pump. This is explained by the high cost of the equipment of the third approach.

Keywords : vacuum membrane distillation, condensation and vacuum creation, energy consumption, unit cost.

CMTDE 2024_66

Adsorption and Regeneration of iron pillared clay adsorbents for removal orange methyle

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Abstract

The present work focused on the performance of iron-pillared clay (Mont-Fe) to remove orange methyl dyes. The adsorbent was prepared using an Algerian bentonite clay the bentonite was purified and then modified using iron nitrate solution; the Mont-Fe was characterized by powder x-ray diffraction, Fourier-transform spectroscopy (FTIR) and the scanning electron microscopy (SEM) to identify the morphology of our adsorbent. The adsorption process was realized including pH of solution, initial MO concentration, contact time, and the adsorbent masse. The optimal contact time for adsorbents was 6 hours, the initial pH 3, 98 using 0,1 g of adsorbents at 25°C giving 75 % removal percent of MO. The regeneration of adsorbent is studied using chemical process by using different concentrations of NaOH and HNO3 solution. The obtained results revealed that the regeneration using the NaOH (1% M) was the most important at 30 min; The regeneration study showed that the Mont-FER exhibited an excellent recycling capability. Overall, the Mont-Fer is very attractive as an efficient, low-cost, eco-friendly, and recyclable adsorbent.

Keywords : Adsorption; regeneration; clay; methyl orange; desorption; wastewater treatment; iron pillared clay.

CMTDE 2024_67

Preparation and Characterization of a Thin-Film Composite Nanofiltration Membrane Based on Polyamide-Cellulose Acetate: Application for dyes removal

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Abstract

In this work, the synthesis of new polyamide thin-film composite nanofiltration membranes (NF-TFC) for water purification was described. The polyamide thin film was deposited over a synthetic cellulose acetate (CA) supported by interfacial polymerization method. 1,3 cyclohexane bis (methylamine) (CHMA) and trimesoyl chloride (TMC) were used as monomers. The membranes were characterized using Scanning Electron Microscopy (SEM), Fourier Transform Infrared spectroscopy (FT-IR), water uptake, porosity, contact angle, water permeability and rejection towards specific salt and dye molecules. The effect of the variation of the CHMA concentration (0.2–2 wt.%) on the morphology, porosity, water permeation and rejection properties of the prepared membranes was studied. SEM results displayed the growth of the membrane thickness when the CHMA concentration increased from 0.2 to 2 wt.%. The strong adhesion between the cellulose acetate substrate and the polyamide layer is explained by the formation of the polyamide film in the substrate surface and inside the pores. The water permeability varied from 36.02 to 17.09 $Lh^{-1}m^{-2}$ bar^{-1} . The salt rejection of Na_2SO_4 and NaCl increased from 9 to 68% and from 38.41% to 89.4%, respectively, when the CHMA concentration was changed from 0.2 to 2 wt.%. The prepared membranes were further applied successfully for the removal of malachite green and Congo red. The results indicated that the maximum rejection reached 89% and 85% for malachite green and Congo red, respectively.

Keywords : Polyamide NF membrane, Thin-film, Interfacial polymerization, Malachite green, Congo red

CMTDE 2024_68

Separation methods of terpenes

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Abstract

Terpenes or terpenoids are extracted or steam distilled for the recovery of the essential oils of specific fragrant plants. These steam distillates are used to create fine perfumes, to refine the flavor and the aroma of food and drinks, and to produce medicines from plants (phytopharmaca). In recent years, consumers have developed an increasing interest in natural products, as most of these terpenoids have been identified as high value chemicals in food, cosmetic, pharmaceutical, biotechnology, and industrial crops. Extensive chemical techniques and biological tests have led to the identification, biological characterization, and extraction of major components that are of wide interest, especially to the cosmetic and industrial recovery of selective terpenes. The status of the knowledge of their general structure, functions, and bioactive properties and the methods for their separation are covered.

Keywords : Terpenes, structure, functions, bioactive properties, separation methods.

CMTDE 2024_69

TiO_2-based nanocomposite for photocatalytic degradation of pharmaceutical pollutant

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Abstract

Industrial, agricultural and urban activities contribute to the pollution of aquatic ecosystems by releasing several organic pollutants and contaminants i.e. pesticides, dyes and pharmaceutical compounds. Among these pollutants, pharmaceuticals are a growing concern due to their bio-recalcitrant character. It is, therefore, necessary to control this type of pollution by developing effective wastewater treatment processes. Several works have focused on the photocatalytic degradation employing semiconductors as a photocatalyst which is recognized as an environmentally friendly, economical and efficient water treatment process by dint of the in-situ formation of strong oxidizing species such as OH° which can oxidize organic pollutants in a non-selective way until their mineralization. Among the most widely used photocatalysts, TiO_2 has received attention due to its oxidizing power under UV irradiation and its ecological nature. Nevertheless, due to its broad band gap and the high electron-hole recombination, TiO_2's photocatalytic activity has limited performance. Consequently, during the last few years, efforts have been devoted to developing efficient and robust photocatalysts. Among all the strategies, coupling TiO_2 with other semiconductors or embedding a conducting carbon nanostructure in a TiO_2 matrix are suitable ways to limit electron-hole recombination. The aim of this study is the hydrothermal synthesis of two TiO_2-based nanocomposite photocatalysts to degrade a pharmaceutical pollutant in aqueous medium. Results demonstrate that the prepared nanocomposites' photocatalytic degradation of the pharmaceutical pollutant is efficient, providing a friendly environmental strategy.

Keywords : TiO_2-based nanocomposite, Photocatalytic degradation, Pharmaceutical pollutant.

CMTDE 2024_70

Harnessing Power : Enhanced Power Density via Reverse Electrodialysis

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Abstract

Mixing waters with different salinity can be used as a renewable energy source. Reverse electrodialysis (RED) process enables us to obtain electricity directly from salinity gradients. Despite recent substantial advancements in research on RED technology, there remains a keen interest in enhancing its efficiency. In this paper, a model was developed to conduct a parametric

study on the RED process. The model used 5 M and 0.1 M salinities for the high and low-concentration solutions, respectively. The influence of spacer thickness and Reynolds number on gross and net power densities was assessed. The results indicated that employing a thicker spacer (270 µm) with a low Reynolds number of 3.4 in the high compartment and a thinner spacer (150 µm) with a high Reynolds number of 16 in the low compartment resulted in an increased net power density of 5.05 W.m_{cp}^{-2}.

Keywords : Reverse electrodialysis (RED), Reynolds number, Spacer thickness, Net power density**.**

CMTDE 2024_71

Ibuprofen adsorption onto natural Tunisian chert

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Abstract

This study investigates the use of chert, a natural and previously unexplored adsorbent from Jebel el Âli (Kef Ensour) in the Gafsa region, for the first time in pharmaceuticals compounds removal. Raw chert (CH-br) was tested for its ability to remove ibuprofen. Structural and morphological characterizations were conducted using XRD, FTIR and BET, along with the determination of the zero point of charge (pHzpc). Batch experiments assessed the effects of contact time, initial ibuprofen concentration, and pH on ibuprofen removal. The adsorption of ibuprofen on chert was strongly influenced by initial ibuprofen concentration. The Langmuir model best described the adsorption, with maximum capacity of 11. 87 mg/g. Kinetics adsorption followed a pseudo-second-order kinetic model. This research highlights chert as a novel, environmentally friendly, and cost-effective adsorbent for pharmaceutical compounds removal from wastewater.

Keywords : Ibuprofen, Chert, Adsorption, Kinetics, Isotherms

CMTDE 2024_72

Innovative Method for Rare Earth Element Extraction: Development of a Novel Process and Comparison with Supported Liquid Membrane and Solvent Extraction Techniques

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Abstract

A new extraction method has been developed to enhance rare earth element (REE) recovery, utilizing a modified supported liquid membrane (SLM) configuration. This approach was compared with conventional solvent extraction and standard SLM techniques. Experiments used the same extractant, di(2-ethylhexyl) phosphoric acid (D2EHPA), diluted in kerosene at 10% (v/v), to assess critical parameters including extractant effectiveness (in both solvent and membrane forms), feed phase pH, and kinetics influencing REE extraction. NMR analysis of the organic solution showed a coordination mechanism between REE^{3+} ions and D2EHPA. The extractant for both solvent extraction and SLM was chosen based on recovery efficiency, with D2EHPA proving the most suitable due to its high partition coefficient of 4.8 and a yield of 48%. Feed solution pH varied between 1 and 4. Optimized systems were then applied to solvent and SLM leaching kinetics, achieving equilibrium times of 2 and 10 hours, respectively, using D2EHPA amounts of 300 µL and 20 µL. This study introduces an innovative SLM configuration that reduces both the amount of extractant and the time to reach equilibrium. The modified SLM design separates extraction and stripping phases in both time and mode (batch), resulting in accelerated REE transport, with equilibrium reached in 30 minutes using only 30 µL of D2EHPA for an 8 mM REE solution. Optimal stripping conditions were achieved with a 1 M HCl phase, a 5-minute stripping time, and 4 mL of acid volume. Under the new process, REE transport efficiency reached

approximately 54%, 68%, and 74% for La, Ce, and Nd, respectively, within 35 minutes. This sustainable extraction system demonstrates potential for recovering REEs from low-content sources such as sewage sludge, industrial by-products, and contaminated solutions. Additionally, the process is environmentally friendly, reducing capital and operational costs, time, and chemical consumption involved in REE extraction.

Keywords : Rare earth element extraction; solvent extraction; supported liquid membrane;

CMTDE 2024_73

Innovative Leaching Techniques for Sustainable and Efficient Recovery of Rare Earth Elements from Phosphogypsum

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Abstract

Phosphogypsum (PG) is generated in large quantities worldwide as a by-product of phosphoric acid production, making it a common waste product. Managing this substantial waste is challenging due to the presence of pollutants, including non-biodegradable rare earth elements (REEs). An effective approach to valorizing PG involves the extraction of REEs, which are essential in numerous modern technologies. However, any recovery method must remain cost-effective and environmentally responsible. This research focuses on improving leaching efficiency and examining the relationship between the REE extraction efficiency from PG and gypsum solubility. Findings show that the leaching efficiency of REEs improves with increased acid concentration, longer leaching duration, and an optimized solid-to-liquid ratio, primarily due to enhanced PG solubility. Notably, hydrochloric acid (HCl) leaching demonstrates high efficiency at ambient temperatures, offering benefits of lower energy use and reduced costs. Additionally, adding ammonium chloride or sodium chloride to HCl as a leaching agent significantly boosts REE extraction from PG. The optimal sodium and ammonium content for maximum leaching efficiency was found to be 2% and 4%, respectively. The highest leaching efficiency for REEs such as Nd, Y, and La in HCl was achieved with an acid concentration of 3 mol L−1, a solid-to-

liquid ratio of 1:40, and a temperature of 25 °C. These results are promising, particularly as they show that no heating is required for REE extraction from PG, aligning with circular economic principles and supporting environmental sustainability. Achieving a high recovery efficiency (about 87%) while keeping costs low is crucial for the economic viability of REE extraction.

Keywords : Rare earth elements; Phosphogypsum solubility; By-product; Leaching; Valorization.

CMTDE 2024_74

Assessment of the microbiological quality of irrigation water and dispersal of antibiotic resistance genes

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Abstract

The discharge of treated or inadequately treated wastewater into the environment is considered as a risk to human and animal health through direct contact or consumption of contaminated fresh produce (by irrigation or soil amendment with contaminated residues). In this study, we assessed the faecal contamination of wastewater treatment plants (WWTPs) residues, surface water and groundwater sampled from wells used for irrigation and animal watering. Furthermore, the prevalence of antibiotic resistance genes in bacterial fractions extracted from these samples was assessed using a molecular method: quantitative real-time PCR. The studied ARGs were the quinolone resistance genes (qnrA) and the blaTEM gene, which confers resistance to β-lactams. This study showed the existence of faecal contamination of surface water and groundwater, as evidenced by the detection and enumeration of a fecal indicator bacteria (E. coli) and a viral indicator (Somatic Coliphages). In addition, ARGs were investigated in urban wastewater, surface water and groundwater. The prevalence of ARGs in these matrices varies according to the nature of the matrix and ARGs. All tested water samples were positive for the presence of ARGs (qnrA and blaTEM). The prevalence of the blaTEM gene is higher than that of the qnrA gene. These results raise concerns about the spread of ARGs in the aquatic environment and the emergence of new resistance phenotypes and new multi-resistant pathogens through food-chain.

Keywords : Surface water, Ground water, Wastewater, Antibiotic resistance genes, Real time PCR, Somatic coliphages, Resistant bacteria.

CMTDE 2024_75

Adsorption of a Phenolic Compound by Activated Carbon Derived from Pinecones : Preparation, Characterization, and Thermodynamic Study.

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Abstract

The aim of this work is to evaluate the adsorption capacity of p-chlorophenol (PCP) by activated carbon (AC) derived from pine cones, prepared by chemical activation with potassium hydroxide (KOH). The activated carbon was obtained in three steps: the first step involved carbonizing the raw material at 600 °C; the second step consisted of impregnating the carbonized material in a KOH solution at a 1:1 ratio for a sufficient time; and the third step involved pyrolyzing the resulting material at 800 °C in a tubular furnace under nitrogen atmosphere. The activated carbon was then subjected to various characterization methods: chemical analysis to determine functional groups by FTIR spectroscopy, measurement of the pHpzc value, and characterization of the porous texture using iodine number, methylene blue number, and BET surface area, based on nitrogen adsorption-desorption isotherms. FTIR results revealed the presence of functional groups such as acids, alcohols, aromatics, amines, alkyls, etc. The pHpzc value was measured at 7.1, with a specific surface area of 100.66 m²/g. Adsorption tests were conducted for the removal of p-chlorophenol (PCP), and the experimental data were modeled using Langmuir, Freundlich, and Temkin models. The results showed that the Langmuir model well described the adsorption process, with a maximum adsorption capacity of 50 mg/g. The adsorption kinetics of PCP followed a pseudo-second-order model. The thermodynamic study showed that the adsorption of PCP by

the prepared activated carbon is spontaneous, endothermic, and favorable. The activated carbon derived from pine cones proved to be effective for the removal of this organic pollutant.

Keywords : Pine Cone, Activation, Adsorption, P-Chlorophenol

CMTDE 2024_76

Development of a Machine Learning Algorithm for Predicting User Engagement and Data Consumption in Popular Applications

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Abstract

This study focuses on the development of a sophisticated machine learning algorithm designed to predict user engagement and data consumption behaviors on popular applications such as YouTube, Facebook, and Instagram. The primary objective is to provide actionable insights that enable decision-makers to optimize resource allocation and improve marketing strategies. The methodology includes several key steps: data collection and preprocessing to ensure the quality of historical data, the application of Long Short-Term Memory (LSTM) networks to capture temporal patterns in time series data, and the integration of MLflow for effective model management and experimentation. A user-friendly interface is also developed to facilitate the generation of forecasts based on user inputs. Results indicate that the model successfully predicts user engagement and consumption trends with an accuracy of up to 90% in some cases. The generated visualizations show a 25% improvement in resource allocation, allowing stakeholders to make informed decisions. Additionally, the forecasts enabled the anticipation of usage peaks with a lead time of 15 days, resulting in a 30% reduction in operational costs related to resource management. This work illustrates the potential of machine learning to drive data-driven strategies and optimize business operations in a rapidly evolving digital landscape.

Keywords : Machine Learning, User Engagement, Data Consumption, Predictive Analytics

CMTDE 2024_77

Effect of stibnite thickness on the degradation of methylene blue in aqueous solutions under visible light

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Abstract

In this work, we have investigated the morphology, structure, optical, and photocatalytic properties of Sb_2S_3 thin films deposited on glass substrates by a dip-coating method as a function of their film thickness. The surface morphology of stibnite films was studied by field emission scanning electron microscope (FESEM), demonstrating that the grain size increased as the film thickness increased. X-ray diffraction (XRD) analysis revealed the formation of a polycrystalline orthorhombic structure with a clear preferred orientation along the (221) plane. The formation of a single phase of stibnite thin films was corroborated by measuring Raman spectra, unveiling five major Raman peaks. The estimated optical band gap (Eg) value decreases from 1.72 eV to 1.67 eV as the film thickness rises from 300 to 1500 nm. Electrochemical impedance spectroscopy (EIS) analysis has demonstrated the outstanding charge transfer properties of the stibnite thin films in the sample with a thickness of 1200 nm. The photocatalytic activities of the samples were evaluated by the degradation of methylene blue (MB) dye under dark and visible light conditions for 60 min. A significant photodegradation rate was achieved in the film with a thickness of 1200 nm, resulting in a 98.5% degradation of MB under visible light conditions. The degradation of MB by the Sb_2S_3 (1200 nm) photocatalyst was found to follow pseudo-first-order kinetics with a rate

constant of 0.049 min^{-1}. These outcomes highlight the potential of film thickness for advanced photocatalytic applications.

CMTDE 2024_78

Technical-economic and comparative study of solar water desalination systems

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Abstract

In Africa, freshwater resources are often exhausted or polluted, and fossil fuels are limited. In Morocco, this scarcity is compounded by insufficient rainfall, especially in the south. Renewable energies are seen as a sustainable alternative to meet energy needs, while desalination and wastewater treatment are helping to improve access to fresh water. Over the last few decades, the evolution of desalination technologies has revealed a growing interest in membrane techniques, often favored over distillation processes. The main objective of this work is to study, qualitatively and quantitatively, two existing brackish water desalination systems at the National Center for Water and Energy Studies and Research (CNEREE) at Cadi Ayyad University, Marrakech. The first system is based on the principle of reverse osmosis (RO). The second uses the Scheffler solar dish to heat the water, while determining its performance, quality and quantity of desalinated water. A comparison of the performance of the two systems will also be presented, while assessing the influence of meteorological and operating parameters on them. Results from the MP20 reverse

osmosis pilot experiment show the influence of external and internal parameters on production, with positive results in terms of desalinated water flow and salinity. A study of the impact of parameters on the Scheffler parabolic desalination system revealed that an optimum cooling flow rate of 2.7 L/min improved performance, even under variations in radiation in September 2024. The conductivity of the water produced is 105-175 µS/cm for RO and 4.42-10.8 µS/cm for the Scheffler dish, meeting WHO standards for drinking water, but still too high for certain industrial uses.

Keywords : Solar distillation, Scheffler solar dish, Reverse osmosis (RO)

CMTDE 2024_79

Mini-station for desalination based on the electromagnetic method

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Abstract

Our study concerns an electromagnetic micro-station for the desalination of seawater with optimal energy consumption. It is mainly dedicated to the desalination of salt water with large salinity values, by using the unconventional method based on electromagnetism (EMD). The desalination process by EMD then consists in separating the particles of soluble salt by the phenomenon of attraction/repulsion according to the Lorentz force.

CMTDE 2024_80

Desirability function and Box-Behnken design optimization for anionic and cationic dyes adsorption by activated Algerian Bentonite

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Abstract

This study investigates the adsorption of Methylene Blue (MB) and Congo Red (CR) dyes onto Algerian clays, in both their natural form and after modification with hydrochloric acid. The modified clays were prepared using varying concentrations of the activating agent, different

temperatures, and agitation times. Optimization of the activation parameters to achieve maximum dye adsorption was conducted using the Box-Behnken experimental design. Clays activated under optimal conditions were characterized using X-ray diffraction (XRD), infrared spectroscopy (IR), and textural analysis (measuring internal porosity and pore volume). This study examined the effects of initial dye concentration, contact time, solution temperature, and pH on CR and MB adsorption. Results showed that CR adsorption was most effective at acidic pH and ambient temperature, while MB adsorption was most effective at neutral pH and 65°C. Maximum adsorption occurred at a CR dye concentration of 120 mg/L and MB concentration of 400 mg/L. Equilibrium for dye adsorption both CR and MB was reached within 40 minutes of agitation.

Keywords : Algerian clays, Acid activation, Adsorption, Methylene Blue, Congo Red.

CMTDE 2024_81

Electrochemical Magnetization of Wastewater for Cleaner Production

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Abstract

The increasing demand for sustainable wastewater treatment has driven research into innovative, eco-friendly methods for contaminant removal. This study explores the electrochemical magnetization of wastewater as an efficient solution for cleaner production. By applying an external magnetic field during electrochemical treatment, the magnetic properties of contaminants are enhanced, facilitating their removal from wastewater. Key parameters, such as electrode material, current density, and magnetic field intensity, were optimized to achieve maximum removal efficiency of heavy metals, organic pollutants, and suspended solids. Experimental results demonstrated that electrochemical magnetization improved pollutant removal by over 30% compared to conventional methods, while reducing chemical consumption and sludge production. Furthermore, this technique minimizes the environmental impact by allowing for the recovery and reuse of certain contaminants. The findings suggest that electrochemical magnetization of

wastewater is a promising approach for cleaner production, aligning with sustainable industrial practices and environmental preservation goals.

CMTDE 2024_82

Impact of Wastewater on the Aquatic Plant Posidonia oceanica (L.) Delile 1813 in the Gulf of Annaba

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Abstract

The Gulf of Annaba is facing multiple sources of pollution resulting from various human activities in its watershed. Additionally, maritime activities also contribute to this problem. Posidonia meadows, by their key role in the Mediterranean coastal ecosystem, are increasingly monitored and considered a priority habitat. These meadows are effectively used as indicators of disturbances in the Mediterranean coastal environment. The aim of this study is to identify the environmental factors influencing the health status of the coastal ecosystem through the Posidonia oceanica meadow and its epiphytes. To assess the health status of the Posidonia oceanica meadow along the East Algerian coast, the study first involved monitoring the physicochemical parameters of the waters in the Gulf of Annaba, followed by the evaluation of metallic contamination (zinc, copper, chromium, nickel, and cadmium) using the endemic Mediterranean seagrass P. oceanica and its epiphytes. A seasonal monitoring of the biometric parameters of P. oceanica was conducted in the Gulf of Annaba, followed by the identification of epiphytes on P. oceanica leaves. The highest concentrations of trace metals (ETMs) in the waters of the Gulf were primarily found at stations S3, S4, and S5, compared to the other sampling stations. The majority of zinc (Zn) and nickel (Ni)

were found at station S4, copper (Cu) was most concentrated at station S5, and chromium (Cr) was found in higher concentrations at station S3. Heavy metals measured in the adult leaves of P. oceanica and its epiphytes in the Gulf of Annaba revealed that the accumulation of ETMs in the plant and its epiphytes varied with the season and station. The biological indicator P. oceanica can serve as an early warning system for contamination, whose effects are still reversible. In the Mediterranean coastal zone, P. oceanica should play a major role in the cycle of ETMs due to its abundance, high productivity, and its ability to accumulate these trace metals.

Keywords : Posidonia oceanica, Epiphytes, Trace Elements, Gulf of Annaba, Pollution.

CMTDE 2024_83

Adsorption of methyl blue dye from aqueous solution by blend polymer based on PVC

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Abstract

Contamination of water by organic pollutants has become a serious global environmental problem. dye-containing wastewater is harmful to human and aquatic life because most kinds of these dyes might cause toxicity, cancer, or mutations in living organisms. Adsorption is known as the best method for detoxifying wastewater from dyeing products by allowing them to stick to the surface of adsorbent materials. Polymers are sometimes preferred for membrane filtration because they are more fexible, easier to handle, and less expensive than inorganic membranes; Moreover, many types of adsorbents have been developed and applied for the removal of dyes from aqueous solutions such as polymeric materials, The aim of the present study is the synthesis of a polymer blend PVC/PVC-g-PDMAEM(N^+) with quaternary amine for the removal of Methyl Blue (MB) dye from an aqueous solution. Different parameters such as pH, adsorbent dye concentration, contact time, and proportion of graft copolymer with quaternary amine relative to PVC in the equilibrium adsorption have been studied using the UV–Visible spectroscopic technique, Fourier transform infrared (FT-IR) spectroscopy and scanning electron microscopy–energy-dispersive spectroscopy (SEM–EDX).

Keywords : Polyvinyl chloride · Methyl blue · Copolymer blend · Dyes adsorption · Isotherms · Kinetics

CMTDE 2024_84

Application of statistical physics formalism for the modeling of adsorption isotherms of water molecules on the microalgae spirulina platensis

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Abstract

Drying and storage of water by spirulina microalgae are among the main uses of Spirulina in food applications. In this work, we are interested in the storage of water by these microalgae. A model based on the statistical physics formalism is one of the supports for imagining the arrangement of water molecules on the Spirulina surface. On the basis of this method, we have interpreted, on a microscopic scale, adsorption isotherms of water molecules by the Spirulina biomass at three temperatures (283 K, 293 K and 303 K). We interpret the results of the fit through the parameters involved in the model, namely the number of water molecules adsorbed per site n , the receptor sites density D and the energetic parameters e1w and e2w , determined by fitting the experimental adsorption isotherms. Lastly we calculated the thermodynamic functions which govern the adsorption process such as entropy, free enthalpy and internal energy.

Keywords : Adsorption isotherm; Spirulina Platensis; Moisture sorption content; Statistical physics model; Statistical thermodynamics potential.

CMTDE 2024_85

Use Low-Cost Bio adsorbents for removal 2-Nitrophenol

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Abstract

This study's goal was to synthesize and construct biomaterials of the cationic and anionic types. These substances were utilized as adsorbents in waters that had been contaminated by various adsorbates that were probably prevalent in the environment. To describe the various materials, various approaches (IRTF, DRX, MEB, BET, and ATG/DTA) will be used. Studies on the adsorption by these substances will be conducted while changing several variables, including pH, mass, concentration, and temperature. Removal of effluents in aqueous media, particularly the adsorption technique, which appears to be well suited to remove pollutants due to its shown efficacy as well as for financial reasons, using inexpensive adsorbents such agricultural and industrial wastes.

Keywords : Characterization; Different materials; Water treatment; Bio adsorbents; adsorption

CMTDE 2024_86

Optimizing the Treatment of Medjerda River Water : The Potential of Moringa Seeds as an Eco-Friendly Adsorbent

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Abstract

Given the growing water stress in Tunisia, it has become strategically important to monitor the water quality of the Medjerda River, which serves as the country's primary watercourse and is a crucial resource for agricultural and drinking water. Innovative and environmentally friendly solutions are needed to preserve this natural resource in a sustainable manner. Recent sampling efforts have highlighted an exceedance in iron concentrations underscoring the need for targeted remediation strategies. In this regard, the potential of moringa seeds, a biosourced adsorbent, in water filtration is being investigated. In order to address the issues of water sustainability and responsible water resource management, this study focuses on the material's efficiency while optimizing adsorption conditions. Specifically, the adsorption process was comprehensively analyzed by examining the effects of pH, adsorbent dosage, contact time, temperature, and initial iron ion concentration. The results demonstrate a high adsorption efficiency, with removal rates reaching 95% within just 30 minutes. Additionally, the adsorption data align closely with the Langmuir isotherm model, indicating monolayer adsorption on the biosorbent surface.

Keywords : water treatment, adsorption, Moringa seeds, optimization, Iron

CMTDE 2024_87

Advanced highly sensitive hybrid nanomaterials for heavy metal ions detection and water treatment

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Abstract

The increasing contamination of water sources by heavy metal ions has raised significant environmental and health concerns, necessitating the development of effective detection and remediation technologies. This work explores the use of advanced hybrid nanomaterials as a promising solution for both the sensitive detection and efficient removal of heavy metal ions from

aqueous environments. These nanomaterials combine the unique properties of inorganic nanoparticles (such as high surface area, stability, and reactivity) with organic or biological components (such as functionalized polymers, peptides, or biomolecules), resulting in enhanced performance for heavy metal ion sensing and water treatment. here we also introduce the development of modified electrodes with nanomaterials for Pb^{2+} and Cd^{2+} ions detection. Electrochemical measurements, structural analysis, morphological observation and theoretical modelling methods were investigated. The present work gives some advancements in the design and fabrication of these nanomaterials, as well as their challenges, scalability, and prospects for large-scale applications in environmental remediation and sustainable water management.

Keywords : Hybrid nanomaterials, Heavy metal ions, Water treatment, Electrochemical sensing, Real-time monitoring, Environmental pollution.

CMTDE 2024_88

Development and Application of an LC-MS/MS Methodology for the Detection and Quantification of Pharmaceutical Residues in Wastewater

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Abstract

The contamination of aquatic environments by pharmaceutical residues (Ph) and their metabolites (Met) has become a significant environmental concern. These substances, resulting from their widespread use in human and veterinary healthcare, are frequently detected in wastewater, surface water, and groundwater. Given their potential impact on ecosystems and human health, their inclusion in monitoring programs and environmental risk assessments is now essential. However, reliable quantification of these emerging contaminants remains an analytical challenge due to their presence at extremely low concentrations, typically at trace or ultra-trace levels. The accuracy and sensitivity of results heavily depend on the robustness of the analytical methods employed, particularly during critical steps such as extraction and quantification. In this study, we developed

an LC-MS/MS methodology for the qualitative and quantitative analysis of six widely used pharmaceutical compounds, representing various therapeutic classes: anticancer drugs, contraceptives, antibiotics, cardiovascular drugs, and antidepressants. The method was rigorously validated to ensure high performance in terms of precision, linearity, and limits of detection and quantification. To assess environmental impact and treatment efficiency, the methodology was applied to wastewater samples collected before and after treatment at the Menzel-Temime wastewater treatment plant (WWTP). The results provide a detailed understanding of the persistence of pharmaceutical residues and metabolites post-treatment, contributing to a deeper insight into the challenges of pharmaceutical pollution.

Keywords : emerging contaminants, pharmaceutical residues, LC-MS/MS, analytical validation, wastewater, WWTP

CMTDE 2024_89

Elimination of Inorganic Micropollutants Present in Water by Bio adsorption: Optimization and Applications

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Abstract

Industrial water pollution with heavy metals is a serious environmental issue resulting from the discharge of water containing toxic heavy metals into water bodies such as rivers, lakes, and oceans. These metals include substances such as lead, mercury, cadmium, chromium, nickel, and zinc, which can leak from factories or industrial facilities into water sources. This study aims to evaluate the effectiveness of date seeds as an adsorbent material for removing lead from aqueous solutions. The physical and chemical properties of the date seeds' surface were analysed, and the influence of several factors on the adsorption process was studied, including pH, temperature, agitation speed, particle size, and contact time. The results revealed that the optimal conditions for the adsorption process were a contact time of 80 minutes, a pH of 6, a temperature of 45°C, an agitation speed of 150 rpm, and a particle size of 100 micrometres. Under these conditions, the maximum lead removal efficiency reached 87.64%. Additionally, the adsorption model was analysed, and the thermodynamic parameters associated with the process were studied. The findings suggest that date seeds are an effective, cost-efficient, and environmentally sustainable option for

lead removal from aqueous solutions, enhancing their potential for use in polluted water treatment and providing innovative and sustainable solutions for environmental challenges in water purification.

CMTDE 2024_90

CFD Modelling of an Integrated Evaporative Cooling and Wind Catcher System for Poultry House Climate Control

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Abstract

Wind catchers, a wind-powered ventilation system, are being explored for improving airflow and cooling poultry houses, especially in hot climate regions, thereby reducing energy consumption. This study explores the incorporation of a passive ”wind catcher” system with a downward evaporative cooling apparatus in poultry housing. Computational Fluid Dynamics (CFD) modelling along with empirical validation are used to examine the effectiveness of this integrated system. The results clearly show that it can improve the environmental conditions within the chicken house. Specifically, the investigation reveals a remarkable reduction in air temperature, plummeting from 35°C to a comfortable 23°C. Concurrently, there’s a noteworthy elevation in relative humidity, ascending from 25% to an optimal 50%, all achieved under a modest wind speed of 1.5 m/s. The results highlight the strong efficacy of our developed technology in cooling poultry homes. The suggested system provides notable improvements in regulating the climate of chicken houses, increasing energy efficiency and economic feasibility in comparison to traditional cooling techniques. The study emphasizes the flexibility and capacity for growth of this method, making it applicable to different chicken house setups and weather circumstances, thereby promoting its broad application. The results indicate other paths for future research. The activities include enhancing the placement of cooling nozzles, studying various droplet sizes, and assessing the long-term economic feasibility of this new cooling system. This study makes a substantial contribution to the ongoing discussion on cooling methods for chicken houses. Demonstrating the practical effectiveness and benefits of combining” wind catchers” with evaporative cooling can lead to significant breakthroughs in poultry farming methods that support sustainability goals and meet industrial needs.

Keywords : CFD Modelling, Evaporative Cooling, Poultry House, Wind Catcher System

CMTDE 2024_91

Optimization of a forced convection solar dryer for food products

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Abstract

The use of solar energy for drying food products is considered not only a key factor in the development and economic growth of a country but also one of the most environmentally friendly methods to reduce reliance on fossil fuels. Tunisia, with abundant sunshine for most of the year, is one of the developing countries with significant potential for solar energy exploitation. The forced convection solar dryer for food products has been the focus of extensive research in recent years, due to its numerous advantages such as energy efficiency, environmental protection, and low cost. In the present work, a mathematical model for simulating, designing, and analysing a forced convection solar dryer with a capacity of 10 to 20 kg is presented. This system consists mainly of two parts: the hot air generation system, which includes a flat plate solar collector with an outer glass cover, a rear insulator, a thermal storage system, and an absorber; and the drying unit, which comprises the drying chamber, trays, and fan motor. The results in this paper are based on a manual analysis using various research studies and data from different sources. The model is validated by comparing the obtained results with experimental data. Additionally, we explore the influence of certain parameters on system performance and determine optimal operating conditions to understand the system's energy and thermal efficiency for achieving optimal performance.

The parameters of each component are calculated using fundamental thermodynamic principles, mass and energy balance equations, and correlations from literature on evaporation, condensation, and liquid-to-liquid heat transfer.

Keywords : Energy Balance, Optimization, simulation, solar dryer

CMTDE 2024_92

A Solar Desalination System: Experimental study and comparaison with the theoretical results

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Abstract

The earth is covered by 97.5% of salt water, which is available for a very large part of the population living near coastal areas throughout the world, which experiences water scarcity due to a limited supply of fresh water. Solar Desalination was a solution for producing potable water and for minimizing the emission of CO_2. This study presents an evapo-condensation system using solar radiation as a source of energy to convert brackish water to freshwater, The system is installed in Marrakech at the National Center of Studies and Research on Water and Energy, consisting of a parabolic dish solar concentrating scheffler parabole a distillation still and condenser. A physical model is created while accounting for a number of factors that influence the distillation production of system . Experimental and theoretical approaches were carried out to test our system under Marrakech climate and were conducted over several months. We succeeded in achieving our main objective, which was to develop a numerical simulation model of the proposed system. This model was then validated through practical experiments, enabling us to verify its accuracy and reliability. This experimental validation confirms the model's effectiveness and its match with behaviours observed in real-life conditions, paving the way for its use in future system analysis and optimization. The results show that climatic factors have a major impact on performance, with the temperature of the condenser also having a substantial effect.

Keywords: Solar desalination, experimental investigation, numerical investigation, Scheffler parabolic.

Study of the Thermal and Mechanical Properties of a Phosphogypsum and date palm fiber composite

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Abstract

The present study aims to evaluate the effect of palm fiber on phosphogypsum-based plaster. The studied samples are prepared with a 1:2 PG:water ratio. The amount of fiber varied from 2% to 8%. The obtained results show that PG consists of fairly pure gypsum with some traces of impurities. The fibers have a similar chemical composition, and the SEM indicates a surface change after alcalin treatment. Pure PG has a low resistance to bending and compression due to its low density and porosity. The addition of the fibers does not improve the mechanical characteristics, and this is due to the low density of the composite. Thermal conductivities for the 2% plaster composite and pure PG were both measured to be very low, around 0.1845 W/mK and 0.1391 W/mK, respectively. No matter the type of fiber or the amount utilized, adding fibers to PG has been demonstrated to increase the composite's conductivity.

Keywords : Phosphogypsum, valorization, fibres, composite, mechanical and thermal properties.

CMTDE 2024_94

Adsorption of Malachite Green using a Magnetized Biosorbent

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Abstract

The treatment of polluted effluents, particularly those containing dyes and inorganic substances, is essential for global regulations. Adsorption is one of the most used techniques to remove these pollutants. The use of modified biosorbents has particularly attracted attention for improving adsorption rates compared to natural biosorbents. This work examines the adsorption of Malachite Green dye in aqueous media using a magnetic biosorbent derived from the plant Casuarina Equisetifolia. The material was characterized by FTIR, TGA, and zero charge point. Adsorption

was then conducted under various parameters: pH (2.5–8), contact time (2–120 min), dye concentration (0.5–6 mg/L), magnetic biosorbent mass (0.005–0.02 g), agitation speed (0–300 rpm), particle size (0.2–0.63 mm), ionic strength, and temperature (20–50°C). The Freundlich, Langmuir, and Sips isotherms, as well as adsorption kinetics and diffusion mechanisms, were studied using various mathematical models. The results show that the magnetic biosorbent is highly effective, with an extraction rate exceeding 95%. This highlights the importance of modified biosorbents in removing pollutants from wastewater.

Keywords : Magnetic Adsorption, Malachite Green, Magnetic Biosorbent, Kinetics, Thermodynamics.

CMTDE 2024_95

Methodology and Feasibility of Flood-Control Dams in Artificial Recharge through the Application of Modflow and PhreeqC: Case of the Large Algerian-Tunisian Transboundary Basin, Oued El Kebir.

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Abstract

Water is a vital resource for life and all human activities, constituting a precious heritage for nations. This study aims to assess the feasibility of flood-control dams for artificial recharge in the large Algerian-Tunisian transboundary basin of Oued El Kebir. To achieve this, we applied the modeling tools MODFLOW and PHREEQC. The use of MODFLOW allowed us to model the hydrogeological impacts of these dams, while PHREEQC evaluated the geochemical interactions associated with artificial recharge. The results show that flood-control dams can significantly increase the natural recharge rates of aquifers, thus stabilizing groundwater levels and improving water resilience in this arid and semi-arid region. In conclusion, this study demonstrates the importance and feasibility of flood-control dams for sustainable water resource management in challenging climatic contexts, providing a robust methodological solution for similar projects.

Keywords : MODFLOW, artificial recharge, flood-control dam, modeling, aquifer, PHREEQC.

CMTDE 2024_96

The utilization of pistachio shell powder as a cellulose producer and its impact on the development of a bio composite

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Abstract

"Natural Fiber Reinforced Polymer Composites" has been used in a wide variety of applications in the automotive components, construction sectors and packaging. The present study investigated the effect of chemical treatment of natural fibers on the development of a bio composite. In this project, the pistachio shell powder was chemically treated and the polylactic acid were used for the production of a green composite (i.e. bio composite). The aim of our study was to perform the scientific techniques of extraction of cellulosic fibers from the pistachio shell powder and to study its impact on the development of a bio composite.

Keywords : Pistachio shell powder, Cellulose, Bio composite, Natural fibers.

CMTDE 2024_97

Adsorption of methylene bleu on effective Bio-sorbent from Almond Shell

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Abstract

This study investigates the use of agricultural waste, specifically Tunisian almond shells, as an environmentally sustainable and cost-effective bio-adsorbent for removing dyes from water, with

methylene blue (MB) serving as the model pollutant. This study explores the influence of various factors, including adsorbent dose (0.1 to 1 g.L-1), dye concentration (10 to 50 mg.L-1), contact time (5 to 120 min), temperature (20–80°C), and pH (1–12). The material was characterized using a variety of techniques, including infrared spectroscopy (IR), X-ray diffraction (XRD), scanning electron microscopy (SEM), elemental analysis (EDX), dynamic light scattering (DLS), and zero-point charge measurement (pHzpc). X-ray diffraction (XRD) was initially used to evaluate the amorphous structure of the ACA matrix. SEM analysis revealed that the particles had irregular shapes and a size distribution ranging from approximately 20 to 100 µm. Additionally, DLS measurements determined the average particle size of the ACA bio-adsorbent to be 392 nm. The optimal conditions for MB removal (100%) were found to be an initial dye concentration of 20 mg.L-1, pH 7, an adsorbent dose of 0.4 g.L-1, and a contact time of 50 minutes. The adsorption kinetics follow a pseudo-second-order model, with a high correlation coefficient ($R^2 = 0.99$). Both Langmuir and Freundlich adsorption isotherms were applied, and the Langmuir model best describes the adsorption process, with a maximum adsorption capacity of 106 mg/g. Reusability of the adsorbent is highlighted as an important factor for both economic and environmental sustainability. These results demonstrate that almond shell-derived bio-adsorbents are highly effective for the removal of organic contaminants from aqueous solutions, presenting a promising solution for wastewater treatment.

Keywords : dyes removal; MB; Bio-sorbent; Almond shell; adsorption process;

CMTDE 2024_98

Industrial Wastewater Treatment Using Olive Seeds Powder and Aluminum Chloride Hybrid Coagulation

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Abstract

High-content heavy metal wastewater is a significant environmental concern due to its toxicity to living organisms and ecosystems. Conventional chemical coagulant methods have been

successfully used for heavy metal removal from industrial wastewater. However, chemical coagulants generate highly toxic sludge, which needs safe handling. Natural coagulants are cost-effective, sustainable, safer to handle, available locally, and have the potential for resource recovery. This study aimed to investigate a hybrid coagulation approach using a combination of olive seed powder (OSP) and aluminum chloride ($AlCl_3$) to remove heavy metals from industrial wastewater. The optimization process of OSP/$ALCl_3$ dosage and pH was used to obtain optimum conditions for heavy metal removal. The main results indicate that OSP/$AlCL_3$ dosage of 5:0.5 (g/g) was the optimum coagulant dosage, resulting in COD, color, TSS, NH_3-N, Mn, Fe, Zn, Al, and Ni removal efficiencies of 87.04%, 95.94%, 99%, and 74.25%, 94.90%, 98.49%, 95.59%, 93.68%, and 93.33%, respectively, at pH 8. Interestingly, the pH optimization results revealed a high removal efficiency of 80.05% COD and 94.94% color, 99% TSS and 74.25% NH_3-N, 92.66% Mn, 90.57% Fe, 95.59% Zn, 99.00% Al, and 93.33 % Ni, which means no pH modification is needed. This study demonstrates that the hybrid OSP/$AlCl_3$ coagulation method can be an effective and sustainable solution for removing heavy metals from industrial wastewater. Further research is needed to explore the applicability of this approach on a larger scale and investigate its potential limitations.

Keywords : Water pollution**,** Natural Coagulant, Heavy Metals, Hybrid OSP/$AlCl_3$, Industrial Wastewater, Optimum Dosage

CMTDE 2024_99

Critical Review of Artificial Rain Production Processes

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Abstract

Artificial rain production, also known as cloud seeding, has become a critical technology in water resource management, particularly in arid and semi-arid regions facing acute water shortages. This paper presents a comprehensive review of the main artificial rain production processes, including cloud seeding techniques using silver iodide, potassium iodide, and hygroscopic salts. We examine

recent advancements, including emerging methods such as ionization and laser-based cloud modification, assessing their efficiency, environmental impacts, and cost-effectiveness. By critically evaluating these technologies, this review highlights both the successes and limitations associated with artificial rain production, with a focus on technical challenges and ethical considerations. The review concludes with recommendations for further research to enhance the efficacy and environmental sustainability of artificial rain production.

Keywords : Artificial rain production, cloud seeding, Chemical Process, Physical Process.

CMTDE 2024_100

Innovations in Artificial RainProduction Processes: New Process for Local Rain Production

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Abstract

The increasing demand for freshwater, coupled with the challenges posed by climate change, has heightened interest in artificial rain production as a supplementary method for water resource management. Traditional methods of rain enhancement, such as cloud seeding, are limited by several factors, including dependency on suitable weather conditions, environmental concerns, and operational costs. This paper explores recent innovations in artificial rain production technologies, focusing on a novel process designed specifically for local rain generation. Through an interdisciplinary approach, we examine advancements in atmospheric science, nanotechnology, and environmental engineering that have contributed to a more efficient, sustainable, and targeted process for inducing rainfall. The proposed process leverages advances in aerosol technology and weather modification techniques to initiate localized rain events under specific atmospheric conditions. Preliminary experimental data, process simulations, and field trial outcomes indicate the process's effectiveness in augmenting local rainfall, providing an alternative to traditional methods. This research represents a significant step towards scalable solutions for arid and semi-arid regions facing water scarcity.

Keywords : Artificial Rain, Rain Enhancement, Local Rain Production, Rain Production Innovations, New Process of Rain Production.

CMTDE 2024_101

Photocatalytic Degradation of Calcifying Organic Molecules in Aqueous Medium Using Synthesized Zinc Oxide: Characterization and Comparative Analysis of Photocatalytic Performance

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Abstract

Two synthesis methods, co-precipitation (ZnO-Cp) and sol-gel (ZnO-Sg), were used to develop zinc oxide in order to compare the effect of each method on the photocatalytic activity and morphology of their surfaces. The prepared catalysts were characterised by different techniques using zeta potential; DLS, IR, XRD, the SEM and solid UV. The Azucryl Red industrial calcifying dye was used to test the photocatalytic activity of both semiconductors. The results of the effect of pH on RA photocatalysis by ZnO-Cp and ZnO-Sg showed that the behaviour of the semiconductors varies considerably depending on this parameter; because the optimal pH is 8 for ZnO-Cp, or the rate constant reaches its maximum at 0.02546 min-1. On the other hand, degradation is more effective at pH 6 (k=0.02429 min-1) for ZnO-Sg. It is clear that the synthesis procedure has influenced the physico-chemical properties of the surface of the photocatalysts, as demonstrated by R. Saha.

Keywords : ZnO nanoparticles, characterisation, dye degradation, photocatalytic.

CMTDE 2024_102

NiO Nanoparticles from Green Chemistry : An Innovative Solution for Diclofenac Degradation in Aqueous Media

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Abstract

The synthesis of nanoparticles is gaining increasing attention, positioning itself at the intersection of nanotechnology and biotechnology. This approach is driven by the urgent need to develop environmentally friendly manufacturing technologies. The use of plant extracts in nanoparticle synthesis has emerged as a promising method in this industry. In this study, nickel oxide nanoparticles (NiO-NPs) were synthesized using a green chemistry approach with an aqueous extract of orange leaves. The synthesized nanoparticles were characterized using techniques such as XRD, FT-IR, XPS, SEM, and EDX. The results indicate that the Ni-NPs are effective in the degradation of diclofenac (DFC), a pharmaceutical compound, in aqueous solution. The study also explored the influence of various independent variables, such as pH, initial DFC concentration, stirring time, as well as the effect of the oxidant H_2O_2 on DFC degradation.

Keywords : Green chemistry, NiO nanoparticles, orange leaf extract, diclofenac (DFC), oxidant H_2O_2.

CMTDE 2024_103

Eco-Friendly Chromium Removal from Tannery Wastewater Using Electrocoagulation and Opuntia ficus indica Powder

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Abstract

This study investigates the effectiveness of coupling electrocoagulation (EC) with Opuntia ficus indica (OFI) powder, also known as prickly pear cactus, for removing chromium from tannery wastewater. The findings reveal that adding OFI powder significantly enhances chromium removal rates, achieving nearly 100% removal in less than 200 minutes. Additionally, this approach reduces energy consumption by 50% compared to using electrocoagulation alone, making the process more cost-effective and energy-efficient. The study focused on optimizing treatment parameters, such as current density and OFI powder dosage. These optimizations enhanced process performance by improving coagulation and flocculation of contaminants while minimizing the formation of

residual sludge. These results demonstrate that integrating natural coagulants like Opuntia ficus indica powder provides a sustainable and cost-effective solution for treating industrial wastewater, especially in regions where this natural resource is abundant and easily accessible. Moreover, using natural additives reduces the environmental footprint of the treatment process, offering promising potential for wastewater treatment in other industrial sectors. Ultimately, this research paves the way for future applications in wastewater remediation and highlights the importance of environmentally friendly solutions for industries, emphasizing the advantage of green technologies in sustainable water resource management.

Keywords : OFI Powder; Chromium; Electrocoagulation; Adsorption; Energy consumption.

CMTDE 2024_104

Photocatalytic Degradation of Anionic and Cationic Dyes Using Magnetic Iron-Doped Zinc Oxide Nanoparticles: A Green Chemistry Approach for Sustainable Water Treatment

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Abstract

Water pollution caused by synthetic dyes in industrial wastewater poses a severe environmental threat, as these pollutants are often resistant to conventional treatment methods. The need for effective, eco-friendly approaches has led to growing interest in photocatalysis as a promising solution. In this study, we present the synthesis and application of magnetic iron-doped zinc oxide (Fe-ZnO) nanoparticles, developed to serve as an efficient photocatalyst for the degradation of both anionic and cationic dyes under natural sunlight irradiation. The Fe-ZnO nanoparticles were synthesized through a straightforward, cost-effective process, designed to align with principles of green chemistry. Detailed characterization of the synthesized Fe-ZnO particles was conducted using Fourier Transform Infrared Spectroscopy (FTIR), which confirmed successful iron doping and provided insights into the structural properties and stability of the particles. The FTIR analysis revealed specific vibrational modes, indicating the formation of a robust ZnO lattice modified with

iron ions, which enhances the photocatalytic activity by narrowing the bandgap and improving visible light absorption. This structural modification enables effective use of sunlight as an energy source, potentially reducing the dependency on artificial UV light sources and thus further lowering the operational costs. The photocatalytic performance of Fe-ZnO nanoparticles was evaluated through degradation experiments involving representative anionic and cationic dyes, under optimized sunlight exposure. Results showed high degradation efficiencies, with a 91% removal rate for cationic dyes and an 83% removal rate for anionic dyes within a relatively short irradiation period. These outcomes underscore the potential of Fe-ZnO nanoparticles as a sustainable and versatile photocatalyst for industrial wastewater treatment.

Keywords : Wastewater, Fe-ZnO nanoparticles, dye degradation, photocatalytic, catalysis

CMTDE 2024_105

Study of Reverse Osmosis Membrane Fouling

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Abstract

Fouling, a phenomenon that is difficult to limit and complex to describe, remains the major challenge in the development of reverse osmosis desalination processes. Mastering the factors influencing fouling is essential for developing strategies to counteract this issue. This study is part of this approach and focuses on the analysis of the fouling layer by X-ray diffraction to identify the fouling substances. This allowed us to highlight the presence of clays, silica, and chemical substances. Additionally, fouling removal tests were carried out using washing agents such as HNO3, HCl, NaOH, pure whey, HNO3 + pure whey, HCl + pure whey, and NaOH + pure whey.

Keywords : reverse osmosis, fouling and befouling, fouling substances, X-ray diffraction analysis, befouling tests.

CMTDE 2024_106

Effect of thermal dispersion on mixed convection flow in non-Darcy porous medium filled by Das nanoliquid

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Abstract

Porous media play a significant role in desalination technologies by aiding in the separation and filtration processes required to remove salt and impurities from water. In desalination, porous materials such as membranes, natural or synthetic filters, and adsorbent materials are used to allow water to pass through while trapping salts and contaminants. The structure and properties of these porous media, including porosity, pore size, and permeability, are critical for ensuring efficient filtration and minimizing fouling, which can hinder performance. Different desalination techniques incorporate porous media in various ways. For example, reverse Osmosis, Membrane Distillation and Capacitive Deionization. Nanofluids are emerging as a promising approach in enhancing desalination processes due to their unique thermal and transport properties. By suspending nanoparticles (such as metals, metal oxides, carbon-based materials) in a base fluid, nanofluids offer enhanced thermal conductivity, increased heat transfer rates, and improved energy efficiency, which can benefit various desalination technologies. In this current paper, a numerical analysis was performed to study the effects of thermal dispersion considered for an Ergun-Darcy mixed convection flow on a heated horizontal plate from below by variable heat flux in a saturated porous medium filled with Tiwari and Das nano liquid (Cu/Water). The governing partial differential equations are transformed into coupled nonlinear ordinary differential equations using appropriate similarity transformations and the resulting system of equations is then solved numerically by an efficient finite-difference method. Numerical results are presented to illustrate how the physical parameters affect the flow field, temperature and concentration. Moreover, the interesting features of the solutions in terms of the number of Nusselt are presented graphically.

Keywords : Porous medium, Nanofluid, Thermal dispersion, heat transfer.

Supported liquid membrane and polymer inclusion membranes for Nickel (II) transport

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Abstract

The application of supported liquid membranes (SLMs) and polymer inclusion membranes (PIMs) for the transport of Ni (II) using di-(2-hethylhexyl) phosphoric acid (D2EHPA) as carrier was examined. The SLM was prepared by soaking a support in D2EHPA-chloroform solution. The PIM was prepared by casting solution containing cellulose triacetate (CTA) as polymer, 2-nitrophenylpentylether noted (NPPE) as plasticizer, and D2EHPA as carrier .Transport of Ni (II) ions through SLMs and PIMs was determined. The effect of feed pH, HNO_3 concentration in strip phase, and D2EHPA concentration in membrane phase were studied. The optimum conditions to transport more than 60% of Ni (II) are; feed pH=5, HNO_3 0.5 M in strip phase and 30% (v/v) of D2EHPA concentration in membrane phase. In the same initial conditions, the PIM containing 35% by weight D2EHPA assured the transport of 70% of Ni (II). The transport of Ni (II) through the SLM and PIM was investigated by evaluating the initial fluxes through the membranes, the recovery efficiency of each, and their stability after many cycles. The experiments demonstrated that the prepared PIM has better performance than the SLM, as proved by a better initial flow, better recovery efficiency, and higher stability.

Keywords : supported liquid membranes (SLMs), polymer inclusion membrane (PIMs), di-(2-hethylhexyl) phosphoric acid (D2EHPA), Nickel (II) transport.

CMTDE 2024_108

Development and Characterization of Zinc Oxide Quantum Dot-Based Fluorescent Probes for Heavy Metal Detection

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Abstract

Heavy metals can be found in chemicals and paints used in the metallurgical, agricultural and foundry industries. The mishandling of these products can lead to heavy metal contamination in the environment and even in food. Due to their persistent and non-biodegradable nature, heavy metals can eventually make their way up the food chain and into the human body. According to research, heavy metals can cause cancer, neurotoxicity, nephrotoxicity, immunotoxicity, hepatotoxicity, and cardiovascular damage. Although conventional detection methods such as mass spectrometry and chromatography have low limits of detection (LODs), they are time-consuming and cannot be used in the field. Environmental monitoring is an area where fluorescence analysis technique is widely used due to its high sensitivity, selectivity and fast analytical speed. Nanomaterials are often used as probes in fluorescence analysis due to their tunable fluorescence properties, which can be controlled by manipulating their size, shape, chemical composition and surface modifications. This study focuses on the synthesis and characterization of fluorescent probes based on zinc oxide (ZnO) quantum dots, specifically designed for the detection of heavy metals. ZnO quantum dots were selected for their unique photoluminescent properties, stability and environmentally friendly composition, which make them suitable for the preparation of highly sensitive and selective fluorescent probes. Characterization techniques, including XRD, FTIR and TGA, confirmed the structural and chemical properties of the synthesized ZnO probes. Fluorescence studies showed significant responses in the presence of heavy metal ions, with optimized parameters enabling high detection sensitivity. This work highlights the potential of ZnO quantum dot-based probes as effective tools for real-time monitoring of heavy metals in environmental samples, providing a rapid and reliable approach to contamination detection.

Hydrochemical Study and Groundwater Quality Assessment of Gafsa South-El-Guettar Shallow Aquifer

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Abstract

Monitoring and predicting groundwater quality is crucial for managing water resources, safeguarding public health, and reducing environmental impacts. A hydrochemical study was conducted on a shallow aquifer of Gafsa-south -El-Guettar in the agricultural region of the Gafsa south basin. Water samples were collected from 16 points within the aquifer network, and 12 physical-chemical parameters were analyzed for each sample. The samples were classified according to their hydrochemical facies, and the water quality was assessed for both agricultural and drinking purposes. Distribution maps of select parameters highlighted a concerning level of pollution, primarily due to salinity. Various physical and chemical parameters were used to calculate quality indices, including the sodium adsorption ratio (SAR), sodium percentage (Na%), and permeability index (PI) for agricultural suitability, as well as the Water Quality Index (WQI) based on WHO drinking water standards. The results indicated that 15 samples fell into the 'unsuitable' category, while one sample was classified as 'doubtful' according to the WQI.

Keywords : Groundwater Quality, Hydrochemical Study, Gafsa South -El-Guettar Shallow Aquifer, Physical and Chemical Parameters.

Fluorescence Turn-On Mode via Europium Complexation for Sensitive Detection of Histamine in Food

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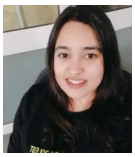
Abstract

Histamine (HA) is a non-chromophoric biogenic amine (BA) that is essential for several physiological functions, including the control of immune responses and neurotransmission. However, elevated levels of this biogenic amine pose a risk to food safety and are a sign of tainted food. It is currently the most toxic biogenic amine of all those found in seafood, cheese, alcoholic beverages and animal products due to its dietary limitations. When the concentration of HA exceeds the minimum safe human intake limit, poisoning occurs. Therefore, the use of effective and sustainable technologies for food quality assessment has become imperative due to growing concerns regarding food safety and security. Fluorescence-based sensing is a rapid monitoring technique for food spoilage detection. Due to the lack of natural fluorescence of histamine, its direct detection via conventional spectrofluorimetric techniques is challenging. This study introduces an innovative approach by leveraging the fluorescent properties of a europium chloride ($EuCl_3$) complex with histamine to achieve effective detection. The methodology was developed through systematic optimization of the $EuCl_3$ concentration and solution conditions to create a stable, highly luminescent complex with histamine. To verify the complexation and examine its stability, the complex was corrected with FTIR, NMR, and fluorescence spectroscopy. In addition, a linear fluorescence response was observed over a range of histamine concentrations, indicating the method's potential for quantitative applications. Furthermore, the influence of different surfactants on the stability of the complexes was investigated, and SDS (sodium dodecyl sulfate) was found to provide the most stable fluorescence signal. The final method shows high sensitivity and reproducibility with low detection and quantification limits, offering a promising tool for rapid histamine analysis in food samples.

CMTDE 2024_111

Binary and ternary removal of cationic and anionic dyes by adsorption onto activated biosorbent: isotherm and kinetics studies



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Abstract

The binary and ternary removal of cationic and anionic dyes by adsorption onto activated biosorbent was investigated and the results were fitted to Langmuir, Freundlich, Temkin and Dubinin-Radushkevich adsorption models at various temperatures. Thermodynamic parameters for the adsorption systems were determined at 25, 35 and 45°C. The obtained values showed that dye adsorption is a spontaneous and endothermic process, even in more complicated solutions, while kinetic studies using first and second–order models showed the implication of the existence of several adsorption mechanisms.

Keywords : Adsorption, Dyes, Activation, Isotherm, Kinetic, Thermodynamic**.**

CMTDE 2024_112

Separation of Zn(II), Ni(II), and Cu(II) Ions using Polymer Inclusion Membranes

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Abstract

Membrane separation techniques hold considerable promise for the removal of heavy metals from polluted water, offering a sustainable and effective solution to this global environmental challenge. Polymer inclusion membranes (PIMs) provide an effective method to separate selectively a variety of species from dilute solutions, including metal cations. A polymer inclusion membrane containing 2-nitrophenyl octyl ether (NPOE) as plasticizer, di-(2- ethylhexyl)phosphoric acid as carrier and poly(vinyl chloride) (PVC) as polymer was prepared to separate Zn (II) from binary and ternary mixture. The synthesized membrane was characterized using various physico-

chemical techniques, including Fourier-transform infrared spectroscopy with attenuated total reflection (FTIR-ATR), scanning electron microscopy (SEM) and contact angle measurement. The PVC/NPOE/D2EHPA membrane demonstrated acceptable operational stability when treating effluent loaded with Zn(II) ions. For the ternary mixture, extraction percentages of 60 %, 19 %, and 40 % were recorded for Zn(II), Ni(II), and Cu(II) ions, respectively. Selective transport was observed and the membrane could be considered for industrial applications.

Keywords : PIM, D2EHPA, Recovery, Separation, Zn(II), Ni(II), Cu(II).

CMTDE 2024_113

Paradigm Shift: How desalination is changing water resources availability and management in Algeria

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Abstract

Algeria, as is other countries in the Mediterranean region, is negatively impacted by climate change. High variability in precipitation, reduction in water volume availability and as a result, many dams have experienced, collectively, the lowest water levels ever for a sustained period of time in their history. To alleviate this situation, a vast program was launched in 2010 resulting in the construction of more than 16 desalination plants with dedicated huge storage units and large transfer systems. The total capacity of these desalination plants amounts to 2.36 106 m3/day. Further a program was launched in 2022 for the construction of five additional plants with a total capacity of 1.5 106 m3/day. Another seven plants are programmed for the period 2025-2030 with a total capacity of 2.1 106 m3/day. The total capacity of these plants amounts to 6 106 m3/day, which would cover more than 80% of drinking water needs for 70% of Algeria's current 45 million population. The rising population levels are likely to place more stress on water infrastructure, requiring several desalination plants in the next fifty years. This increase in water availability will free up large quantities of water, albeit not as reliable, for other users, especially industry and agriculture. The goal of this paper is to present alternative strategies for the management of water resources in order to respond to several aspirations in areas of industry, agriculture. The methodology adopted takes into account three main principles: (i) ensure redundancy by safeguarding the availability of traditional resources (surface and subsurface) in the north, (ii)

improve interconnection between resources and regions, and (iii) improve cost recovery principle in the sector to ensure durability.

Keywords : water desalination, water management in Algeria, water reallocation, redundancy

CMTDE 2024_114

Emerging trends in textile wastewater treatment using cellulose nanofibrils : Optimization through Response Surface Methodology

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Abstract

The degradation of environmental ecosystems as a result of the depletion of nonrenewable resources and the burden of toxic substances is considered a global concern. To this aim, there has been a lot of interest in using renewable and green reactive materials to enhance environmental sustainability while also dealing with hazardous substances. This study explored the performance of cellulose nanofibrils (CNFs) produced from agricultural waste as a new adsorbent for dye molecule removal. Methylene blue (MB), a cationic model dye, was removed from aqueous solution using CNFs under various experimental conditions. The adsorbent was first morphologically characterized using scanning electron microscopy. The influence of variables such as dye concentration, adsorbent dose, contact time, and temperature on dye removal has been optimized using response surface strategy. Using an adsorbent dosage of 4.27 g per 40 mL and an initial dye concentration of 3 mg L^{-1} resulted in over 94% removal efficiency within 28.5 minutes at pH 7 and 20°C. To sum up, this study demonstrated that CNFs, as a low-cost adsorbent, had a high potential for MB removal as an environmentally friendly alternative process.

Keywords : Textile wastewater, Cellulose nanofibrils, Adsorption, Dye removal.

CMTDE 2024_115

Sythesis of nanometerial based sensor for heavy metals detection

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Abstract

We have devised a simple and rapid approach based on Nickel Cobalt Double Hydroxides (NiF@CoNi-LDHs) sensors for the electrochemical detection of the heavy metal Pb (II). The determination procedure was carried out utilizing cyclic voltammetry. The proposed sensor was created by depositing a thin multi-layer of nickel cobalt double hydroxides (Ni(OH)2 and Co(OH)2) on a nickel foam using cyclic voltammetry (CV) in the potential range of -1,2 to 0,2 V vs Ag/AgCl at a scan rate of 5 mV s1, followed by placing the pre-prepared electrode in an oven at 60 ° for 12 hours. The sensor was then characterized as Phosphate buffer saline (PBS), which has a pH of 6, was utilized as the supporting electrolyte in all tests. By conducting CV tests with a trace concentration of Pb (II) and Cr (III) at scan rate of 20 $mV.s^{-1}$ between the potentials -1,5 and 1,5 V, it was possible to verify the produced electrode NiCo-LDHs' effectiveness for the heavy metals Pb (II) and Cr (III) detection. The results demonstrate that the oxidation peak current significantly increased as the concentration increased, indicating that the NiCo-LDHs electrode has an efficient electrocatalytic activity for Pb(II) and Cr(III) detection and can be used as a low-cost, environmentally friendly substitute for Pb (II) and Cr(III) environmental monitoring.

Keywords : Electro-chemistry, Electrochemical sensor, Multi-layered double hydroxide, Cyclic voltammetry.

CMTDE 2024_116

Osmotic Energy and Water Use in Electricity Generation (Application to the Waters of the Ouargla Region)

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Abstract

This work aims to demonstrate the feasibility of producing electrical energy using osmotic energy after desalination (demineralization) of water in the Ouargla region. The concept of osmotic energy is explored by explaining its fundamental principles, with a focus on its application to the waters of the Ouargla region. The experimental results showed success despite limited resources. The work evaluates the advantages and disadvantages of this technique, highlighting future prospects for applications in the renewable energy sector in arid regions.

Keywords : Desalination, reverse osmosis, electrical energy, brackish water, freshwater**.**

CMTDE 2024_117

Evaluation of Groundwater Hydrogeochemical Characteristics Using an Integrated Approach: Graphical and Statistical Methods Applied to the 'UZ' Maknessy Basin, Central Tunisia

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Abstract

The Maknessy plain, located in central Tunisia, stands as one of the most important agricultural regions. Due to the area's semi-arid climate, irrigation heavily depends on groundwater extraction. Ensuring the quality of irrigation water is essential for safe agricultural production. This study aims to evaluate the physicochemical properties of irrigation water in this region through a combination of chemical and statistical analyses. The results reveal that the water exhibits a mixed chlorinated facies with magnesium enrichment. Multivariate statistical techniques, including PCA and HCA, along with a geochemical assessment, were utilized to analyze water quality in relation

to its chemical properties. The findings indicate that electrical conductivity (EC) and total dissolved solids (TDS) are the primary factors influencing water quality.

Keywords : Upper Zebbug deep aquifer. Hydrogeochemistry. PCA. CHA. Maknessy basin

CMTDE 2024_118

Determınatıon of Na lıgnosulfonate effıcıency and performace as a natural coagulant ın textıle wastewater treatment

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Abstract

Industrial enterprises produce wastewater that contains large amounts of pollutants, and this wastewater must be treated before it is released into the environment. The aim of this study is to remove pollution parameters such as chemical oxygen demand (COD), total suspended solids (TSS), color and ammonium nitrogen (NH3-N) and heavy metals from textile wastewater by using sodium lignosulfonate (SLS), which is an environmentally friendly and cost-effective substance, and to increase the removal efficiency. In this study, the optimum dose of SLS that provides the most relief by using different doses was determined. Using this optimum dose, trials were carried out at room temperature (25°C) under different pH (3,5,7,9,11) conditions, and the optimum pH that provides the most removal was determined. Similarly, by keeping the optimum dose constant, trials were carried out at different speeds and at different durations, and the optimum number of cycles and duration that provides the most removal was determined. Maximum removal from textile wastewater was achieved at a dose of 0.0625 g/L sodium lignosulfanate, at a pH of 7 and at a rotational speed of 200 rpm for 15 minutes, followed by 90 rpm for 30 minutes and at optimum concentration (0.0625 mg/L). The optimum dose removal efficiency of heavy metals is aluminum (Al) 93%, boron (B) 96.6%, sodium (Na) 87.6%, copper (Cu) 68%, zinc (Zn) 60.5%, (iron Fe) 85.9% . Sodium lignosulfonate is an important renewable natural resource that is expected to provide significant environmental, economic, and social benefits.

Keywords : Coagulation and Flocculation, Sodium Lignosulfonate, Industrial Wastewater, Pollutants Removal, Textile Wastewater, Natural Coagulants.

CMTDE 2024_119

Study of the Corrosion Inhibitory Effects of Plants on Steel in Contact with Oilfield Produced Water

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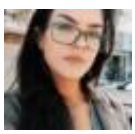
Abstract

This research focuses on the use of plant-based compounds as corrosion inhibitors, offering an eco-friendly and sustainable alternative to conventional chemical treatments. The plants studied—acacia, jumping cucumber, and castor—were selected for their recognized biochemical properties. The objective was to evaluate their effectiveness in reducing steel corrosion when exposed to produced water, a highly corrosive by-product of oilfield operations. The methodology involved exposing steel coupons to this corrosive medium at various temperatures, with the addition of varying concentrations of plant extracts. The primary parameter monitored was the mass loss of the coupons, a direct indicator of corrosion intensity. The tests revealed significant differences among the plants, with castor extract standing out for its superior efficacy. To further validate these findings, specific surface area analyses were conducted, showing a significant improvement in protection when castor extracts were used. Scanning Electron Microscopy (SEM) was employed to examine the microscopic alterations on the coupon surfaces, confirming reduced damage under optimal inhibition conditions. The results highlight not only the effectiveness of castor as a natural corrosion inhibitor but also the potential for further exploration of the biomolecules present in these plants. These compounds could pave the way for the development of environmentally friendly anti-corrosion solutions tailored to the specific challenges of the oil and gas industry.

CMTDE 2024_120

Sustainable Solutions for Water Scarcity: Co-Current Humidifiers in Humidification-Dehumidification Systems



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Abstract

Water shortage is a significant worldwide problem driving the demand for efficient and sustainable water use and desalination technologies. Over the last decades, humidification-dehumidification technologies have emerged as an interesting solution for small-scale and decentralized systems. This research paper addresses the numerical modeling of heat and mass transfers in co-current humidifiers based on thermophysical capabilities, water and air-surface exchange, and flow rate factors. By modeling these variables, we assess the humidifiers' efficiency which can be used in real-world applications. The research results will help optimize design parameters such as flow rates and surface areas, ensuring the most efficient operation of co-current humidifiers in humidification-dehumidification systems. Ultimately, the results will contribute to advancing humidification-dehumidification technologies, providing a powerful tool for tackling global water shortages and promoting sustainable water management practices.

Keywords : Water, Co-current-humidifier, Numerical simulation.

CMTDE 2024_121

Preparation and characterization of membranes for membrane distillation: Application for water purification

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Abstract

Membrane distillation (MD) is an emerging membrane technology capable of treating a diverse range of feed waters .In this study, membranes were fabricated using polyvinylidene fluoride (PVDF1015) as the base polymer with Polarclean as a green solvent, employing both non-solvent induced phase separation (NIPS) and vapor-induced phase separation (VIPS) techniques. The primary goal was to develop membranes with optimized structural and functional properties for enhanced MD performance. Characterization of the membranes included scanning electron microscopy (SEM), porosity, pore size distribution, contact angle, and thickness. Mechanical tests were conducted to evaluate the elasticity and robustness of the membranes under operational

conditions. The results showed that the membrane properties varied depending on the fabrication method, with VIPS-based membranes demonstrating higher porosity and more favorable hydrophobicity compared to NIPS-based membranes. These membranes exhibited promising mechanical strength and thermal stability, making them suitable for MD applications. This work provides valuable insights into the design and optimization of membranes for water desalination and purification using membrane distillation, highlighting the potential of using eco-friendly solvents like Polarclean in membrane fabrication.

Keywords : Polarclean®; green solvent; PVDF membranes; NIPS-VIPS; water treatment.

CMTDE 2024_122

Photocatalytic Degradation Of Pharmaceutical Pollutants In Water Using $BaMnO_3$ Semiconductor

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Abstract

The study investigates the photocatalytic degradation of paracetamol in water using a synthesized semiconductor, $BaMnO_3$. This research addresses pharmaceutical pollutants in aquatic environments through innovative water treatment techniques. $BaMnO_3$ was synthesized via a nitrate route, verified for structural purity using X-ray diffraction (XRD) and characterized optically (UV-Visible spectroscopy), electrochemically, and structurally (IR spectroscopy). It exhibited a direct bandgap energy of 2.13 eV, suitable for solar-driven photocatalysis. Photocatalytic degradation experiments were conducted under solar illumination. Paracetamol solutions were treated with $BaMnO_3$ after establishing adsorption equilibrium. Degradation was monitored via UV-Visible spectroscopy and High-Performance Liquid Chromatography (HPLC). The photocatalytic efficiency was high, with an 88.14% degradation rate under sunlight, while adsorption contributed minimally, and photolysis was ineffective. The process followed first-order kinetics, with a reaction constant of 0.0017 min^{-1}.

The study highlights the potential of $BaMnO_3$ as a robust photocatalyst for pharmaceutical pollutant remediation. This research underscores the viability of using semiconductor photocatalysis for advanced water treatment, aligning with sustainable desalination efforts.

Keywords : Water Treatment, Photocatalysis, $BaMnO_3$ Semiconductor, Paracetamol Degradation, Pharmaceutical Pollutants.

CMTDE 2024_123

Enhancing Rhodamine B Removal from Aqueous Solutions: A Comparative Study of Clinoptilolite and Fe_2O_3-Modified Clinoptilolite for Advanced Wastewater Treatment

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Abstract

This study investigates the adsorption of Rhodamine B (RhB), a persistent environmental pollutant, using clinoptilolite zeolite and its Fe_2O_3-enhanced composite. Comprehensive characterization via XRD, SEM-EDS, FT-IR, and BET analysis revealed the structural and surface properties of these adsorbents. The clinoptilolite-Fe_2O_3 composite demonstrated superior adsorption capacity compared to unmodified clinoptilolite. Optimal conditions were established at pH 7, temperature 25°C, and contact time 20 minutes. The Langmuir isotherm model best described the equilibrium data, indicating monolayer adsorption on a homogeneous surface. Kinetic studies aligned with the pseudo-second-order model, suggesting chemisorption as the rate-limiting step. Thermodynamic analysis revealed a spontaneous, exothermic process with negative ΔG and ΔH values. The enhanced performance of clinoptilolite-Fe_2O_3 is attributed to increased surface area and additional active sites provided by iron oxide incorporation. This study not only elucidates the RhB adsorption mechanisms on these materials but also highlights their potential for efficient water treatment applications, offering a sustainable approach to dye pollution remediation.

Keywords : Nanocomposites, Rhodamine B, water treatment, clinoptilolite-Fe_2O_3, Ecotoxicology.

CMTDE 2024_124

Removal of emerging pollutants using gamma irradiation combined by nanofiltration

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Abstract

Tramadol hydrochloride (TRAH) is an analgesic widely used in recent decades. This medicine is classified as an emerging contaminant, responsible for environmental damage and aquatic toxicity, that conventional wastewater treatment technologies are unable to successfully eliminate. This study focuses on TRAH degradation in aqueous solution by integrated methods of advanced oxidation and membrane filtration. Gamma irradiation was employed as an advanced oxidation process (AOP) and the nanofiltration (NF) membrane was applied for the separation procedure. Indeed, the degradation of TRAH solution by gamma irradiation was investigated by applying absorbed doses varying between 0.05 and 5 kGy. The experimental results indicate that at an initial concentration of 20 mg L−1, the maximum TRAH removal efficiency was 100% at 5 kGy while the removal efficiency of total organic carbon (TOC) was 78.7% at the same dose. NF enabled the rejection of TRAH with 90% efficiency. The integration of the two methods was then proposed and the results give 99.7%TRAH elimination and 81.5% TOC removal by a low absorbed dose of 0.4 kGy and applied pressure of 8 bar. The overall results show that the proposed coupled process in the first time is a suitable alternative for TRAH and TOC removal in an economic way with low energy consumption and sustainable as proven by the absence of chemical additives.

CMTDE 2024_125

Synthesis and optoelectronic study of TiO_2 nanotubes decorated with Palladium Pd nanoparticles for photocatalytic application.

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Abstract

Titanium dioxide TiO_2 nanotubes were synthesized with a simple anodization method to form highly ordered and organized nanotubes, this morphology is preferred for its advantages in electron transfer and high specific surface area for more active sites related to photocatalytic activity. We used the electrodeposition method to deposit palladium Pd nanoparticles onto the TiO_2 nanotube, the surface modification with noble metal will help enhance light absorption and electron/hole pair recombination. To study the LSPR effect on TiO2 nanotubes photoactivity, a morphological, structural and optical characterization were conducted with scanning electron microscopy, x-ray diffraction and PL and UV-Vis spectroscopy. The obtained results showed, The presence of nanotubes with a length of 15 micrometers and a diameter of 100 nm. An agglomeration of palladium nanoparticles was observed, along with their dispersion within the TiO_2 nanotubes. The estimated size of the Pd nanoparticles is 0.26 nm. Optical analyses, such as photoluminescence and diffuse reflectance spectroscopy, have confirmed the charge transfer between metallic nanoparticles and the semiconductor. The successful incorporation of Pd onto TiO_2 nanotubes (TiO_2-NTs) enhanced photocatalytic activity beyond that of the unmodified sample. The Pd/TiO_2-NT sample with a Pd deposition time of 300 seconds exhibited optimal photocatalytic performance, demonstrating efficient degradation under UV light. This enhancement in photocatalytic activity is attributed to the plasmonic effect of the Pd nanoparticles. Kinetic studies revealed that the photocatalytic reaction followed first-order kinetics, thus positioning Pd/TiO_2 NTs among the most efficient photocatalysts for dye removal. Furthermore, quenching experiments indicated that hydroxyl radicals (OH°) and superoxide radicals ($O2°^-$) were the primary and secondary reactive species involved in the photodegradation process.

Keywords : titanium dioxide TiO_2 , Palladium nanoparticles, Pd/TiO_2 nanotube, Electrochemical deposition,Local Surface Plasmonic Resonance LSPR, Photocatalysis

CMTDE 2024_126

Thermally Activation of Persulfate for Brilliant Green degradation: Plackett-Burman Design and Response Surface Methodology

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Abstract

The main objective of this work is to study the effect of different operating parameters on the removal efficiency of a toxic “Brilliant Green (BG)”dye using temperature-activated persulfate. The determination of the optimal operating conditions to achieve maximum removal efficiency is carried out using the design of experiments methodology, which is the "Plackett-Burman" screening design. This is done in order to select the factors most influencing the response. The results of the screening reveal only one important factor which is the time of the oxidation reaction. Despite the good correlation between theoretical and practical returns (R^2=97.53%), this study is not complete, it requires to be followed by a second order optimization plan, this is the Box-Behnken plan. to find exactly the optimal conditions for Brilliant Green degradation.

Keywords : Brilliant Green (BG) dye, Textile dyes, Design of experiments, Plackett-Burman, Screening.

CMTDE 2024_127

Desalination in mud fluids

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Abstract

Desalination in Mud Fluids: Desalination plays a crucial role in the oil and gas sector , particularly in the formulation of mud fluids used during drilling operations., by providing necessary water for various processes while also addressing water scarcity issues. The industry is increasingly

adopting desalination technologies to enhance water reuse and minimize environmental impacts associated with wastewater disposal. As regulations tighten regarding water usage and waste discharge, the integration of efficient desalination systems becomes essential for sustainable operations.

Keywords : Desalination , oil and gas sector , mud fluids

CMTDE 2024_128

Enhancement of a single slope solar still performance using an external reflector

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Abstract

Solar desalination seems to be the greenest and environmentally friendly option to produce fresh water. This technique uses renewable solar energy to heat brackish water and convert it into fresh water, which is based on evaporation and condensation mechanisms. In this work, two configurations of solar stills were examined. In this work an experimental investigation of two configurations of solar stills is conducted in Gafsa city, Tunisia. The main objective of this paper is the study and the design of two single slope solar stills to obtain distilled water that can supply drinking water needs. A comparison was developed between a conventional system and modified single-slope stepped solar still coupling with external reflector by measuring the temperatures of the various parameters involved in the studied systems as well as the production in freshwater. The aim of this comparison is to accelerate the condensation process in order to improve the performance of our system. The results of the comparison showed that, when using an external reflector, the outlet temperatures were rising for the same comparison days with an increase in the productivity of distilled water. The productivity improvement rate of stepped solar still was 131% compared to conventional one.

Keywords : single slope solar still, stepped solar still, external reflector, solar desalination.

CMTDE 2024_129

Remediation of paracetamol as model emerging pollutant from aqueous medium using an inexpensive adsorbent: Adsorption Modelling

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Abstract

Wastewater treatment is a crucial step in preserving the environment. Recently pharmaceuticals are emerging as a major source of pollution. In light of the high consumption of paracetamol and its prevalence in the ecosystem, as well as its negative effects on human health, it is vital to find solutions to eliminate it or try to minimize its concentration in aquatic areas. Biochar is a solid material obtained from biomass carbonization has become an important low cost environmental management material and has more economic benefits than other adsorbents. The present study was undertaken to prepare a biochar from agricultural waste and tested it in the removal of paracetamol pollutants from aqueous solution. The adsorption process was then modelled using isotherms (Langmuir, Freundlich) and kinetics models (Pseudo first order and pseudo second order).

Keywords : Adsorption; Pharmaceutical pollutant; biochar; isotherms; Kinetics

CMTDE 2024_130

Batch and fixed bed column studies for the removal of triphenylmethane dye by Algae root

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Abstract

This study involves the removal of dye containing synthetic wastewater using Algae root (AR), as biosorbent by batch and column methods. The effect of different process parameters such as

contact time, initial dye concentration, medium pH, biosorbent dose and temperature on the biosorption ability of AR was investigated in batch study. Pseudo-second-order kinetic model was better fitted to the experimental data. The equilibrium experimental data were analyzed by the Langmuir, Freundlich, Flory-Huggins and Harking- Jura models. Thermodynamic study showed that the biosorption is spontaneous. A series of column tests using AR as biosorbent were performed to determine the breakthrough curves with varying bed height and flow rates. To predict the breakthrough curves and to determine the characteristic parameters of the column useful for process design, Bohart -Adams and Clark and were applied to experimental data.

Keywords : Biosorption, Triphenylmethane dye; Kinetics; Dynamic; Algae root ; Modeling

CMTDE 2024_131

Removal of Fuchsin basic dye with Ultrasonic-assisted and Conventional batch biosorption on Cattail leaves

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Abstract

Ultrasound is a green technology because it requires no additional chemicals and only involves sound energy and biosorption is an emerging technique for water treatment utilizing abundantly available biomaterials. Therefore, in this work Cattail leaves (CL) were investigated as biosorbent for the removal of Fuchsin basic dye (FB) from aqueous media in the presence and absence of ultrasonic irradiation. Batch biosorption studies were conducted to study the effects of different parameters such as ultrasonic power, initial dye concentration, contact time, initial pH solution, biosorbent dose on FB dye biosorption in order to explain the influence of ultrasonic irradiation on biosorption kinetics. For both methods (ultrasonic and conventional) different kinetic and equilibrium models were applied to the experimental data. Pseudo-second-order kinetic model and Langmuir biosorption isotherm model showed better fitness to the experimental data for both methods. Maximum dye removal FB dye on CL was obtained with ultrasonic method. Furthermore, thermodynamic parameters such as $\Delta G°$, $\Delta S°$ and $\Delta H°$ were calculated, and the

results suggest that the biosorption is spontaneous, a physical process in the absence and presence of ultrasonic irradiation.

Keywords : Ultrasonic irradiation; Biosorption; Cattail leaves**;** Fuchsin basic**;** Kinetics; Modelling

CMTDE 2024_132

Remediation of soils polluted by crude oil with anionic surfactants

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Abstract

The objective of this work is to study the power of surfactants and cosurfactants to remove hydrocarbons present in contaminated soils using a continuous washing process. We used sodium dodecyl sulfate (SDS) and sodium dodecylbenzenesulfonate (SDBS) as surfactants. Three soils were selected for this study, and they were contaminated with the crude oil to be used in continuous washing. The results obtained during this study demonstrated the potential of the two surfactants in the decontamination of soils contaminated by the crude oil, and showed the existing synergy which exists between the different parameters studied. Extraction of hydrocarbons from polluted soil using SDBS surfactant is more efficient compared to SDS in the presence of pentanol alcohol, with overall yields ranging from 78-83% for SDBS and 71-81% for SDS.

Keywords : crude oil, anionic surfactant, contaminated soil, de-pollution.

CMTDE 2024_133

Study of the inhibitory effect of nickel oxide nanoparticles on the corrosion of carbon steel X70

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Abstract

During this study, we synthesized Nickel oxide nanoparticles (NiO NPS) to use them as a corrosion inhibitor for X70 carbon steels. During this work, we analyzed the phase structure, crystallinity, surface morphology and other characteristics of NiO NPs produced using different techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM). , X-ray fluorescence (FX) analysis and X-ray diffraction (EDX). Subsequently, we studied the electrochemical corrosion behavior of NiO NPs in the presence of an aqueous electrolyte containing NaCl at a concentration of 0.6 Mol/l.

Keywords : Nickel oxide nanoparticles (NiO NPs), corrosion, SEM, EDX, FX, DRX…

CMTDE 2024_134

Adsorption Test of Lead by Two Natural Adsorbents: Thistle Stems (Scolymus maculatus) and Jujube (Ziziphus lotus)

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Abstract

Industrial pollution refers to the portion of environmental pollution directly caused by industry when it introduces biological, physical (radiation), chemical, or organic alterations, affecting the functioning of the ecosystem to varying degrees. Algeria faces complex ecological challenges related to the rapid development of its industrial activities, which pose a threat to public health, public sanitation, the sustainability of fragile ecosystems, and the ability of future generations to access the resources needed to meet their socio-economic needs. The objective of this study is to examine the adsorption efficiency of copper using two natural adsorbents: thistle stems (Scolymus maculatus) and jujube (Zizyphus lotus). The preparation of these adsorbents (thistle and jujube) involves several steps, namely: washing, drying, grinding, and finally sieving, which allowed us to obtain two powders with a homogeneous particle size of around 250 µm. These adsorbents underwent a series of physicochemical analyses, including X-ray diffraction, X-ray fluorescence (XRF), specific surface area (BET), infrared spectroscopy (IR), and scanning electron microscopy (SEM) for potential characterization. To test the performance of these two adsorbents, adsorption experiments of copper were conducted. The effect of several parameters was studied, such as

temperature, pH, adsorbent mass, and the initial metal concentration. Experimental results were modeled using two models: Langmuir and Freundlich. A kinetic study was also performed using the pseudo-first-order equation, which was found to best match the experimental data.

Keywords : thistle, jujube, adsorption, characterization, copper.

CMTDE 2024_135

The Application of Donnan Dialysis for micropollutants removal

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Abstract

Historically, Tunisia is considered an arid and semiarid region due to its limited freshwater resources, making brackish, drainage, and surface water essential sources for drinking and agriculture. There are issues related to the quantity and quality of Tunisia's surface water resources. Due to the semi-arid to the arid climate found in most parts of the country, periodic droughts, and salty rocks found within the country, water quality has naturally deteriorated. It can also contain relatively high concentrations of various chemical compounds such as boron, phosphate, nitrite, nitrate, calcium and magnesium depending to the nature of water. Donnan Dialysis (DD) is a membrane process based on the cross-exchange of ions having the same electrical charge sign between two solutions through an ion-exchange membrane. Its simple operation, low installation and operating costs, and low energy consumption make Donnan dialysis (DD) a very attractive process. Its main difference from other membrane technologies is the absence of electrical potential or pressure across the membrane, which does not require any extra energy. The removal of micropolluants by Donnan Dialysis was studied in this work. First, a preliminary study was conducted to determine the experimental field of operating parameters using different membranes. Response surface methodology using Doehlert design was adopted to predict the optimal conditions. This approach via experimental designs is more efficient than the conventional optimization approach (the "one-at-a-time" method) which is time consuming and requires a large number of experiments.

Keywords : Donnan Dialysis, Removal, Exchange Membranes, Micropolluants

CMTDE 2024_136

The removal of dyes by adsorption onto bioadsorbent from agricultural waste

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Abstract

The growing global generation of billions of tons of waste annually necessitates innovative and sustainable approaches to waste management. Among these, the valorization of agricultural waste as a functional resource offers a transformative solution to multiple environmental challenges. This aligns with the urgent need to address the issue of wastewater contamination, particularly by synthetic dyes, which are prevalent in industrial effluents. Dyes not only compromise the aesthetic quality of aquatic ecosystems but also pose severe risks to human health due to their toxicity, carcinogenicity, and resistance to biodegradation. Therefore, the removal of dyes from wastewater is a critical priority for environmental sustainability and public health protection.

In this context, the conversion of agricultural waste into effective adsorbents represents a synergistic strategy to tackle both waste management and water pollution. Agricultural waste, being abundant, cost-effective, and renewable, provides a sustainable alternative to conventional adsorbents. Utilizing such waste for dye adsorption not only reduces the environmental burden of solid waste but also offers an eco-friendly and economically viable approach to wastewater treatment. This study investigates the adsorption potential of agricultural waste for the removal of dyes from aqueous solutions, with a focus on optimizing critical operational parameters such as pH, initial dye concentration, and adsorbent dosage. By integrating waste valorization with pollution control, this research contributes to the development of sustainable solutions that address global environmental and resource management challenges.

Keywords : Adsorption, Dyes, Low Cost adsorbent, Optimisation

CMTDE 2024_137

pH measurement of seawater: State of the art for measurement of mean activity coefficients in saline aqueous matrices

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Abstract

Seawater is a low buffered medium, with a pH around 8, due to dissolved salts, but especially in the presence of bicarbonate ions, HCO_3^-. Its capacity "buffer" however, is not a constant function as highly dependent on the amount of CO_2 contained. Therefore, natural seawater can't be used as the reference buffer solution to ensure the reliability of the pH measurements. In contrast, according to published articles, the most studied buffer medium is a base, 2-amino-2-(hydroxymethyl) -1,3-propanediol, simply called TRIS. This base may be used in combination with the hydrogen form $TRIS - H^+$ ($TRIS - HCl$) and by varying the ratio between the two compounds; it is possible to cover a pH range of 7 to 9, which is suitable for measurements in seawater. Thus, to minimize the contribution of liquid junction potentials, it is necessary to have buffer solutions having an ionic strength and a composition similar to seawater. In order to get as close as possible to the natural environment, the choice was made to characterize the buffers in artificial seawater, ASW (Artificial SeaWater).This study allowed us to compare two different approaches for the determination of the coefficient average activity ($\gamma \pm HCl$) of HCl in order to calculate the pH measurement in an artificial sea water solution.

Keywords : pH measurement, artificial seawater traceability, mean activity coefficients, Pitzer model, TRIS.

CMTDE 2024_138

Highly porous biochars developed from orange, pomegranate, and watermelon peels as potential adsorbents for hexavalent chromium removal: Optimization by Response Surface Methodology

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Abstract

Orange, Pomegranate and Watermelon peels were used as biomasses to produce highly effective adsorbent biochars through the physicochemical activation method for the removal of Cr (VI) from aqueous solutions. The chemical activation was done with the phosphoric acid at the ratio 2:1 (wt%) between the biomasses and the acid, followed by the nitrogen pyrolysis. The physicochemical properties of the activated carbons were characterized via pH of zero charge, Fourier transform infrared spectroscopy (FTIR), elemental analysis, surface area (BET), nitrogen adsorption-desorption isotherms, particle size distribution, and scanning electron microscopy-energy-dispersive X-ray spectroscopy (SEM-EDX). Response surface methodology was investigated to evaluate the influence of process factors (adsorbent amount, pH, and temperature) on Cr (VI) uptake. The optimum conditions for Cr (VI) removal by biochars were at pH 2.54, 36.83 °C with amount of 9 mg for AC-OP and at pH 1.5 with 10 mg for both activated carbons AC-PP and AC-WMP and at temperature of 22.99 and 22.27 °C, respectively. The kinetic results showed good correlation with pseudo first order model for AC-OP, AC-WMP and pseudo second order for AC-PP. Maximum Langmuir adsorption capacities of hexavalent chromium were found 53.387 mg g^{-1}, 235.588 mg g^{-1}, 64.216 mg g^{-1}, for AC-OP, AC-PP and AC-WMP, respectively.

Keywords : activated Carbons, biomasses, Chemical modification, adsorption, Doehlert design

CMTDE 2024_139

Rehabilitation study calco-carbonic equilibrium of water.

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Abstract

The study was carried out on industrial water quality to restore it to calco- carbonic equilibrium with the aim of fighting against scaling, chemical corrosion and electrochemical corrosion of destination equipment. Several treatment options were required, but we used decarbonation. The tests were based on the optimization of the operating parameters and the results of the water quality obtained meet the quality specifications and provide a corrosion order of magnitude considered to be correct, within a range of 0,11 to 1,11 mm/year .

Keywords : calco-carbonic balance , corrosion , scaling , water quality ,

CMTDE 2024_140

Dyes removal from water by adsorption on coffee grounds

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Abstract

Dyes and pigments are emitted into wastewaters from various industries, mainly from the dye manufacturing and textile dyeing. Methylene blue (MB) is a cationic dye having various applications in chemistry, biology, medical science and dyeing industries. Its long term exposure can cause vomiting, nausea, anemia and hypertension. Due to its toxicity, MB must be removed from wastewaters prior to discharge into aquatic environments. In this study, response surface methodology (RSM) was used to optimize the experimental conditions in the adsorptive removal of MB from aqueous solution using Coffee grounds. The studied parameters are the pH of the

solution, the temperature, the adsorbent mass, initial concentration, the stirring speed, the contact time and the ionic strength. The analysis of variances (ANOVA) showed that the quadratic model of boron ion removal rate is highly significant (R^2 = 0.998). The graphical representation of the Pareto diagram shows that the initial concentration is the most influential factor. In order to determine the optimal conditions giving a better elimination, the desirability study shows that we can reach a maximum rate of 97.88% at pH equal to 12, a mass of adsorbent of 1.8 g, an ionic strength of 0.5 molL^{-1} and the initial concentration equal to 100 mg.L^{-1}. The adsorption isotherm and the kinetics study were carried out using the optimum conditions determined previously. The correlation coefficients and the values of the "Chi-square" test show that the adsorption can be described according to the Langmuir model and that the adsorption kinetics follow the pseudo-first-order model.

Keywords : Methylene blue, Response surface methodology, adsorption models, kinetic models.

CMTDE 2024_141

Application of response surface methodology for chromium removal by adsorption on date pits

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Abstract

This study focuses on chromium removal by adsorption on date pits, a natural biomaterial. The physico-chemical properties of the adsorbent were characterized by ICP spectrometry, BET analysis for specific surface area and granulometry test. Adsorption performance was evaluated as a function of several operational parameters: pH, initial concentration, adsorbent mass, stirring speed, contact time and temperature. Experimental conditions were optimized using response surface methodology, revealing the ideal conditions for maximum efficiency. Finally, adsorption models and thermodynamic parameters were investigated to gain a deeper understanding of the mechanisms involved.

Keywords : Chromium removal, Adsorption model, factorial design, Optimization, Response surface methodology

CMTDE 2024_142

Preparation and characterization of PVDF flat sheet membranes using DMF solvent for the water treatment by membrane distillation

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Abstract

Membrane Distillation (MD) is a thermally-driven separation process, in which only vapour molecules transfer through a microporous hydrophobic membrane.

In this work, flat sheet PVDF membranes have been successfully prepared from Polyvinylidene fluoride polymer (PVDF) and dimythylformamide DMF as solvent by using phase inversion induced by an immersion precipitation technique. The effect of polymer concentration and additives were investigated.

Furthermore, the surface structure of the membranes was characterized via a series of techniques. The characterization techniques used in this study are morphology, porosity, contact angle, pure water permeability (PWP), scanning electron microscopy (SEM), Fourier Transform Infrared spectroscopy (FTIR).

Keywords : membranes PVDF, additives, characterization, membrane distillation.

CMTDE 2024_143

Water contaminated by Legionella pneumophila: Detection, Quantification and Typing of Strain

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Abstract

Legionella constitute a frequent contamination of Man-made water systems and can cause, by inhalation of contaminated aerosols, a severe pneumonia commonly called 'Legionnaires disease' (LD). The aim of this study, the first one in Algeria, is to assess the *Legionella* water burden contamination in Algerian public buildings.7344 water samples of several hotels and other buildings from northern, eastern, western and southern Algeria were analyzed. Confirmation and identification were carried out through Latex test except for 3 strains identified by a MALDI-TOF mass spectrometry-based method. Samples were assigned to 1 of 5 levels of contamination. Statistical analysis was performed to determine the influence of risk factors for contamination. A total of 819 strains of *Legionella* were isolated. 92.68% of strains were *Legionella pneumophila*, 3 strains (0.37%) of them was identified only to the species level, the others belong to serogroup 2-14(74.24 %) and to serogroup 1(18, 07%). 60 strains (7.32%) have been identified as *Legionella species*. 71.92% of the positive samples presented a high risk of contamination.

LD is a preventable illness if adequate measures are taken to control Legionella in water systems. Chlorine treatment and heat treatment are the treatments of choice for the prescription of a water system contaminated by Legionella. However, these two methods are not always effective. This is why we proposed to assess the efficiency of microfiltration, solar disinfection, photocatalysis and UVC radiation, on Legionella-contaminated water. For these four methods tested, the percentages of legionella removal were above 99.99%.

Keywords : Legionella pneumophila, Water systems, Detection, Quantification, Disinfection, Microfiltration, Photocatalysis, UV-C254

CMTDE 2024_144

Treatment of paper industrial wastewater by constructed wetlands system

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Abstract

One of the principal tasks of advanced industry is wastewater reuse. For this reason, phyto epuration technologies are widely used. They are sustainable, low-cost and environmentally friendly process. The present study evaluates the removal efficiency of the organic matter and hardness of paper industrial wastewater using a constructed wetlands system (CWs). An hybrid small-scale wetland system was designed containing two vertical subsurface flow system

(VSSFCWs) and one horizontal subsurface flow system (HSSFCWs) in series planted with Cattails. The system was fed at the beginning of the experiment with groundwater, then with effluent water from the sand filter, the decanter and finally the CROFTA of the paper mill water treatment plant. The evaluation parameters included are biochemical oxygen demand (BOD5), chemical oxygen demand (COD), total suspended solids (TSS), and water hardness (TH). The results showed that the best removal efficiency for the BOD_5, COD, TSS and TH were equal to 72.48%, 78.9%, 70.77%, and 63.41%, respectively. The biodegradability of organic matter increases with higher COD and BOD removal efficiency and with lower biodegradability ratio. It was observed that the removal efficiency of pollutants increased with increasing TSS, COD and BOD of the influent. Suspended solids are well removed by VSSFCW through the filtration process, while organic matter is removed by HSSFCWs through bacterial activity in aerobic or anaerobic environments. HSSFCW provides maximum removal efficiency of 95.4% for BOD_5 and 71.8% for COD. It also helps to solve the disorders caused by VSSFCWs in the clogging period. Sufficient supply of oxygen and nutrients, as well as optimal pH value, are also important factors in the phytoremediation process. The performance of CWs may change over time due to changes and accumulation of contaminants in the substrate. This limitation is also evident in the present study when it comes to removing water hardness. Efficient removal of THis possible, but not in the long term. Once a certain level of accumulation of contaminants in the system, the plant releases the elements that cause water hardness. Instead of removing hardness, it becomes a source of TH.

Keywords : Organic matter; Cattail; Removal efficiency; Hybrid constructed wetland; paper industrial water.

CMTDE 2024_145

New and Improved Design for the HDH Humidification-Dehumidification Desalination System

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Abstract

The global shortage of fresh water caused by climate change, human population increase and industrialization gets worse every year. The search for new, efficient and promising technologies for producing fresh water from salty water is imposed and becomes a vital necessity. Desalination techniques still remain the main solutions to tackle the problems of fresh water shortage. In this paper, we present the experimental and energy analyses of the desalination system based on the humidification dehumidification (HDH) technique and improved by the integration of vapor compression heat pump (HP). The experimental prototype is constructed and equipped with the necessary sensors and metrology. The feasibility and efficiency of coupling the classic HDH desalination configuration with a vapor compression Heat Pump (HP) are evaluated by calculating the gain output ratio, GOR, the coefficient of performance, COP, the recovery ratio, RR, and the energy utilization factor, EUF. The models for standard HDH and the new HDH_HP system were developed based on first-law thermal analysis, energy and mass balance equations for each system component as well as heat and mass transfer analyses in the humidifier and the dehumidifier. The results showed that the new HDH_HP system is more productive and more efficient with good energy savings. Coupling with the heat pump significantly improved the GOR, the water productivity and the RR.

Keywords : Desalination, Heat Pump, Humidification, Dehumidification, GOR, COP, .

CMTDE 2024_146

Prevention of iron fouling of reverse osmosis desalination membrane

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Abstract

The fouling of reverse osmosis membranes remains a persistent challenge in water desalination. Interestedly, colloidal compounds, especially iron oxides are frequently encountered on RO membrane surfaces. Therefore, the purpose of this study is to examine iron oxide fouling and how it interacts with the RO membrane's surface. This work includes a modeling study about iron oxides oxidation in water during the desalination process. The examination of standardized flux decrease affects by process such pH, initial iron concentration, and initial feed composition was achieved. This study explored the inhibition effect of citric acid in desalination membrane fouling. The composition and morphology of the fouled membranes were examined by SEM, EDX, and

FTIR analysis. The findings indicated that the rejected solution is the primary factor contributing to fouling because a notable reduction flow rate was seen when the pH of the rejected water was higher than 6. The qualitative investigation demonstrated that the creation of cake layers is the mechanism of iron oxide deposition and that the δ-FeOOH phase makes up the majority of the foulant. Citric acid performs well in inhibition tests and can be used as an effective, environmentally acceptable cleaning agent and to reduce flux drop.

Keywords : Reverse osmosis; Membrane; Fouling; Iron oxides; Citric acid.

CMTDE 2024_147

Eco-friendly adsorption of Nitrates and Phosphates from Natural Waters by Oleander Leaves

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Abstract

Potable water resources are increasingly at risk due to population growth, industrialization, agricultural intensification, and drought. These factors, combined with the inefficiency of measures to protect natural water sources from pollutants, have led to the accumulation of mineral micropollutants, such as nitrates and phosphates, in drinking water. Although these elements are essential for natural cycles and the growth of living organisms, their excessive concentrations; primarily caused by human activities; disrupt the ecological balance of aquatic ecosystems. Ensuring high-quality drinking water while protecting ecosystems from the adverse effects of these pollutants remains a critical challenge. Various research studies have explored methods to remove nitrates and phosphates, including reverse osmosis, electrodialysis, ion exchange, and adsorption. This study focuses on the biosorption potential of oleander leaves as an inexpensive adsorbent for phosphate and nitrate removal. Preliminary experiments were conducted to identify the optimal conditions for this removal. To better understand the adsorption mechanism and process characteristics, equilibrium, kinetic, and thermodynamic studies were carried out. Finally, water samples from a Menzel Bouzalfa well were treated to demonstrate the effectiveness of oleander leaves as a low-cost and efficient adsorbent for nitrate and phosphate removal.

Keywords : Micropolluant ; Nitrates ; Phosphates ; Oleander leaves ; Bio-sorption

CMTDE 2024_148

NiAl2O4-NiO nanostructures as a new nanotechnology platform for detecting pesticides in natural water

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Abstract

The current study focused on the design of an extremely sensitive electrochemical sensor of ascorbic acid based on a mixture of $NiAl_2O_4$-NiO nanoparticles that, produced in a single step using the sol–gel method, on an ITO electrode. This new sensing platform is useful for the detection of pesticides present in water with a wide range of concentrations extending from the attomolar to the molar. SEM micrographs show the porous structure of the $NiAl_2O_4$-NiO sample, with a high specific surface area, which is beneficial for the catalytic performance of the nanocomposite. An XRD diffractogram confirmed the existence of two phases, $NiAl_2O_4$ and NiO, both corresponding to the face-centred cubic crystal structure. The performance of the modified electrode, as a biomolecule, in the detection of pesticides was evaluated electrochemically by cyclic voltammetry and chronoamperometry.

Keywords : $NiAl_2O_4$-NiO nanostructures; electrochemical detection; pesticide; electron transfer; catalytic effect.

CMTDE 2024_149

Modeling and performance analysis of membrane distillation coupled with thermo-solar for seawater desalination.

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Abstract

In the Mediterranean regions especially Algeria, freshwater resources are very scarce and its production requires higher electrical energy and consumption of fossils such as natural gas, thus increasing the price of production. Desalination of seawater is the method to meet the growing demand for water. The main objective of this research is to develop solutions to provide drinking water to small communities in isolated coastal areas by integrating AGMD water purification units associated with solar energy installations (thermal and PV). An attempt was made to achieve this goal with a study, modeled with Matlab software and the optimization of the solar thermal system for desalinated seawater. For the system, an AGMD powered by a plant glass solar collector was proposed and carried out on July 15 in the meteorological conditions of the city of Algiers (Algeria). The results showed that the present model is in good agreement with the experimental and theoretical data in the literature.

Keywords : Solar desalination, AGMD membrane distillation, Plant solar collector, Photovoltaic panel.

CMTDE 2024_150

Effective Alzarin Red S dye adsorption and removal from aqueous solution onto artichoke waste biochar, synthesis, characterization, adsorption studies and optimization by Box-Behnken design

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Abstract

Wastwater pollution from organic dyes has been a serious and increasing environmental problem. Research efforts are focusing on investigating cost-effective and ecologically friendly ways to create biosorbent as a result of promising developments in green technology. The present work aims to synthesize and characterize biochar (BCA) from artichoke waste for application as a biosorbent in the Alzarin Red S removal. Box-Behnken design was used to determine the ideal condition by adsorption process and BC was characterized by BET surface areas, zero charge point(pH_{ZCP}) and Scanning Electron Microscope (SEM). The adsorption process of the biochar is well described by a pseudo-second order kinetics model, and the adsorption isotherm closely fitted the Langmuir model. Therefore, it was possible to synthesize and characterize an alternative biosorbent from artichoke waste with high adsorption capacity, meeting the circular economy for wastewater treatment.

Keywords : biochar BCA, Alzarin Red S dye, Box-Behnken design, adsorption isotherm

CMTDE 2024_151

Investigation on the Impact of Renovating Old Buildings on Energy Consumption and Greenhouse Gas Emissions: A Case Study of Single-Family Homes in France

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Abstract

Faced with issues related to water pollution, environmental degradation, and climate change, it is logical for the world's major countries to take appropriate measures aimed at contributing to the sustainable development of the planet Earth. As the building sector is one of the main sectors that consumes vast amounts of natural resources and has a negative impact on the environment, a law has been established in France to limit and improve energy consumption in buildings. This is the Energy Transition Law, whose objective is to improve energy efficiency. In our case, the issue of improving energy efficiency in buildings revolves around the concepts and challenges of energy efficiency in all buildings, as well as the prerequisites required before implementing this approach. To help buildings reduce their energy consumption and contribute positively to improving the environment and climate, the Energy Transition Law has established measures such as energy audits and several financing mechanisms to enable property owners to engage in this reform process, which is vital for the planet. By conducting the energy audit of the given dwelling using

the BAO software, for a living area of 166 m², we found CO2 emissions of 77.8 kg/m² and a primary energy consumption of 499 kWhEP/m².year. After applying the modifications recommended by the owner, the primary energy consumption was reduced to 101.8 kWhEP/m².year, and CO2 emissions decreased to 3.04 kg/m².

CMTDE 2024_152

Numerical simulation of energy storage with phase change materials in building applications

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Abstract

The building sector is consuming more and more energy, reaching 37% of global operational energy in 2022, while the transport and industry sectors are becoming more energy efficient. It is therefore high time to save energy in all types of buildings and to think about other forms of non-polluting energy. It is reported that nearly 70% of the total energy consumed in a building is used to produce thermal energy for both heating and air conditioning. This fairly high rate leads to think about reducing heat losses.

In the current environmental context and in order to reduce energy consumption and protect the environment, the solution consists on integrating phase change materials (PCMs) into the walls for new buildings and carrying out energy renovation work on existing buildings. In other words, the idea is to design a kind of thermal battery that stores solar energy by using phase change materials (PCMs). In summer, PCMs absorb heat of the day and prevent the building from overheating. On the other hand, they will store energy to reduce heating consumption due to their inertia in winter.

The main objectives of this work are to develop a well-founded model to address phase change problems in order to accurately predict the thermal performance of latent heat of fusion energy storage systems, and also to evaluate the impact of phase change materials on the thermal comfort of a building in a natural environment.

We numerically analyze the thermal behavior of these materials in green buildings. Interaction between outdoor climatic and meteorological conditions and the quantity of PCM incorporated in the building envelop in discussed.

.It have been observed that the amplitude of the fluctuation of the external temperature decreases with the increase of the amount of PCM incorporated in the building walls. The amplitude of the fluctuation of the outside temperature decreases with the increase in the amount of PCM incorporated in the coating.

We conclude that the incorporation of such a composite material in the envelope of a building reduces the energy consumption of buildings and improve occupant comfort conditions.

Keywords : PCM, buildings, solidification-fusion, solid-liquid interface, thermal storage, passive air conditioning.

CMTDE 2024_153

Developement of Sustainable Polymer Inclusion Membranes for Effective Cobalt Ion Extraction and Recovery

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Abstract

By prioritizing environmentally safe materials, minimizing toxic chemicals, reducing energy consumption, and improving long-term economic viability, polymer inclusion membranes (PIMs), offer an efficient and sustainable solution for addressing water contamination problems, such as cobalt recovery and separation. The primary objective of this research is to synthesize novel PIMs based on cellulose triacetate (CTA)/ polyvinyl chloride (PVC) as the base polymer with specific proportions of 2-nitrophenyl octyl ether (NPOE)/2-nitrophenylpentylether (2NPPE) as plasticizers (at 10%), and di(2-ethylhexyl) phosphoric acid (D2EHPA) as the carrier (at 30%), to facilitate the transport and separation of Co(II) ions under controlled conditions. To assess their morphology and composition, scanning electron microscopy (SEM) and attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR) were employed. These characterizations revealed that the inclusion of the plasticizer resulted in a dense and smooth membrane structure, with pores filled by plasticizer molecules. This led to a thicker membrane, demonstrating uniformity and strong adhesion between the polymer matrix, carrier, and plasticizer. The mechanical properties

and hydrophobicity of the PIMs were evaluated using tensile strength and contact angle measurements. To further assess the feasibility of the newly developed membrane compositions, the PVC/10% NPOE/30% D2EHPA and CTA/10% 2NPPE/30% D2EHPA PIMs were tested. The influence of the receiving phase type and plasticizer amount on the stability of these PIMs was examined. Finally, the performance of the PIM system for the separation of cobalt and nickel was evaluated. The selection of the appropriate receiving phase and the membrane composition significantly influences the efficiency of selective cobalt recovery.

Keywords : Polymer Inclusion Membranes, D2EHPA, Plasticizer, Membrane characterization, Cobalt Recovery, Separation.

CMTDE 2024_154

Enhancing Copper Recovery: The Impact of Voltage in Electromembrane Extraction with Supported Liquid Membranes

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Abstract

This study demonstrates the effectiveness of electromembrane extraction (EME) of metal cations, particularly copper (Cu^{2+}), using supported liquid membranes with di-2-ethylhexylphosphoric acid (D2EHPA) as carrier. The application of electric current enhances ion transport, accelerates extraction, and improves efficiency, offering significant advantages over conventional methods, especially in terms of energy efficiency and selectivity. Optimization of extraction time is crucial, with maximum yield achieved after six hours. Voltage application significantly impacts the extraction process, influencing both kinetics and pH reduction due to electrochemical reactions. Higher voltage speeds up extraction, while lower voltage slows it down. The addition of NaCl improves extraction rates without voltage but becomes counterproductive under voltage, highlighting the superior effectiveness of voltage alone for copper extraction. The impact of voltage on copper (Cu^{2+}) extraction efficiency using Supported Liquid Membranes and Electromembrane Extraction, while considering the competition between copper and nickel (Ni^{2+}) ions was also assessed. The results show that applying voltage significantly enhances extraction rates, with a more pronounced effect for copper (Cu^{2+}) due to D2EHPA's stronger affinity for copper (Cu^{2+}) and favorable electrochemical effects. The electric current promotes ion transport,

optimizing the extraction process in multi-ionic environments and improving ion separation, which is crucial for selective recovery in industrial applications.

Keywords : Electromembrane extraction, Supported liquid membrane, D2EHPA, Voltage, Copper recovery.

CMTDE 2024_155

Synergistic Adsorption and Photocatalysis: A Bifunctional Approach for Efficient Dye Removal in Wastewater Treatment

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Abstract

This study explores a bifunctional technology incorporating adsorption and photocatalysis processes. Despite photocatalysis's ability to alter and neutralize dye properties under ultraviolet (UV) exposure, it fails to achieve complete mineralization. Hence, we combined it with biochar-mediated adsorption, which aids in electron–hole separation and dye adsorption on the photocatalyst surface, leveraging the synergistic effects of the composite system. Our research involved preparing and characterizing bark biochar and TiO_2 impregnated on cellulose fiber. The characterization was conducted using scanning electron microscopy (SEM) and energy-dispersive spectroscopy (EDS). The adsorbing performance of these materials was assessed by measuring the removal of methyl orange (MO) in pure water in the presence of different metal ions. The results showed a significant removal of 100% MO (6 mg/L). This was achieved through a process involving adsorption as a pretreatment, followed by photocatalysis—each step lasting 6 h, under neutral pH conditions using an 80 mg/mL biochar dose. The presence of metal ions, notably $CuCl_2$, improved the oxidative/adsorption performance, potentially facilitating photogenerated charge separation and promoting interface formation between $CuCl_2$ and TiO_2. Moreover, the MO decomposition process was analyzed and found to align with the pseudo-first-order model. This

study, therefore, provides valuable insights into the combined functioning of biochar-mediated adsorption and photocatalysis, offering a promising solution for efficient wastewater treatment methodologies.

Keywords : Adsorption, Photocatalysis, Biochar, Combined process, MO removal.

CMTDE 2024_156

Optimization of Cadmium Extraction from Tunisian Phosphates via Vapometallurgy: An Experimental Design Approach

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Abstract

This study employed an experimental design methodology to optimize the calcination of phosphate rock from Métlaoui, Tunisia, using vapor metallurgy. Key parameters, such as temperature, residence time, chlorinating agent, and its quantity, were systematically varied to assess their effects. A factorial design, developed using Nemrod, allowed for the identification of optimal conditions to maximize cadmium extraction efficiency. Physicochemical techniques, including SAAF spectroscopy, potentiometry, and gravimetry, were used to evaluate the process.The results show that vapor metallurgy significantly improves cadmium extraction efficiency under optimized conditions, with temperature and chlorinating agent identified as the most influential factors. Additionally, investigations into the physical and chemical transformations of the calcined phosphate rock revealed no adverse effects on its quality. Unlike previous studies that reported a reduction in chemical reactivity during calcination, the optimal process in this study did not decrease the reactivity of the phosphate. Significant positive changes in the chemical composition highlight the potential impact of industrial phosphate processing, especially in fertilizer production

Keywords : Tunisian phosphate, Calcination, experimental design methodology (Nemrod), cadmium extraction , vapometallurgy, reactivity.

CMTDE 2024_157

Impact of Mining Activities on Soil Contamination: Assessment of Trace Elements: Cadmium in Phosphate transformation Sites of Mdhilla,Tunisia.

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Abstract

This study provides an in-depth analysis of the environmental impact of mining activities on soil contamination, focusing on the release of metallic trace elements, particularly cadmium (Cd), from phosphate transformation sites in Mdhilla, Tunisia. Soil samples were systematically collected at various depths to evaluate the presence and concentration of key contaminants. Analytical techniques, including atomic absorption spectroscopy, gravimetry, and specific electrode analyses, were employed for precise characterization of the samples. The results demonstrate significant environmental impacts, particularly a moderate positive correlation between calcium oxide (CaO) content and cadmium (Cd) levels. This relationship is likely associated with large deposits of phosphogypsum, a byproduct of fertilizer production, which serves as both a source of calcium and a potential carrier for cadmium when improperly managed. Additionally, a strong negative correlation was observed between sulfur trioxide (SO_3) content and cadmium levels, indicating that high sulfur concentrations may reduce cadmium contamination, possibly due to competition for adsorption sites or precipitation as cadmium sulfate. An unexpected increase in cadmium concentrations was found in the deeper soil layers, which can be attributed to the clay-rich nature of these layers. The clay acts as a reservoir, facilitating cadmium accumulation at depth, which poses long-term environmental risks. These findings highlight the critical need for effective

management strategies to address soil and groundwater contamination in the phosphate mining regions of southern Tunisia.

Keywords : Environmental Impact, Phosphate Transformation, Soil analysis, Metallic Trace Elements, Cadmium, phosphogypsum,

CMTDE 2024_158

Water Softening Optimization: Calcium and Magnesium Removal via Donnan Dialysis Using Cationic Fujifilm Membranes – A Doehlert Design Approach

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Abstract

The removal of calcium and magnesium from water was investigated in this study using the Donnan dialysis (DD) according to the Doehlert design. Three cation-exchange membranes Fujifilm (Type 1, Type 2, and Type 10) were used in a preliminary investigation to establish the upper and lower bounds of each parameter and to more precisely pinpoint the optimal value. The concentration of compensating sodium ions [Na^+] in the receiver compartment, the concentration of calcium [Ca^{2+}] and magnesium [Mg^{2+}] in the feed compartment, and the membrane nature were the experimental parameters. The findings indicate that the Fujifilm Type 1 membrane offers the highest elimination rate of calcium and magnesium. Using the software NemrodW, which is essential support for the practical implementation of the Experimental Research Methodology, The Full Factorial Design makes it possible first to determine how the experimental factors affect the removal of calcium and magnesium by DD. All parameters used had a favorable impact on the response; however, the calcium and magnesium concentration were the most significant ones. The Doehlert design's Response Surface Methodology (RSM) was used to determine the optimum

conditions ([Mg^{2+}] = 89 mg.L^{-1}, [Ca^{2+}] = 83 mg.L^{-1}, [Na^{+}] = 0.46 mol.L^{-1}) allowing a 99.84% hardness removal rate with the Type 1 Fujifilm membrane.

Keywords : Hardness, Donnan Dialysis, Full Factorial, Response surface methodology, Doehlert design

CMTDE 2024_159

Optimization of Copper and Nickel Removal from Aqueous Solutions Using Donnan Dialysis with Fujifilm Cation-Exchange Membranes: A Response Surface Methodology Approach

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Abstract

This study investigates the removal of copper (Cu^{2+}) and nickel (Ni^{2+}) from aqueous solutions using Donnan dialysis with two types of cation-exchange membranes (CEMs), Fujifilm Type 1 and Type 2. The removal efficiency of these metal ions was evaluated based on several parameters, including the initial concentrations of copper and nickel in the feed compartment, the type of cation-exchange membrane used, and the concentration of counter-ions in the receiver compartment. A response surface methodology (RSM) based on the Central Composite Design (CCD) was employed to optimize the conditions for the removal process. A linear mathematical model was developed from the experimental results, capturing the effects and interactions of the various parameters. Statistical analysis, including Analysis of Variance (ANOVA), the F-test, and Student's t-test, revealed that the type of cation-exchange membrane had the most significant impact on the removal of both copper and nickel ions. The findings demonstrate that Donnan dialysis is a promising, energy-efficient method for removing metal contaminants, with potential

for various industrial and environmental applications requiring low energy consumption and simple operation

Keywords : Copper, Nickel, Donnan Dialysis, Cation-exchange membranes, Response surface methodology, Central composite.

CMTDE 2024_160

Development of Polymer Inclusion Membrane System for Selective Cadmium Removal from acidic media

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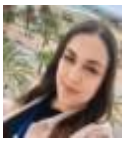
Abstract

This study presents the development of a polymer inclusion membrane (PIM) system for the treatment of cadmium-contaminated aqueous solutions. The PIM was composed of cellulose triacetate (CTA) as the base polymer, trioctylmethylammonium chloride (Aliquat 336) as the extractant, and 2-Nitrophenyl octyl ether (2-NPOE) as the plasticizer. The study focused on optimizing the conditions for cadmium (II) transport through the PIM by varying the compositions of the feed and receiver aqueous phases. The optimal membrane composition (60% CTA, 30% Aliquat 336, 10% 2-NPOE) and operating conditions ([NaCl] = 2 mol/L, pH = 6, [HClO4] = 0.1 mol/L) were determined, achieving an 88% cadmium recovery efficiency. The transport mechanism was driven by a pH gradient, with NaCl enhancing complex formation at the membrane-source phase interface. The synthesized PIM demonstrated satisfactory operational stability over five continuous cycles. Additionally, the membrane exhibited selective extraction, achieving 70% removal of Cd(II) and 43% removal of Cu(II) from a mixed solution. The calculated selectivity coefficient confirmed the PIM's preference for cadmium ions, highlighting its potential for efficient and selective metal ion removal in environmental applications.

Keywords : Polymer Inclusion Membrane, Cadmium Removal, Selective Extraction, Cellulose Triacetate, Aliquat 336, 2-Nitrophenyl Octyl Ether.

CMTDE 2024_161

Nutrient Removal from Aqueous Solutions Using Wood-based Biochar : Adsorption Capacities, Kinetics, and Isotherm Analysis



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Abstract

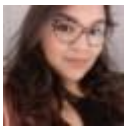
In this study, batch biosorption experiments were carried out to evaluate the phosphate, nitrate and ammonium adsorption capacities onto wood-based biochar.In this study the biochar was produced from wood chips through temperature pyrolysis at 550˚C and used as an adsorbent for ammonium, phosphate and nitrate removal from aqueous solutions.The effects of contact time, pH of solution, biochar dosage and nutrient initial concentration on the nutrient biosorption capacity onto the biochar were investigated. The results indicated that the removal of the three nutrients increased with increasing initial solution concentration and the adsorbent dosage. However, for pH, the adsorption capacities of anionic nutrients (PO_4^- et NO_3^-) increased with acid pH, and decreased with basic pH in contrast to ammonium. The adsorption kinetics were analysed using pseudo-first-order, pseudo-second-order and intraparticle diffusion models.Adsorption can be described by a pseudo-second-order model predicting a chemisorptions process. Equilibrium data were very well represented by Langmuir and Freundlich isotherms.The maximum adsorption capacities obtained were 16.82, 14.13 mg/g and 14.79 mg/g for ammonium, nitrate and phosphate, respectively.

The comparison of nutrient adsorption capacities onto biochar and other adsorbent materials cited in the scientific literature indicated that the tested wood-based biocharin our study can be considered as potential adsorbent of nutrients from aqueous solutions.

Keywords : Adsorption; Biochar, Batch, Nutrients, Isotherms, Kinetics.

CMTDE 2024_162

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



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Abstract

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

Keywords : Activated sawdust, Biosorption, Tartrazine, Isotherm modelling, Kinetic.

CMTDE 2024_163

Sorption-photocatalysis–enhanced effects of biochar-nanocomposite based on palm cellulose fibers

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Abstract

This study aims to evaluate the efficiency of raw biomass from palm and its derived biochar (PBC) for treating wastewater-containing dyes through adsorption. Structural and morphological analyses of RPB and PBC were performed using Fourier-transform infrared spectroscopy and scanning electron microscopy. The adsorption performance of RPB and PBC for removing methyl green (MG) was further examined in batch mode. The CCD model generated optimal conditions for both materials, with a contact time of 80 and 39 minutes, an MG concentration of 137 and 150 mg/L, and a medium temperature of 306 K for biomass and biochar, respectively. Kinetic studies showed that the adsorption of MG was well described by the pseudo-second-order model. A thermodynamic study indicated that the adsorption process is exothermic and that adsorption is not spontaneous under standard conditions.

Keywords : biochar, Biosorption, removal dye, optimization

CMTDE 2024_164

Memo on Microprocessor Cooling

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Abstract

The performance of modern microprocessors heavily depends on their ability to dissipate the heat generated during operation, ensuring their reliability and longevity. This paper provides a comprehensive review of the cooling techniques developed for microprocessors over the past few decades, highlighting their evolution and limitations. The solutions studied include traditional heat sinks, liquid cooling systems, as well as emerging approaches such as heat pipe cooling and nano-fluid cooling. We also analyze the impact of materials, architectures, and environmental conditions on thermal efficiency. Finally, perspectives are offered to improve these technologies, drawing on recent advancements in nanomaterials and numerical simulation. This presentation aims to provide a framework to guide future research in the field of cooling, a critical issue for cutting-edge technologies.

Keywords : Microprocessors; Cooling techniques; Heat dissipation; Nano-fluids; Thermal efficiency

CMTDE 2024_165

Modeling predictions of soluble microbial product using integrate ASM1-SMP model and statistical analysis in a submerged membrane bioreactor for wastewater treatment under different COD/N ratios.

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Abstract

This study focuses on developing a model to predict soluble microbial products (SMP) and address membrane fouling in Membrane Bioreactors (MBR), which are widely used for wastewater treatment. Membrane fouling is a significant challenge in MBR systems, reducing membrane permeability and efficiency. The study integrates a mechanistic (ASM1-SMP) and non-mechanistic modeling approach using four techniques: multivariate projection to latent structures (PLS), artificial neural networks (ANN), principal component analysis (PCA), and modeling equation structural (MES) models. Sensitivity analysis was conducted to identify key parameters influencing SMP production and fouling, with the results showing that autotrophic biomass (SOUR, XBAI, XBAA) has the most significant impact on SMP production. The study demonstrated that using hybrid modeling, specifically the PLS model, could effectively predict SMP outcomes without the need for additional laboratory analysis. The integrated ASM1-SMP model, with recalibrated parameters, proved to be a comprehensive tool for predicting key MBR performance indicators and fouling parameters, emphasizing the importance of proper monitoring and data integration for optimal MBR operation

Keywords : Membrane bioreactor, statistical analysis, sensitivity analysis, wastewater treatment, soluble microbial product (SMP).

CMTDE 2024_166

A novel LiBr-H_2O Absorption Cooling System Incorporating a Turbo-Compressor

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Abstract

This study investigates the incorporation of a turbo compressor into an absorption cooling system (ACSTC) using the LiBr-H_2O mixture. The emphasis is on leveraging vapor expansion from the generator to raise absorber pressure. Results indicate a substantial improvement in Coefficient of Performance (COP) for ACSTC compared to the conventional system (ACS), reaching 0.92 at a pressure ratio (PRC) of 4, surpassing ACS's COP of 0.8. However, this enhancement is coupled with a necessary 10 °C increase in the generator's operating temperature. Optimal exergy efficiency exhibits a marginal decline with higher PRC, diminishing beyond the temperature

corresponding to the optimal COP. Exergy destruction rates analysis identifies the generator, absorber, evaporator, and condenser as key contributors.

Keywords : Absorption chiller, Coefficient of performance, Exergy efficiency, Turbo-compressor, Water.

CMTDE 2024_167

Using desalination brine on Halophyte Cultivation

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Abstract

This study presents an environmentally sustainable approach to valorizing desalination brine through the cultivation of halophytes in soil and hydroponic systems. The research aims to evaluate the efficiency of halophytes in reducing brine salinity. The methodology encompasses halophyte selection and adaptation, brine collection and analysis, experimental prototype development, and the monitoring of plant physiological parameters alongside the physico-chemical properties of soil and water. Halophytes were cultivated using brines of varying salinity levels (3, 6, and 9 g/L) in both soil (via frequent irrigation) and hydroponic systems. The results revealed a clear correlation between irrigation water salinity and halophyte growth, with denser root development observed at the highest salinity level (9 g/L). Chemical analyses further underscored the ability of halophytes to lower brine salinity, as potassium and sodium were found to accumulate significantly in plant tissues. Electrical resistivity tomography (ERT) conducted on experimental plots irrigated with brine water confirmed that soil salinity in halophyte-planted plots increased at a slower rate compared to control plots without halophytes. These findings demonstrate the potential of halophytes to mitigate soil salinity when irrigated with highly saline water. Moreover, they highlight a sustainable and viable pathway to valorize brackish water from desalination processes through halophyte cultivation.

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Effect of Demister Separation Efficiency on the Freshwater Purity in MSF-OT/TVC Desalination Process

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Abstract

The purity of freshwater is very important for consumption by living beings and for industrial services such as boiler feed to produce steam and demister plays an important role in determining the purity of freshwater produced in MSF-OT/TVC desalination plants. For fixed water demand and top brine temperature, this work studies the effect of separation efficiency of demister on the final purity of freshwater for both clean and fouled demister with seasonal variation of seawater temperatures. Also this study estimates the required number of flash stages to maintain the purity of freshwater at the desired level using clean demister. To maintain the purity of freshwater product, comparatively large number of flash stages is required for fouled demister. Also for clean demister it is found that the total number of stages needs to increase when the seawater temperature decreases and vice versa.

Keywords : MSF-OT/TVC desalination process, demister, freshwater purity, fixed water demand, simulation.

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Naturel tracer and Isotopic approach to describe groundwater behaviour: an example of the Sejnane Basin (North-Western Tunisia)

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Abstract

This study presents the first results from the multicriteria approach using geochemical and isotopic tools to understand the origin, geochemical evolution and renewability of deep groundwater in

Sejnane basin, northwestern Tunisia. The study area is a coastal plain that plays an important regional socio-economic role, as the groundwater resources are the most important source for agricultural and drinking supply. Geochemical and isotopic (18O,2H,3H) data show that the water-rock interaction and cation-exchange process are the major geochemical mechanisms controlling hydrochemical evolution of groundwater. Isotope data (Oxygene-18, deuterium and tritium) point out recent recharge by atmospheric precipitations. Drilling samples varied between 100 and 250 m deep characterized by low 18O and 3H contents suggest older recharge under different climatic conditions.

Keywords : Coastal aquifer, Geochemistry, Isotopes, Recharge, NW Tunisia.

CMTDE 2024_170

Degradation of Aqueous Quinoline Yellow Solutions Induced by Gamma Irradiation

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Abstract

The gamma radiolysis process has proven to be very effective for the decolorization and mineralization of Quinoline Yellow (JQ), a harmful dye commonly used in various industries. In this study, aqueous solutions of JQ were subjected to irradiation using a 60Co source, with doses ranging from 0.2 to 8 kGy. The solutions treated were analyzed by UV-visible spectroscopy, NMR spectroscopy, chemical oxygen demand (COD) measurements, and pH evaluations. The analysis revealed a significant reduction in absorption peaks as the radiation dose increased, with complete decolorization achieved at 0.6 kGy. COD measurements showed a 95% reduction, indicating near-total mineralization of the dye. Kinetic studies based on spectrophotometric data demonstrated that the degradation process followed pseudo-first-order kinetics. These results demonstrate that gamma radiolysis is a very promising method for the treatment of wastewater contaminated by the JQ dye.

Keywords : irradiation Gamma; Jaune de Quinoline; Efficacité de traitement; Etude cinétique; DCO

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Valorization of biomass in an efficient treatment process for oil wastewater

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Abstract

The depletion of freshwater resources and increasing water stress worldwide necessitate the urgent and efficient management of wastewater, particularly from the oil industry. These wastewater discharges contribute significantly to environmental pollution, affecting public health and ecosystems. Addressing these impacts is a key priority for countries aiming to balance economic development with environmental sustainability. This study focuses on developing an effective treatment process for oil industry wastewater using innovative and cost-effective methods, including electrocoagulation and adsorption. Electrocoagulation was studied using a cell equipped with aluminum electrodes, while various bio-adsorbents derived from biomass, such as fig leaf powder, nettle leaf powder, cactus pad powder, and sawdust, were tested for their adsorption capabilities. The results demonstrated that the elimination rate of ions (Ca^{2+}, Mg^{2+}, K^{+}, Na^{+}, and Cl^{-}) was significantly influenced by the applied current intensity during electrocoagulation. Sawdust exhibited the most remarkable performance among the bio-adsorbents, both individually and in combination with electrocoagulation. The study highlights the potential of this combined approach for effectively treating wastewater from the oil industry, promoting sustainable development, and contributing to a circular economy by valorizing renewable biomass resources.

Keywords : Oil industry wastewater, Electrocoagulation, Adsorption, Bio-adsorbents

CMTDE 2024_172

An Innovative Strategy for Repurposing End-of-Life Desalination Membranes in Technical Textile Applications

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Abstract

Water shortages in most parts of the world are becoming severe by growing population demands, rising water use, and economic expansion, as well as declining water resources brought on by pollution and climate change. According to recent estimates, 40% of people worldwide are severely water scarce, and by 2025, that number is expected to rise to 60%. For at least one month out of the year, 4 billion people, or 66% of the world's population, live in extreme water shortage. According to these figures, conventional water sources including rainfall, snowmelt, and river runoff collected in lakes, rivers, and aquifers are no longer enough to support human needs in places with limited water supplies.

In this current study, end-of-life reverse osmosis membranes from a seawater desalination plant which supplies treated water from the Marmara Sea in order to use for production. The end-of-life reverse osmosis membranes were first disassembled by opening the outer shells. Then, they were physically examined and possible cracks on their surfaces, if any, were examined. Afterwards, the membrane sheets, whose integrity was ensured, were physically cleaned superficially to remove solid particles. Then, different chemicals were applied to strip the polyamide layer on the surface of the reverse osmosis membranes. In the studies, $KMnO_4$, H_2O_2 and NaOCI chemicals were applied to the surfaces of the membranes at different concentrations and times and the results were discussed. When the results were examined, it was concluded that the different chemicals used were effective in stripping the polyamide layer on the reverse osmosis membrane surfaces and could be used as a breathable fabric in the intermediate layer of technical textile fabrics.

Keywords : reverse osmosis membranes, end of life reverse osmosis membranes

Eco-Friendly and Cost-Effective Water Treatment: Degradation of Acid Green 25 via Fenton Process Using Fe/Perlite Catalyst

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Abstract

Herein, iron-doped perlite catalysts were synthesized using the impregnation method and characterized by different spectroscopic methods, namely XRD, FTIR, TGA, and DTA. Moreover a microscopic observation was performed. The catalytic performance of the prepared materials was evaluated for the degradation of Acid Green 25 (AG25) based on an heterogeneous Fenton oxidation process. Preliminary optimization focused on key parameters such as reaction time, iron content, and the synergistic interaction between adsorption and the Fenton process. The results demonstrate the high efficiency of the synthesized catalysts, achieving significant pollutant removal as monitored through UV–vis spectrophotometric analysis of AG25 degradation. These findings provide valuable insights into the development of efficient and eco-friendly water treatment methods.

Keywords : Perlite, Degradation, Heterogeneous Fenton process, AG25, water treatment.

CMTDE 2024_174

Synthesis and characterization of a novel eco-friendly bioflocculant: Perfomance study for treatement of real industriel effluent

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Abstract

This work focuses on the preparation and application of a bio-flocculant biodegradable, non-polluting and economical for the clarification of wastewater by coagulation flocculation. The bioflocculant is an extract from the cactus (Opuntia Ficus Indica), specifecly from the cladodes,

by simple cold grinding, using a domestic blender, followed by filtration. The cactus juice is characterized in the laboratory at room temperature (viscosity, pH, color, molar mass, conductivity) and its efficiency was tested by reduction amount of turbidity, conductivity, MES and hydrocarbon content to evaluate its flocculating aspect. The best results are obtained for a dose of bioflocculant equal to 12.5 mL for which maximum reduction in color and turbidity of the wastewater is observed. The mechanism study showed that flocculation occurred through charge neutralization and interparticle bridging between the bioflocculant and the particles in the lake water. The flocculation tests for color and turbidity removal indicated that bioflocculant performed comparably to commercial coagulant (Al2(SO4)3), wich synthetic compound, non-degradable, unavailable and/or expensive to implement and able to respond to the requirements of the Tunisian discharge standard. The use of this bioflocculant should minimize industrial water treatment costs from a health, environmental and sustainable development point of view.

Keywords : cactus juice, bioflocculant, industriel effluent, turbidity, conductivity.

CMTDE 2024_175

Solar photo-Fenton at neutral pH using Fe^{3+}-NTA as a novel tertiary treatment for microcontaminants removal

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Abstract

This work presents, for the first time, a kinetic study of the solar photo-Fenton process at neutral pH mediated by the Fe^{3+}-NTA complex (molar ratio 1:1) applied to remove contaminants of emerging concern (CECs). To this end, wastewater treatment plant (WWTP) secondary effluents were treated in a raceway pond reactor (RPR) at pilot plant scale with 0.1 mM Fe^{3+}-NTA and 0.88 mM H_2O_2 under average solar UVA irradiance of 35 W/m^2. Sulfamethoxazole and imidacloprid, at 50 µg/L of initial concentration each, were selected as model CECs. Up to 40% of the sum of both model CECs was removed from simulated WWTP effluent by the Fe^{3+}-NTA Fenton-like process, and more than 80% was removed by solar photo-Fenton. The effect of liquid depth in the reactor was evaluated, showing an increase of the treatment capacity from 12 mg CEC/m^2·h to 18 mg CEC/m^2·h when liquid depth increased from 5 to 15 cm. Afterwards, these results were validated with real WWTP effluents and compared with the results obtained with the Fe^{3+}-EDDS complex under the same operating conditions. The same CEC removal rates were obtained with Fe^{3+}-NTA and Fe^{3+}-EDDS at 5 cm of liquid depth (kinetic constants of 0.110 min^{-1} and 0.046 min^{-1} for sulfamethoxazole and imidacloprid, respectively). Conversely, at 15 cm of liquid depth, the degradation rates were lower with Fe^{3+}-NTA (kinetic constants of 0.034 min^{-1} for sulfamethoxazole and 0.017 min^{-1} for imidacloprid), whereas with Fe^{3+}-EDDS the values were 0.076 min^{-1} and 0.047 min^{-1} for sulfamethoxazole and imidacloprid, respectively. Regarding process cost estimation, the use of NTA as iron chelate for solar photo-Fenton at neutral pH at pilot plant scale resulted very cost-effective (0.13 - 0.14 €/m^3) in comparison with the use of EDDS (0.46 – 0.48 €/m^3) at the two liquid depths tested.

Keywords : Advanced Oxidation Process, Chelating agents, Real Wastewater, EDDS, Cost

CMTDE 2024_176

Cysticidal Activity of *Trachyspermum ammi* Essential Oil against *Acanthamoeba* Isolates from Dental Clinic and Hospital Water Networks

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Abstract

Acanthamoeba genus is widespread in the environment, including the hospital water sources and medical devices especially in dental units and dialysis machines. It poses a threat to public health. The aim of this study was to isolate the pathogen from the dental units and hospital water network and treatment of Acanthamoeba with Trachyspermum ammi essential oil that have the ability to kill cysts. Out of T. ammi oil showed that, higher concentrations (90 µg/mL after 72 and 96 hrs and 100 µg/mL after 24 and 48 h) was more active, being able to kill 100% of the Acanthamoeba cysts. The results showed the cysticidal activity of T. ammi essential oil, LC50 values estimated to be 73.31, 61.69, 57.21 and 53.01 µg/mL with 24, 48, 72 and 96 h, respectively. This is the first report of in vitro cysticidal activity of T. ammi essential oil and the activity of this oil makes it a promising anti-Acanthamoeba.

Keywords : Amoebicidal, Cysticidal, Acanthamoeba spp., Water sources, Essential oil

CMTDE 2024_177

Bacteriological Evaluation of Treated Wastewater in Tunisia

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Abstract

The presence of pathogenic bacteria, such as *Salmonella*, in wastewater poses a significant risk to both public health and the environment, especially in regions where treated wastewater is reused for agricultural irrigation. This study aims to evaluate the bacteriological quality of wastewater in Tunisia, with a specific focus on the detection and quantification of *Salmonella* species. A total of 80 treated wastewater samples were collected from wastewater treatment plants located across the 24 governorates of Tunisia. The results demonstrated variable levels of *Salmonella* contamination, with higher detection rates observed at stations with insufficient treatment processes. These findings underscore the urgent need for improvements in wastewater infrastructure and treatment protocols in Tunisia to mitigate the risks associated with *Salmonella* contamination.

Keywords: *Salmonella*, wastewater, Tunisia, bacteriological evaluation.

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Valorization and Development of a Polyester Polymer from Alfa Fiber

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Abstract

Natural fibers have been known for a long time and are used as reinforcement in the manufacturing of composite materials specifically, in the fields of packaging, healthcare, pharmaceuticals, automotive construction, and aerospace. Natural fibers offer numerous advantages such as availability, low cost, low density, rigidity, biodegradability, and significant mechanical behaviour. Many researchers have observed that the preparation of composite materials reinforced with natural fibers can enhance the mechanical performance of these composites. A composite material was previously prepared from an unsaturated polyester matrix with Luffa fibers, which underwent various chemical treatments (NaOH, permanganate, dichromate, silane, and bleach) to improve the fiber-matrix interfacial adhesion. The aim of this work is to study the effect of an alkaline treatment and treatment duration on the mechanical properties of a thermoset matrix (unsaturated polyester) composite reinforced with Alfa fibersmots clés: Fibres naturelles, Composite, Traitement chimique, polyester insatured , Alfa.

Références

[1] M. Abdelmouleh, S. Boufi, M.N. Belgacem, A. Dufresne, Short natural-fibre reinforced polyethylene and natural rubber composites: effect of silane coupling agents and fibres loading, Composites science and technology, 67 (2007) 1627-1639.

[2] V.V. Do Thi, Matériaux composites à fibres naturelles/polymère biodégradables ou non, Université de Grenoble; Université des Sciences Naturelles d'Ho Chi Minh Ville, 2011.

[3] M. Nciri, D. Notta-Cuvier, F. Lauro, F. Chaari, R. Delille, G. Haugou, Y. Maalej, B. Zouari, Performance over a wide range of strain rate of polypropylene reinforced by short alfa fibers, Polymer Composites, 40 (2019) 2850-2862.

[4] A. Amrane, Z. Sereir, C. Poilâne, A. Vivet, Effet du Facteur de Forme et de la Fraction Massique des Fibres Courtes d'Alfa sur le Comportement Mécanique d'un Bio-composite Alfa/Greenpoxy, Revue des Composites et des Matériaux Avancés, 29 (2019).

[5] Z. Kassab, A. Boujemaoui, H.B. Youcef, A. Hajlane, H. Hannache, M. El Achaby, Production of cellulose nanofibrils from alfa fibers and its nanoreinforcement potential in polymer nanocomposites, Cellulose, 26 (2019) 9567-9581.

[6] R. Imen, S. Wadhah, B.Y. Rached, Identification de la loi de comportement des matériaux composites à fibres organiques (Stipa Tenacissima L).

[7] N. Laib, A. Benyahia, A. Redjem, N. Deghfel, Effect of chemical treatment with oxidants on the mechanical properties of luffa sponge/unsaturated polyester composites, (2020). Nanocomposites, Cellulose, 26 (2019) 9567-9581.

CMTDE 2024_179

Study of the Salinity of Irrigation Water and Soil in Several Irrigated Plots in the Relizane Wilaya

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Abstract

In the Wilaya of Relizane, the salinity phenomenon is a major issue affecting several hectares of land, primarily due to irrigation with poor-quality water. The objective of this study is to determine the salinity of groundwater and soil in several irrigated areas of the Wilaya of Relizane and to establish correlations between water and soil salinity based on pH and Electrical Conductivity (EC). The results showed that the average salinity of the irrigation water is 5.05 dS/m, indicating that the use of this water for irrigation could lead to serious soil salinization problems. To confirm these results, the SAR was calculated, revealing low values with an average of 1.95 mmol/l, which are below 6 meq/l, indicating no risk of sodicity issues. Additionally, it was observed that the samples are rich in calcium and magnesium. On the other hand, the soil samples had slightly alkaline pH, which poses a risk of alkalinization over the long term. In terms of salinity, the majority of the soils are mildly saline, with most plants yielding well in this salinity range.

Keywords: Water salinity, soil salinity, water quality, irrigation, Wilaya of Relizan

CMTDE 2024_180

Hydro-chemical diagnosis and quality of groundwater in the M'zab Valley following the effects of floods. Algeria

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Abstract

Due to its geo-environmental location, strong population growth, and as a result of changing consumption patterns, the Wadi M'zab region is subject to risks of groundwater pollution following the deposit of household waste assimilated to levels of its banks. The effects of the floods that the city experienced during the catastrophic floods of October 2008 clearly showed the risk to give back a more severe impact of environmental pollution. The water table, given its high permeability, is very vulnerable to pollution, mainly at the level of Wadi beds. The methodology established uses conventional hydrochemical approaches, the analysis of the main component of electrical conductivity, and the sodium content in water expressed as a percentage to highlight the quality of water resources upstream and downstream of the water of Wadi M'zab. This study also consists of establishing an inventory of historical floods and the impact they may have on the quality of groundwater. It was established, following a campaign of samples at the level of the wells controlled all along the extremities of the wadi of the M'zab valley to diagnose the state of the pollutants by infiltration through the impermeable layer, from the groundwater. According to the WILCOX classification, the results obtained allowed us to conclude that the most polluted part is downstream.

Keywords : Wadi M'zab, Water quality, flooding, groundwater, pollution.

Validation of analytical method for the determination of pesticides residues in environmental matrix

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Abstract

Validation of analytical procedures is the process of determining the suitability of a given methodolgy for provinding useful analytical data. It's the formal and systematic proof that a method compiles with the requirements for testing a product when observing a defined procedures. In the present work an analytical methodology for quantification of the pesticides by an adapted Quechers method: Dichlorovos, Ethoprophos, Disulfoton, Alpha HCH, Gamma HCH, Propyzamide, parathion-methyl, Ronnel, Fenitrothion, Chlorpyrifos, Alpha endosulfane, Tokuthion, DDT, Endosulfane Sulfate, Bifenthrin, Cypermethrin residues in environmental matrix (Water and sediment)) was developed and validated using Gas Chromatography with a Electron Capture Detector (GC-ECD). The validation parameters studied, in accordance with the requirements of SANTE/11312/2021 guideline [1] of the European Commission, focused on the matrix effect, linearity, specificity, limit of quantification and accuracy of the method. The possibility of a matrix effect was studied.

Key words : analytical validation, pesticide residues, water, sediment, GC-ECD

References

[1] Guideline of SANTE/11312/2021

Author list

A

ABBES Maroua · 143
ABDELAOUI Dorsaf · 16
ABDELJABAR Ridha · 151
ABDELLI Sara · 61
ABDELMALEK Fatiha · 33
ABDERRABBA Manef · 72
ABDERRAZAK Houyem · 89, 155
ABDESSEMED Djamal · 152
ABED Badra · 71
ABIDI Walid · 27, 29
ADDELI Ferdaous · 88
ADDOU Ahmed · 33
ADJEROUD Nawel · 100
AGAGUENA Amel · 85
AISSAT. F. · 124
AIT NOUH Fatima · 81, 92
AKACHA Imane · 122
AKKARI Imane · 43
AKRIMI Rawaa · 27, 29
AL KHAZAALI Mohammed · 90
ALHAMDAN Atheer Ali Awwad · 113
ALI AGHA Hamza · 103, 124
ALLOUACH Ahmed Amine · 42
AL-MESRI A. · 36
ALOULOU Hajer · 50
ALYANI Ibtissem · 104, 141
AMARA Khaoula · 151
AMDOUNI. N. · 105, 107
AMIRI Chorouk · 155
AMMAR Salah · 34, 58, 83, 151
AMOKRANE Samira · 24, 25
AMOKRANE, Samira · 117
AMRI Islem · 77
AMRI Sondess · 158
ARAISSI Manel · 74
ATMANI Fatiha · 43
ATTIA Afef · 52, 96
ATTOUTI Salima · 78
AYACHI Fakher · 86
AZAIEZ. S. · 129
AZEIZ Hajer · 153
AZIZI Nedra · 110

B

BABA AMER Zohra · 164
BAHROUNI Jamila · 52, 96
BAHSINE Saida · 81, 92
BAKLOUTI Lassaad · 52
BALAMANE-ZIZI Ouafia · 43
BARBOUCHI Sonia · 114, 156
BARDAOUI Afrah · 137
BARHOUMI Houcine · 88
BARHOUMI Malek · 156
BARKAT Djamel · 16, 44
BECHIRI Ouahiba · 120
BEKKOUCH Mohamed Fouzi · 42
BELAYACHI Amel · 28
BELAYACHI.Hanane · 28
BELGACEM Ahmed · 32
BELHADJI Kinza Amel · 33
BELHAKEM.Mostefa · 28
BELKHIR Meriem · 125
BELKHIR. M. · 124
BELLACHE Dihia · 62
BELLAGI Ahmed · 134
BELLAKHAL Nizar · 150
BELLAZIZ Yassir · 81
BELMEDANI Mohamed · 18
BEN ABDALLAH Samira · 57
BEN ABED Rokaya · 115
BEN ABID Taycir · 139
BEN ACHOUR Mounir · 128
BEN ALI Mongi · 154
BEN AMAR Raja · 38, 50, 52, 96
BEN BRAHIM Fatma · 112
BEN EZZINE Nizar · 134
BEN FATHALLAH. B. · 91
BEN HAMED Karim · 153
BEN HASSEN Khouloud · 56
BEN ISSA. A. · 107
BEN JABRALLAH Sadok · 53
BEN KAMEL. K. · 105, 107
BEN KHALIFA Eya · 138
BEN KHALIFA. E. · 129
BEN LAMINE Abdelmottaleb · 86
BEN SAED Massouda · 55
BEN SALAH Sarra · 38
BEN SALEM Malak · 155
BEN SALHA Ghada · 72

BEN SIK ALI Mourad · 132
BENABBOU Amina Amal · 132
BENABDESSELAM Soulef · 123
BENABED FATMA Baghdad · 78
BENALIA Mokhtar · 23
BENALIOUCHE Fouad · 152
BENALIOUCHE Hana · 152
BENAOUDA Bestani · 78
BENBELLAT Noura · 85
BENCHETTARA. A. · 111
BENDAIKH Tahar · 85
BENDERDOUCHE Noureddine · 78
BENMANSOUR Yasmine · 94
BENSAADI-OUZNADJI Zohra · 43
BENSALEM Fella · 26
BENSELHOUB Aissa · 59
BENYAHIA Azzedine · 162
BENZAGRI IKram · 99
BENZEKI BENALLOU Mokhtar · 63
BENZEKRI BENALLOU Mokhtar · 78
BENZIDOUNE Amel · 120
BENZINA Mourad · 47, 82
BERRABAH. SE · 111
BERREDJEM Yamina · 87
BESBES Néji · 64, 65
BESBES Sonia · 73
BESSROUR Jamel · 49
BESTANI Benaouda · 63
Bhiri S. · 140
BITAM Kamel · 66, 67
BOUASLA Ihcène · 19
BOUAZIZ Aya · 99, 101
BOUBAHRI Chokri · 48, 49, 51
BOUBIDI Fatima · 19
BOUCHELAGHEM Ouahiba · 35
BOUCHENAK Fatima · 55
BOUCHERDOUD Ahmed · 63
BOUDAOUD Asma · 23
BOUDJEMAA Amel · 100
BOUGHERARA Saliha · 125
BOUGHERARA. S. · 124
BOUGHERARA. Saliha · 124
BOUGUERRA Wided · 75, 76, 104, 108, 143, 144, 145, 146, 147
BOUGUEURRA Wided · 141, 142, 148
BOUHOUF Loubna · 37
BOUJELBANE Faten · 118
BOUKEZZOULA Faiza · 23
BOUKHALFA-DJEBBAR Chahrazed · 37
BOULAGHMEN[2]Farida · 164
BOUMAIZA Fatma · 108
BOUMESSAIDIA Selman · 26
BOUMNIJEL Ibtissem · 158
BOUNAB Bouchra · 19
BOUNACEUR Boumediene · 64, 65
BOURAHLA.Sarra · 28
BOURAS Omar · 20, 21
BOURI Salem · 112
BOURWINA Mansoura · 47
BOUSLIMI Sondes · 31
BOUSSAADA Nawel · 111
BOUSSAID Oussama[a] · 163
BOUTABIA-TREA Saliha · 84
BOUTALBI Nadir · 103
BOUTOUMI Hocine · 28
BOUZERARA FERHAT · 17
BOUZID khadidja · 122
BOUZID Lakhdar · 44
BOUZID Radia · 125
BRAHMI Khaled · 75, 76
BRANDVOLL Øyvind · 61

C

CALZA Paola · 61
CESANO. F. · 129
CHAABANI Nabila · 146, 147
CHAKNANE Omar · 70
CHANDOUL Belgacem · 102
CHAOUIA Cherifa · 55
CHEHIMIMohamed M · 151
CHELBI Yosr · 95
CHEMINGUI Hajer · 58
CHEMRAK Mohamed Amine · 63
CHENINI Ismail · 54
CHERIK. .D. · 124
CHERNI Yasmin · 110
CHEVALIER.Y. · 107
CHIBANI Amel · 145
CHIHI Adel · 80
CHIKHI Bilal · 100
CHOUAF Fethi · 44
CHOUCHENE Fraj · 88
CHOUHA Nora · 23
CHTOUROU Radhouane · 58

D

DAHMANE. M. · 116
DAMMAK Lasaad · 104
DAMMAK Lasâad · 52, 96, 108, 126
DAMMAK. L · 146, 147
DEBILI Mounia · 19
DEGHFEL Nadir · 162
DELECI K. · 124
DELLECI Kamel · 125
DENDANI Boutheina · 19
DERATANI Andre · 52
DHAFFOULI Afef · 88
DHAOUADI. H. · 72

DHIB DRINE Soukeina · 161
DJEBALI Kais · 58, 110
DJEBBAR Yassine · 109
DJEDIOUI Abdallah · 19
DJELLOULI Amir · 87
DJEMA Fatma · 32
DJEMEL Amira · 127
DOUARA Nadia · 63
DOUINAT Oukacha · 63
DREMCHI. A. · 124
DRIDI Mohamed Ali · 60
DRIDI Rafik · 77
DRIOUECHE Asma · 28

E

EL GHOUL. Islam. N · 82
EL MELKI Mohamed Nejib · 79
EL MOUEDDEB Khaled · 90
ELABBAS Saliha · 100
ELAKHDAR ABOUDA. M. · 91
ELAKHDAR Mouna · 90, 153
ELALOUI Elimam · 146, 147, 148
ELALOUI Elimame · 74, 108, 143, 145
ELALOUI Elimem · 104
ELAZIBY Nader · 68
ELBARKAOUI Ayoub · 81
ELBERKAOUI Ayoube · 92
ELFIL Hamza · 39, 135, 153
ELIMAME Elaloui · 93
ELLEUCH Amal · 49
ETURKI Saifeddine · 55
EULDJI Amel · 25
EZZROUG Kaouther · 21

F

FAKHFAKH Fatma · 156
FAKHFAKH Nadim · 82
Faten Daly · 165
FEDDANE Souad · 94
FEHDI chemsedinne · 94
FERGANI Zineb · 46
FERHAT Djawad · 24, 25
FERRANDO-CLIMENT Laura · 61
FERSI Chaima · 89
FERTIKH.N. · 130
FEZAI Mariem · 90
FIGOLI Alberto · 115
FILALI Djihene · 99
FIOL Nuria · 99
FOUDHIL Walid · 53
FRIKHA Nader · 56, 57, 69, 92
FRIOUI Salah · 39

G

GABSI Slimane · 56, 57, 69, 92
GAMOUDI Safa · 159
GARBAYA Hela · 93
Garrouri S. · 140
GARUDACHARI Bhadrachari · 36
GASSEMI Belhassen · 30
GHABRI Chafik · 142
GHANMI. H. · 120
GHAZOUANI Sabrine · 118
GHEBGHOUB Fatima · 16, 44
GHERBI Naima · 99, 101
GHEZAIEL Abir · 134
GHEZZAR Mouffok Radouane · 33
GHODBANI Zahwa · 159
GOUASMI Meriem · 100
GRAMI Emna · 30, 41
GRINE Sahar · 121
GRITLI Imene · 58
GUECHI El-Khamssa · 122, 123
GUESMI Fatma · 128, 130, 131, 132
GUESMI FATMA · 138
GUESMIA Hadjer · 87
GUESMIYoussef · 71

H

HAB Hamada · 23
HABACHE Naima · 120
HABBACHI Wafa · 84
HABBECHE amina · 84
HABBECHE Amina · 19
HABBECHE amira · 84
HABOUBI Ibtissem · 41
HADDAD Zakaria · 45, 52
HADDAR Nader · 95
HADDOUK Amani · 149
HADJAR Hafida · 101
HADOUN Hocine · 32
HAFIANE Amor · 58, 71
HAJJAJI Feryel · 55
HAJJAJI. A. · 119
HAMDAOUI Oualid · 123
HAMDI. C. · 91
HAMED Younes · 106
HAMIDI F · 40
HAMMAD Nabila · 111
HAMMAMI Asma · 137
HAMMAR Yahia · 59
HAMMEMI Rania · 153
HAMMOU Kayra · 33
HAMMOUDI Hadda Aya · 24
HAMMOUDI, Hadda Aya · 117
HAMROUNI Bechir · 90

HAMROUNI Béchir · 75, 76, 108, 115, 126, 127, 128, 130, 131, 132, 133, 137, 138
HAMROUNI Najia · 34
HAMROUNI. B. · 129
HAMZA Wiem · 47, 82
HAMZAOUI-AZZAZA Fadoua · 106
HANNACHI Chiraz · 90, 115, 126, 128, 130, 131, 132, 133, 138
HAOU Sana · 122, 123
HASSOUN NEDJAR Nizar · 109
HATTAB Zhour · 87
HBAIEB. S. · 105, 107
HDHIRI Rihab · 158
HECINI Mouna · 35
HEDHIRI Riha · 41
HEDHIRI Rihab · 30
HENTABLI Mohamed · 25
HERAN Marc · 38, 152
HIDOURI Ammar · 121
HIDOURI Naima · 106, 112
HIHN Jean-Yves · 34, 83
HOUARI Mohamed · 21
HOUTI Iman · 26
Houyem Hamdi · 165
Hussein A.H. Said-Al Ahl · 161

I

IBIDHI Maiem · 114
IBRAHIM Mohamed · 42
ILLOULI Thileli · 125

J

JADLAOUI Chiraz · 142
JADLAOUI Chiraz · 148
JAOUAD Yasamine · 100
JAOUANI Atef · 60
JDIDI Marwa · 64, 65
JEBALI Raouf · 75, 76
JEBRI Sihem · 77
JELLOULI ENNIGROU Dorra · 118
JIBU P. Thomas · 36
JOMAA Sarra · 73
JRABAA Abderraouf · 93

K

KACI Mohamed Mehdi · 43
KAHRI Hamza · 88
KAIROUANI Lakdar · 102, 154
KAIROUANI. L. · 91
KALBOUSSI Nesrine · 153
KALLEL Fatma · 95
KAMOUN Nesrine · 39
KANE Abdoulaye · 143
KECHAYE mohamed · 87
KERCHICH Yacine · 35
KESHK Sherif M.A.S · 58
KHAOUA Oussama · 85
KHENISSA. MI · 111
KHERFANE Wahida · 59
KHETTALA Amel · 16, 44
KHIARI Kaouther · 131
KHIARI Ramzi · 110
KHOUATMIA Mohamed · 155
KOLSI Fayçal · 60
KOUAIED Amal · 54
KOUASS. S. · 72
KOURDALI Sidali · 20, 21

L

LABIDI Jalel · 72
LACHGUER Chaymae · 81, 92
LAIB Nouri[1] · 162
LAIDI Maamar · 25
LAKHDARI. A. E · 82
LAKHDARI. R. · 82
LAMALI Aicha · 66, 67
LAOUINIB Faten · 87
LARBI .L. · 130
LARCHET Christian · 96, 108, 146, 147
LASGAA Ibrahim · 42
LEBID Mahmoud[1] · 162
LECHEB Fatma · 125
LECHEB. F. · 124
LECLERC Jean pierre · 100
LESAGE Goeffroy · 152
LETTREUCH Hichem · 28
LOUADJ Amel · 20, 21
LOUHAB.k. · 125
LOUICHAOUI Tassadit · 16, 44

M

MAALAOUI IMEN · 131
MABROUK Walid · 58
MADIOULI Jamel · 121
MADJI Sérine · 18
MAGNACCA. G. · 129
MAHJOUBI Najah · 74
MAHMOUD Hayet · 108, 141
MAHMOUDI Amal · 133
MAKHALDI Youssouf Islam[a] · 163
MANDI Laila · 100
Manel Haraketi · 165

MANSERI Amar · 35
MANSOUR Ahmad · 36
MARI SOUCASE. B. · 119
MARZOUK TRIFI Ikhlass · 108, 126, 127, 136
MARZOUKI Riadh · 58
MASMOUDI Ahmed Slaheddine · 77
MASTRODONATO Luigi · 61
MECHMECHE Hana · 89
MECHRAOUI Nessrine · 23
MEDJDOUB Fatma · 125
MEGRICHE Adel · 98
MEHDAOUI. A. · 119
MEHENI mokthar · 87
MEHERZI Radhouan · 51
MEHERZI Radhouane · 48, 49
MEJRI Amal · 160
MEKATEL Elhadj · 18
MEKIBESS Zohra · 63
MELLITI Emna · 39, 135
MENASRI Rabah · 46, 137
MENASRI Yahia · 137
MERIBAI Nadjib · 35
MERZOUGUI Abdelkrim · 122
MESSAOUD Olfa · 137
MILADI Rihab · 69
MIRALLES-CUEVAS Sara · 160
MLAOUAH Marwa · 144, 145
MNIF Amine · 108
MOEZ Youssef · 51
MOHAMMEDI Ourida · 26
MOKHATI Asma · 43
MOUAS Amina · 55
MOUEDHEN Ghada · 144
MOUHOUCHE Hanane · 125
MOULAI-MOSTEFA Nadji · 124
MOUSSACEB Karim · 62
MOUSSAOUI Zouhour · 106, 112
MRAD Dounia · 109
MSAADI Radhia · 151
MZIR. T. · 116
MZOUGHI Nadia · 16, 118

N

Nadia Nasraoui · 165
NAFADY Ayman · 34
NAHDI. A. · 72
NAHOUI Azzedine · 45, 52
NAÏLI Houcine · 47
NAJAR Hanene · 87
NAKBI Amel · 86
NCIB Sana · 104, 108, 141, 142, 148
NECIBI Mouna · 16
NEDJIMI Mohammed Said · 33
NEGGACHE. L. · 124
NEMCHI.Fadéla · 28
NIBOU Djamel · 24, 25
NIBOU, Djamel · 117

O

ODOUNGA LENDOYE Darcy · 49
OTHMEN Kemla · 104, 108
OUALI Kaouthar · 82
OUALI Kouthar · 47
OUAMANE. A. T · 82
OUAZZANI Naaila · 100
OUCIF Omar · 45
OUESLATI Adel · 98
OUESSAR Mohamed · 55
OUKEBDANE Khalil · 94
OULED LTAEIF Olfa · 47
OUNIFI Ibtissem · 71
OUNIS Fatma · 39
OUNNAR Yasmine · 137

P

PAŞAOGLU Mehmet Emin · 157
PINTO Luiz. A. A · 86
PISTRE Severin · 54

R

RABIE Renad · 32
RAHAL Soufiane · 103, 124
RAHALI Nadia · 63, 114
RAHMANI Ahmed · 44
RAISSI Sahar · 114
RAJESHA KUMAR Alambi · 36
RAMDANI Rayene Sirine · 94
REBBADJ Sifeddine · 99
RUSSO Francesca · 115
RZIG Boutheina · 150

S

SAADI Adel · 100
SABBA Nassila · 66, 67
SAHLI Haythem · 153
SAHNOUNE Rachid · 62
SAIDI Mouldi · 77
SAIDI Neila · 30, 31, 41
SAIGHI Nabila · 35
SAKLY Abdellatif · 86
SALAH Zouhair · 50
SALHI Noussaiba · 30, 31

SÁNCHEZ PÉREZ José Antonio · 160
SAOUDI Fethi · 122
SARDI Amina · 64, 65
SARI MOHAMMED H · 40
SASSI Wafa · 34, 83, 151
SEBATI Farouk · 24, 25
Sediki E. · 140
SEFROU Zineb · 94
SEKIOU Omar · 59
SELADJI M · 40
SELLAM Randa · 70
SELLAMI Ahlem · 154
SERREAU Catherine · 89
SESSI Marwa · 29
SGHAIER Jalila · 134
SHARIF Abubaker · 68
SHENQIR Iman · 68
SLEIMI Noomene · 106
SMAILI. S. · 124
SORIANO-MOLINA Paula · 160
Souai S. · 140
SOUISSI Radhia · 89

T

TAB. A. · 116
TABASSI Dorra · 138
TABLAOUI Meftah · 35
TALHA Abir · 62
TATAR mohamed amine · 94
TERKHI Mohammed Cherif · 33
TERKHI Sabria · 33
TERMOUL Mourad · 78
TLILI Salah · 33
TOUATI. F. · 72
TOUAYLIA Samir · 31
Trabelsi S. · 140
TRABELSI Darine · 68
TRABELSI Ismail · 110, 149
TRIFI. B. · 72
TRIKI Zakaria · 46, 137

U

UGURLU KARAAĞAÇ Sakine · 97, 113

V

VAN DER BRUGGEN Bart · 118, 135
VIONE Davide · 61
VULLIET Emmanuelle · 89

W

Wafaa M. Hikal · 161
WAHAB Mohamed Ali · 149
WALHA Sandra · 47
WANNASSI Jacem · 88
WERFELLI Naima · 87
Wided Bellazreg · 165

Y

YAHYAOUI Amel · 79
YASIN Vian · 61
YEDDOU-MEZENNER Nacera · 43
YOUNES Hamed · 112
YOUNES Mohamed Kadri · 114
YOUSEF Moez · 49
YOUSSEF Moez · 48

Z

ZAALOUNI Yathreb · 139
ZABAT Nacéra · 22
ZABAT Nacéra · 19
ZAIRI Youcef[a], HARTANI Tariq[b] · 163
ZAMMEL Nourhene · 47
ZANETI Djelloul · 42
ZAOUAK Amira · 155
ZAVISKA Francois · 38
ZEGHIOUD Hicham · 143
ZENDAH Houda · 136
ZERMANE Faiza · 70
ZILI-GHEDIRA Leila · 63, 114
ZITOUNI Imène · 19
ZOUAOUI Ahlem · 63, 114