

## Book of the 1<sup>st</sup> National Conference on Sustainable Resources **Waste**, **Water** and **Energy**

كتاب المؤتمر الوطني الأول للموارد المستدامة  
النفايات، المياه، الطاقة



# SRWWE 2023

**December 13-14 (ENSL) Laghouat, Algeria**



[www.srwwe.com](http://www.srwwe.com)



[conf-001@ens-lagh.dz](mailto:conf-001@ens-lagh.dz)



[www.facebook.com/SRWWE/](https://www.facebook.com/SRWWE/)





**Ministry of Higher Education and Scientific Research  
Higher School of Professors, Laghouat**



**Book of the 1st National Conference on Sustainable  
Resources **Waste**, **Water** and **Energy****  
**كتاب المؤتمر الوطني الأول للموارد المستدامة  
النفايات، المياه، الطاقة**

**SRWWE**

**First National Conference on Sustainable Resources:  
**Waste**, **Water**, and **Energy**  
(SRWWE 2023)**

**Organized by  
The Higher College of Teachers (ENSL), Laghouat, Algeria**

**Date:  
December **13-14**, 2023**

**Location:  
The Higher College of Teachers (ENSL), Laghouat, Algeria**

**Website: [www.conferences.ens-lagh.dz](http://www.conferences.ens-lagh.dz)  
Contact Email: [conf-001@ens-lagh.dz](mailto:conf-001@ens-lagh.dz)**

**Hosted with the support of leading academicians, industry  
professionals, and environmental experts.**

**publisher:**





**Ministry of Higher Education and Scientific Research**  
**Higher School of Professors, Laghouat**



**Supervision:**

**Dr.BABAGHAYOU Meriam Imane**



**Ministry of Higher Education and Scientific Research**  
**Higher School of Professors, Laghouat**



# **ORGANIZING COMMITTEES FOR SRWWE 2023**

## **PRESIDENT**

**Dr.** BABAGHAYOU Meriam Imane ..... ENS-Laghouat

## **HONORARY PRESIDENT**

**Pr.** BOUZIANI Khaled ..... ENS-Laghouat

## **SPEAKERS**

**Mr.** MEDJAOUI Djawed ..... SENIA Electrique

**Mrs.** KHACHBA Rafika ..... Department Manager ONA

**Pr.** LOUHAB Abdelkrim ..... ALJEST

**Pr.** LOUNICI Hakim ..... ENP,Alger

**Pr.** FERHAT Mahmoud..... U. Laghouat

## **SCIENTIFIC COMMITTEE**

### **PRESIDENT**

**Dr.** BABAGHAYOU Meriam Imane ..... ENS-Laghouat

## **ORGANIZATION COMMITTEE**

### **PRESIDENT**

**Dr.** BATANA Fatima Zahra .....U. Laghouat

## SCIENTIFIC COMMITTEE MEMBERS

<b>Pr.</b> BAYOU Samir .....	U. Oued Souf
<b>Pr.</b> BENALIA Mokhtar .....	U. Laghouat
<b>Pr.</b> BENCHATTI Ahmed .....	U. Laghouat
<b>Pr.</b> BENSACIA Nabila .....	U. Blida
<b>Pr.</b> CHABIRA Salem Fouad .....	U. Laghouat
<b>Pr.</b> CHEKNANE Ali .....	U. Laghouat
<b>Pr.</b> DJEDID Mabrouk.....	U. Laghouat
<b>Pr.</b> FERHAT Mahmoud.....	U. Laghouat
<b>Pr.</b> FERROUKHI Ouassila.....	USTHBA Alger
<b>Pr.</b> HAMDİ Ahmed .....	U. Laghouat
<b>Pr.</b> HEBBOUL Zoulikha .....	U. Laghouat
<b>Pr.</b> KAOUKA Alaeddine .....	ENS-Laghouat
<b>Pr.</b> LOUHAB Karim.....	U. Boumerdes
<b>Dr.</b> LOUNICI Hakim .....	ENP.Alger
<b>Pr.</b> OUCI Houari Boumediene .....	U. Saida
<b>Pr.</b> SAIDAT Boubakeur .....	U. Laghouat
<b>Pr.</b> TAOUTI Med Benabdallah .....	U. Laghouat
<b>Pr.</b> YOUSFI Mohamed .....	U. Laghouat
<b>Pr.</b> ZOUKEL Abdelhalim .....	PTAPC-Laghouat
<b>Dr.</b> ABBASSI Mouna Souad .....	ENS-Laghouat
<b>Dr.</b> BABA AMER Zohra .....	U. Gharda'fa
<b>Dr.</b> BABAGHAYOU Fatiha .....	ENS-Laghouat
<b>Dr.</b> BATANA Fatima Zohra .....	U. Laghouat
<b>Dr.</b> BENCHATTI Toufik .....	ENS-Laghouat
<b>Dr.</b> BENGUECHOUA Mebarka Imane .....	ENS-Laghouat
<b>Dr.</b> BENNACEUR Farouk .....	UPM. Laghouat
<b>Dr.</b> BELAID Salim .....	U. Laghouat
<b>Dr.</b> BRIKI Khaled .....	ENS-Laghouat
<b>Dr.</b> DAOUD Mounir .....	ENS-Laghouat
<b>Dr.</b> HELLAL Djamila .....	ENS-Laghouat
<b>Dr.</b> DJAILI Salim .....	ENS-Laghouat
<b>Dr.</b> MAATI Ahmed .....	U. Laghouat
<b>Dr.</b> MAHFOUDI Reguia .....	ENS-Laghouat
<b>Dr.</b> YAGOUBI Wassima .....	ENS-Laghouat
<b>Dr.</b> ZAABAL Moufida .....	ENS-Laghouat
<b>Dr.</b> SOUILEH Rachid .....	ENS-Laghouat
<b>Dr.</b> AGAGNA Belkacem .....	ENS-Laghouat
<b>Dr.</b> BOURAS Hadj Daoud .....	U.Ghardaia
<b>Dr.</b> BENSAFEDDINE Djallal Elddine .....	ENS-Laghouat
<b>Dr.</b> REGUE Hanane.....	U. Laghouat

## ORGANIZATION COMMITTEE MEMBERS

<b>Mr.</b> BELKORICHI Med Lamine.....	ENS-Laghouat
<b>Dr.</b> BOUAFIA Mourad .....	ENS-Laghouat
<b>Mrs.</b> BOUDERBALA Halima.....	ENS-Laghouat
<b>Dr.</b> BOUMAAZA Benharzallah .....	ENS-Laghouat
<b>Dr.</b> BRIKI Khaled.....	ENS-Laghouat
<b>Dr.</b> DAHMANE Sofiane.....	ENS-Laghouat
<b>Dr.</b> DRAOUI Ahmed.....	ENS-Laghouat
<b>Mr.</b> HACHANI Aissa.....	ENS-Laghouat
<b>Dr.</b> DJOKHDEM Khaled .....	ENS-Laghouat
<b>Dr.</b> MAABED Said.....	U. Laghouat
<b>Mr.</b> MESSAOUDI Abdeljalil.....	ENS-Laghouat
<b>Dr.</b> NEBAIR Houcine.....	ENS-Laghouat
<b>Dr.</b> SOLTANI Amel .....	ENS-Laghouat
<b>Dr.</b> SEHAIRI Kamel.....	ENS-Laghouat
<b>Mrs.</b> TAIBI Hanane .....	ENS-Laghouat
<b>Mrs.</b> GUENFOUD Fatima.....	ENS-Laghouat
<b>Mr.</b> ZAOUI Mustapha.....	ENS-Laghouat
<b>Dr.</b> BENSAFIEDDINE Djallal Eddine.....	ENS-Laghouat
<b>Mr.</b> TARBAG Laadjal.....	ENS-Laghouat
<b>PhD.</b> students.....	U. Laghouat & ENS-Laghouat

# Welcome and Context

**Welcome to the First National Conference on Sustainable Resources: Waste, Water, and Energy (SRWWE 2023), an event hosted by The Higher College of Teachers (ENSL) in Laghouat, Algeria. In an era where the effects of climate change and resource depletion are more pronounced than ever, SRWWE 2023 represents a pivotal moment in the journey toward sustainable development. This conference is a call to action for leaders, scholars, researchers, and industry professionals to come together, share their expertise, and contribute solutions to some of the most pressing challenges facing our world today.**

**The Purpose of SRWWE 2023: This conference is not just a meeting; it is a forum for progress. It is designed to encourage dialogue that transcends academic and professional boundaries, fostering an environment where innovative ideas can flourish. By uniting a diverse group of thinkers and doers, SRWWE 2023 aims to bridge the gap between research and real-world application, ensuring that cutting-edge knowledge is translated into meaningful action.**

**A Platform for Change: At SRWWE 2023, participants will experience a program filled with keynote speeches, oral presentations, poster sessions, and panel discussions that cover a broad range of topics related to sustainable resource management. Attendees will have the opportunity to network with some of the brightest minds in the field, creating new partnerships and collaborations that will extend beyond the conference.**

**The setting of Laghouat, known for its blend of historical and modern influences, provides an inspiring backdrop for the discussions that will take place. This region exemplifies the balance between preserving cultural heritage and embracing new technologies—values that align perfectly with the themes of SRWWE 2023.**

# Themes and Objectives

## Central Themes of SRWWE 2023:

**Waste Assessment and Valorization:** This theme focuses on the potential to transform waste into resources. Discussions will cover the latest techniques in waste management, from recycling and composting to waste-to-energy technologies. The goal is to shift the paradigm from a linear economy to a circular one, where materials are continuously repurposed to minimize environmental impact. Case studies from around the world and innovative solutions from local initiatives will be presented, demonstrating how waste can be a starting point for sustainable development.

**Water Treatment:** Water scarcity and pollution pose significant threats to global stability. This theme emphasizes cutting-edge water treatment technologies, sustainable water management strategies, and policies that ensure equitable access to clean water. Attendees will explore approaches ranging from advanced filtration systems to community-based water conservation projects. Discussions will include challenges such as the treatment of industrial wastewater and the use of natural filtration methods to enhance water quality.

**Renewable Energies and Energy Efficiency:** The transition to renewable energy is not just desirable; it is essential for mitigating climate change. This theme will showcase the latest research and practical applications in solar, wind, hydro, and biomass energy. Participants will also delve into strategies for improving energy efficiency in residential, commercial, and industrial settings. Experts will share insights on how energy policies can drive sustainable practices and foster innovation that leads to energy independence and reduced carbon footprints.

**Environment and Material Degradation:** Understanding how materials degrade in the environment and developing strategies to mitigate these effects is crucial for long-term sustainability. This theme will cover the environmental impact of various materials, the role of innovative and biodegradable alternatives, and how policies can promote the use of sustainable materials. Research on reducing the impact of construction materials and industrial waste will be a highlight, providing a pathway for greener infrastructure development.

## Objectives of the Conference:

**Knowledge Sharing:** Create a platform for the dissemination of groundbreaking research and best practices in sustainability.



**Fostering Collaboration:** Bring together experts from various fields to form partnerships that extend beyond the conference.

**Policy Influence:** Generate insights that can inform and shape policies aimed at environmental conservation and resource efficiency.

**Practical Solutions:** Inspire actionable ideas that can be implemented by communities, businesses, and governments.

**Why Participation Matters:** Participation in SRWWE 2023 goes beyond attending a conference; it is an opportunity to be part of a transformative movement. By contributing to discussions, presenting research, and engaging with peers, participants play an active role in building a sustainable future. This event is a collective effort where each voice contributes to a broader dialogue about the planet's well-being and the steps needed to secure it for future generations.

# **The Importance of Participation and Acknowledgments**

**Why Participation Matters:** Participation in SRWWE 2023 goes beyond attending a conference; it is an opportunity to be part of a transformative movement. By contributing to discussions, presenting research, and engaging with peers, participants play an active role in building a sustainable future. This event is a collective effort where each voice contributes to a broader dialogue about the planet's well-being and the steps needed to secure it for future generations.

## **Opportunities for Attendees:**

**Networking:** Build valuable connections with other professionals, researchers, and industry leaders.

**Exposure to Cutting-Edge Research:** Access presentations and discussions that reveal the latest advancements in sustainable technologies and practices.

**Collaborative Environment:** Engage in workshops and panels that encourage collaboration and idea-sharing.

**Acknowledgments:** The success of SRWWE 2023 is attributed to the hard work and dedication of many. The organizing committee, led by Dr. BATANA Fatima Zahra, and the scientific committee, chaired by Dr. BABAGHAYOU Meriam Imane, have played pivotal roles in ensuring that the conference meets the highest standards of academic and professional excellence. Special thanks go to our keynote speakers, panelists, and contributors who bring their expertise and insights to the event.

**A Note of Gratitude:** We are deeply grateful to our sponsors and partners whose generous support has made SRWWE 2023 possible. Their commitment to fostering sustainability and environmental stewardship is invaluable. We also extend our appreciation to the participants for their contributions, engagement, and shared passion for building a more sustainable world.

**“The path to sustainability is one we walk together, guided by knowledge, collaboration, and a shared commitment to the future.”**

Let this conference be a reminder of the power of collective action and the potential that lies in every discussion, idea, and partnership formed at SRWWE 2023.

# TOPICS OF SRWWE 2023

## Waste Assessment and Valorization

---

This topic explores innovative approaches to assess, manage, and transform waste into valuable resources. Presentations under this theme include:

- Industrial waste assessment and characterization.
- Strategies for composting and reusing organic waste.
- Developing eco-friendly methods for recycling and repurposing materials.

## Water Treatment

---

The focus on water treatment addresses modern solutions for purifying and conserving water. Key discussions include:

- Advanced techniques for treating wastewater and industrial effluents.
- The use of natural and modified adsorbents for pollutant removal.
- Sustainable water management practices and the prevention of water contamination.

## Renewable Energies and Energy Efficiency

---

This theme emphasizes the development and optimization of renewable energy sources and practices to enhance energy efficiency. Notable topics include:

- Solar and wind energy technologies and their applications.
- Innovations in photovoltaic systems and energy storage solutions.
- Improving energy efficiency in domestic and industrial settings.

## Environment and Material Degradation

---

Examining the impact of environmental and material degradation, this theme includes:

- Analysis of corrosion inhibitors and sustainable material development.
- Eco-friendly solutions for reducing material degradation in construction.
- Strategies to mitigate the negative environmental impact of industrial by-products.

# COMPLETE INDEX OF SRWWE 2023 RESEARCH

## TOPICS AND PARTICIPANTS

### Waste Assessment and Valorization

Research Title	Participant Name	Participation Mode & type	p
Propriétés mécaniques et absorption d'eau de Mortier autoplaçant avec de la poudre de verre recyclé et de la brique calcinée	KSIR Kamilia	In-Person\Poster	16
Caractérisation environnementale des métaux lourds issus des rejets phosphatiers de Djbel Onek, Tébessa - Algérie	YAHIAOUI Younes	In-Person\Poster	17
Numerical modeling of the behavior of sandwich panels based on E-glass fibers waste core under flexural loading	MEDDOUR Mohamed	In-Person\Poster	18
Sewage sludge industrial waste assessment characterization and valorization	REZIG Walid	In-Person\Poster	19
La Gestion Intégrée et la Valorisation des Déchets en Algérie	CHICHOUNE Malika	In-Person\Oral	20
FILTRATION OF PURIFIED WASTE WATER FOR IRRIGATION	OULHACI Dalila	In-Person\Oral	21
STUDY AND CHARACTERIZATION OF THE HOUSEHOLD WASTE OF THE CITY OF MOSTAGANEM (the WEST ALGERIA)	GUERMOUD Nouredine	In-Person\Oral	22
Predicting Treated Wastewater Quality at Illizi WWTP Using Machine Learning and Remote Sensing	KOUADRI Saber	Virtual\Poster	23
A plant extract as an eco-friendly corrosion inhibitor for zinc	KSIR Kamilia	Virtual\Poster	25
Valorisation des déchets agricoles par procédé d'extraction de la silice	KHELLIF Meriem	Virtual\Poster	26
VALORIZATION AND RECYCLING OF DATE PALM WASTE	KADDOURI Nawal	Virtual\Poster	27
The use of plant waste as a source of pickling inhibitors	TOUATI Lamis	Virtual\Poster	28
Calcium phosphate Biomaterials from Agricultural Waste: bovine bone -based Hydroxyapatite	BOUYEGH Saida	Virtual\Poster	29
Enhancing Cement Brick Properties Through Incorporation of Plastic Bag Strips	BABOURI Kaoutar	Virtual\Poster	30
Etude du phénomène d'adsorption d'un colorant cationique le Bleu de Méthylène (BM) sur les coquilles de noix de coco modifiées	BELAID Taous	Virtual\Poster	31
Predicting Treated Wastewater Quality at Illizi WWTP Using Machine Learning and Remote Sensing	KOUADRI Saber	Virtual\Oral	32
Assistance de quelques villages de la commune de bouzeguene (Tizi-Ouzou) pour le perfectionnement de leur schéma de gestion des déchets ménagers	METNA Fatiha	Virtual\Oral	34

Valorization of agricultural wastes from orange peels by adsorption of organic pollutants	MEZIANE Ouahiba	Virtual\Oral	35
Valorisation d'une biomasse végétale - Application à l'adsorption des colorants	FEDDAL Imen	Virtual\Oral	36
Propriétés mécaniques et absorption d'eau de Mortier autoplacant avec de la poudre de verre recyclé et de la brique calcinée	BOULEGHBAR Yasmina	Virtual\Oral	37
Synthesis & characterization of high surface area mesoporous activated carbon from pomegranate processing solid waste by chemical activation	BENMAHDI Fatiha	Virtual\Oral	38
<b>Water Treatment</b>			
Treatment of industrial water from the textile factory, SAFILCO Ain Djasser Batna	AOURAGH Abdellatif	In-Person\Poster	40
ETUDE DE LA QUALITE DES EAUX SOUTERRAINES DANS LA REGION DE DJELFA	GHIBECHE Ismail	In-Person\Poster	41
Study of the Thermodynamic Parameters Affecting the Removal of a Cationic Pollutant	CHEBBA Samira	In-Person\Poster	42
L'effet des conditions opératoires sur le traitement des eaux usées par micro algue	REZZAG Sara	In-Person\Poster	43
Diagnosis of the physicochemical quality of groundwater and its preservation	BEHILIL Asma	In-Person\Poster	44
Advanced Eco-friendly Method for Synthesizing Iron Nano Particles using Plant Extract for Industrial Wastewater Treatment	KHELALI Ahlem	In-Person\Oral	45
Electrochemistry study of Enhanced counterion transport through anion exchange membranes in electromembrane processes	TIMMAOUI Abdallah	In-Person\Oral	46
Kinetic & thermodynamic studies of gentian violet adsorption on natural & modified bentonite	BRICHI Nour Elhouda	In-Person\Oral	47
Valorisation of Nuclei and Bark of Ziziphus Jujuba in waste water treatment	BOUZIANE Lamya	Virtual\Poster	48
Contribution à l'amélioration de la qualité des eaux traitées de station de déshuilage Haoued Berkaoui	BOUZIANE Lamya	Virtual\Poster	49
Study of Synergistic Systems based on TOPO-Aliquat 336 for Selective Separation of Copper-Magnesium	MESROUK Samir	Virtual\Poster	50
The adsorption of a food coloring the Yellow Tartrazine	BRAHMI Nour-Elhouda	Virtual\Poster	51
Jujube stones based highly efficient activated carbon for industrial textile waste water decolorization: comparative study between two effluents	BOUCHELKIA Nasma	Virtual\Poster	52
CuO nanostructures as photocatalyst: An approach to water treatment of organic pollutants	BACHA Oussama	Virtual\Poster	53
Synthesis & characterization of multilayer ceramic membranes for wastewater treatment	BOULEKRINAT Amina ABID Ghania	Virtual\Poster	54
EVALUATION OF GROUNDWATER QUALITY FOR IRRIGATION WATER PURPOSES IN THE INSALAH REGION	KADRI Abdelaziz	Virtual\Poster	55
Biosorption performance of pomegranate peel wastes for toxic lead ions removal	ADDALA Abdelhamid	Virtual\Poster	56

Study of methylene blue adsorption process on Algerian soil by column method	ABID Ghania	Virtual\ Poste	57
VALORISATION OF BIOMATERIAL FOR REMOVAL OF CATIONIC DYES FROM WASTEWATER	DRA Rafik El Arslene	Virtual\ Poste	58
Optimisation de la coagulation/floculation de l'aluminium pour l'élimination de la DCO et de la turbidité des eaux usées dans la province de Biskra	BENAKCHA Mansoura	Virtual\ Poste	59
Caractérisation et adsorption de l'Acid Blue 40 par Charbons actifs en poudre préparés à partir de Ficus Carica	BAASSOU Zohra	Virtual\ Poste	60
Epuration des eaux usées par filtration sur sable (cas des bains maures à Adrar ville)	YAKOUBI Mimouna	Virtual\ Poster	61
ELIMINATION OF MALACHITE GREEN BY ADSORPTION OF AGRICULTURAL BY-PRODUCTS (ROSMARINUS OFFICINALIS)	BADIS Dalila	Virtual\ Poster	62
Removal of Methyl Violet 2B Dye from Water Using Modified Carob Fruit	MEKIDICHE Bouchra	Virtual\ Oral	63
Dégradation photocatalytique du bleu de méthylène à l'aide de CuO en couches minces	MEGLALI Omar	Virtual\ Oral	64
Imidazolium-Based Ionic Liquid for Ethyl acetate Separation from Water	RABHI Fadhila	Virtual\ Oral	65
Heterogeneous Photocatalytic Degradation under UV Irradiation of pharmaceutical pollutant	AOUDJIT Farid	Virtual\ Oral	66
STRATEGIES ET TECHNIQUES DE DEVELOPPEMENT DURABLE DES RESSOURCES EN EAU EN ALGERIE PAR LE TRAITEMENT ET LE RECYCLAGE DES EAUX USEES	BOUNAADJA Zoulikha	Virtual\ Oral	67
Etude de l'adsorption du Vert acide 20 par le charbon actif commercial	KOLLI Mounira	Virtual\ Oral	68
Détection des résidus du ciprofloxacine dans les eaux usées	SAIM Souhila	Virtual\ Oral	69
Analyzing the physico-chemical properties of wastewater from the Bordj Bou Arreridj wastewater treatment facility	BOURAHLA Amel	Virtual\ Oral	70
PROTECTING WATER & THE ENVIRONMENT BY TREATING WATER FROM THE TEXTILE INDUSTRY - TLEMCEN (WESTERN ALGERIA)	ABDELMOUMENE Hanane	Virtual\ Oral	71
<b>Renewable Energies and Energy Efficiency</b>			
Topologies of single phase photovoltaic inverters	CHEMSEDDINE Aicha	In-Person\ Poster	73
Faculté de Technologie,Mémoire fin d'étude Conception d'une centrale photovoltaïque pour recharge de voitures	GHOZLAN Ikram Manal	In-Person\ Poster	74
Appropriate Diminution of the Magnetic Field Intensity Produces from the High Voltage Three Phase Overhead Transmission Lines	HOUICHER Salah	In-Person\ Poster	75
Advancing Sustainability: The Synergy of Renewable Energies and Energy Efficiency	HELIFA Fatima Zohra	In-Person\ Poster	76
theoretical study on the different HTM & ETM layers' effect on the solar cell efficiency using SCAPS-1D Theoretical study on the different HTM & ETM layers' effect on the solar cell efficiency using SCAPS-1D	BEGAGRA Anfal	In-Person\ Poster	86

A theoretical study on potassium germanium tri-chloride for perovskite solar cells A theoretical study on potassium germanium tri-chloride for perovskite solar cells	SARHANI Mohammed El Said	In-Person\Poster	87
Efficiencies evaluation of various advanced meta-heuristic optimization techniques for the optimal configuration of distribution systems in the presence of PV and wind turbine hybrid systems	TERBAH Hocine	In-Person\Poster	88
Synthèse par électrodéposition du film ZnS utilisé comme couche tampon dans la cellule solaire à base de CIGSe	BENCHERIF Amria	In-Person\Poster	89
Numerical Analysis of the Efficacy of Turbulence Models in Predicting Aerodynamic Performance of Asymmetric	BOUKARAOUN Racha	In-Person\Poster	90
Impact of ceramic tungsten oxide and diazonium salts chemistry on a polypyrrole-based ternary composite material's enhanced thermoelectric features	NEDJAR Linda	In-Person\Poster	91
ETUDE EXPERIMENTALE DES PERFORMANCES ENERGETIQUES D'UN SYSTEME SOLAIRE THERMIQUE DE PRODUCTION D'EAU CHAUDE A USAGE SANITAIRE	BOUGUERGOUR Yassine	In-Person\Oral	93
Les propriétés structurales, optiques et électrochimiques des couches minces électrochimiques d'oxyde de cuivre	BENSENOUCI Halima	In-Person\Oral	94
Experimental study of horizontal & inclined solar radiation through empirical models applied in Photovoltaic power plants center Ghardaïa state	BOURAMDANE Abderraouf	In-Person\Oral	95
Electrochemical and optical investigations on Ag doped CdS thin films for solar cell application	MADKOUR Abia Kamilia	In-Person\Oral	96
EVAPORATION ESTIMATION FOR THE BREZINA RESERVOIR DAM- AL BAYADH A NOVEL MODEL INTEGRATING HAMON AND SCHENDEL APPROACHES	MEZIANI Assia	In-Person\Oral	97
Enhancing ZnX (X = O, Te, S) Compound Properties via LDA Approach and CASTP Program: Computational Investigation of Structural, Elastic, and Mechanical Aspects	BENLAKHDAR Faiza	In-Person\Oral	98
Study the impact of bulk traps on an IZTO/Ga2O3/ITO solar-blind photodetector	CHERROUN Rima	In-Person\Oral	99
Supplying electricity from a hybrid PV/wind turbine system to an isolated house	Ait Amrane Ouardia	Virtual\Poster	100
First-principles Calculations of Optical Properties of Bi2S3	KACEMI Nourelhouda	Virtual\Poster	101
Geochemistry evaluation of phosphorite deposits in Ain Dibba and Ain Kissa	DIAB Ibtissem	Virtual\Poster	102
ETUDE DES PARAMETRES ET PERFORMANCES D'UN DISTILLATEUR SOLAIRE SYMETRIQUE	DELIOU Adel	Virtual\Poster	103
Comparison between absorber materials CH3NH3GeI3 and CsSnGeI3 in nip perovskite solar cell	ABDALLAOUI Doua	Virtual\Poster	104
Investigation of Lead-Free FASnI3-Based Perovskite Solar Cell Performance Using phenyl-C61-butyric acid methyl ester (PC61BM) as an Electron Transport Layer	BELARBI Mossaab	Virtual\Poster	105



<b>Study of morphological, semi conducting &amp; electrochemical characteristics of the brownmillerite <math>\text{Ca}_2\text{Fe}_2\text{O}_5</math> , used as photocatalyst for hydrogen production</b>	<b>BENALLAL Sara</b>	<b>Virtual\Poster</b>	<b>106</b>
<b>Nanotechnology Boosting Solar Efficiency: A Sustainable Energy Revolution</b>	<b>ARAB Assia</b>	<b>Virtual\Poster</b>	<b>107</b>
<b>Characterisations of New Material Based on Phenyl Vinyl Acrylonitril, Used as Precursor in Solar Cells</b>	<b>MOSBAH Salima</b>	<b>Virtual\Poster</b>	<b>108</b>
<b>Evaluating the Thermal Behavior of Pitched and Flat Roofs with Natural Convection Ventilation: A Comparative Study</b>	<b>DJELDJELI Tarek</b>	<b>Virtual\Poster</b>	<b>109</b>
<b>Winter heating of air via an earth-air heat exchanger</b>	<b>MERDASSI Mustapha</b>	<b>Virtual\Poster</b>	<b>110</b>
<b>Deposition of thin films from copper-based <math>\text{Cu}_2\text{ZnSnS}_4</math> nanopowders</b>	<b>KESSENTINI Nour Elhouda</b>	<b>Virtual\Poster</b>	<b>111</b>
<b>Structural and Optical properties of <math>\text{CuIn}_3\text{Se}_5</math> / <math>\text{Cu}_2\text{SnSe}_3</math> thin films</b>	<b>REKKACHE Hadjer</b>	<b>Virtual\Poster</b>	<b>114</b>
<b>Effect of Annealing Temperature on Structural Properties of Spin-coated <math>\text{Ga}_2\text{O}_3</math> Thin Films</b>	<b>MESSEDEK Lobna</b>	<b>Virtual\Poster</b>	<b>115</b>
<b>Unlocking Efficient Bioethanol Production from lignocellulosic biomass through Enzymatic Hydrolysis and Yeast Fermentation</b>	<b>KERNANI Ridha</b>	<b>Virtual\Poster</b>	<b>116</b>
<b>Solar Energy Prediction in Algeria: A Supervised Machine Learning Approach</b>	<b>KOUHLANE Yacine</b>	<b>Virtual\Poster</b>	<b>117</b>
<b>Electrodeposition of environment-friendly CZTS absorbing layer for photovoltaic applications</b>	<b>MEGLALI Omar</b>	<b>Virtual\Oral</b>	<b>118</b>
<b>Experimental study of horizontal and inclined solar radiation through empirical models applied in Photovoltaic power plants center , Ghardaïa state</b>	<b>BOURAMDANE Abderraouf</b>	<b>Virtual\Oral</b>	<b>119</b>
<b>Experimental study of horizontal &amp; inclined solar radiation through empirical models applied in Photovoltaic power plants center Ghardaïa state</b>	<b>HADBI Med</b>	<b>Virtual\Oral</b>	<b>120</b>
<b>Hydrogen storage on 2D-carboneous single-layer : A DFT study</b>	<b>DJEBABLIA Ikram</b>	<b>Virtual\Oral</b>	<b>121</b>
<b>Semiconducting and electrochemical properties of the perovskite <math>\text{KNBO}_3</math>. Application to <math>\text{H}_2</math> production Under Visible Light.</b>	<b>MEKERSI Romaissa</b>	<b>Virtual\Oral</b>	<b>123</b>
<b>Superior Ferroelectric Properties Coupled with High Shift Current of Copper Sulfide <math>\text{Cu}_2\text{S}</math> for Green Energy Conversion Theoretical Study</b>	<b>CHELIL Naouel</b>	<b>Virtual\Oral</b>	<b>124</b>
<b>Eco-friendly &amp; cleaner process for isolation of essential oils</b>	<b>BENABED Meriem</b>	<b>Virtual\Oral</b>	<b>125</b>
<b>Cooling Performance Investigation of Pure Low-GWP Refrigerants as Substitutes for <math>\text{R134a}</math> (1,1,1,2-Tetrafluoroethane) in Standard Cooling System : Search for an Adequate Refrigerant</b>	<b>MAALEM Youcef</b>	<b>Virtual\Oral</b>	<b>126</b>
<b>New mechanism of electrodeposited copper &amp; its oxide onto planar aluminium electrode</b>	<b>ZAIDI Nadia</b>	<b>Virtual\Oral</b>	<b>127</b>
<b>Etude ab-initio des constantes diélectriques d'un matériau binaire à base de bismuth</b>	<b>BENATMANE Saadia</b>	<b>Virtual\Oral</b>	<b>128</b>



# Environment and Material Degradation

Preparation and characterization of a biodegradable film based on potato starch	GOUANE Khadidja	In-Person\Poster	131
Ecodatabase electronic platform (ECO_DATA)	SAROUT Nesrine	In-Person\Poster	132
Mise en évidence des mycorhizes arbusculaire chez l'armoise blanche, plante endémique des écosystèmes arides et semi-arides et leur effet sur les stress abiotiques	GUENFOUD Fatma	In-Person\Poster	133
Processus d'adsorption pour éliminer les métaux lourds de l'eau contaminée	LASMI Faouzi	In-Person\Poster	135
Physico-chemical characterization of raw clay for the elimination of phosphate by adsorption	BEHILIL Asma	In-Person\Poster	136
Metallurgical Transitions Characterization of Heat-Treated X70 Steels using Magnetic Barkhausen Noise method	NEBAIR Hocine	In-Person\Oral	138
Synthesis of Graphitic Nitride modified Maghnite Clay Catalyst for Efficient Dye Degradation via Impregnation Calcination Method	MEKIDECHE Mounir	Virtual\Poster	139
Contribution of green Deep Eutectic Solvents in organic synthesis- Asymmetric Biginelli reaction as an example of application	SACI Fatima Zohra	Virtual\Poster	140
استخدام الاستشعار عن بعد في رصد تدهور الغطاء النباتي	HADDAD Hanane	Virtual\Poster	147
CARACTERISATION PARASITOLOGIQUE DES EAUX EPUREES DE LA STATION D'EPURATION DE LA COMMUNE DE TIGZIRT	Aissaoui Dyhia	Virtual\Poster	148
Determination of optimal electrodeposition conditions of NiO thin films for environmental applications	BAKA Ouidad	Virtual\Poster	149
Valorisation et traitement chimique des fibres végétales pour préparer des matériaux composites	NOURI Laib	Virtual\Poster	150
Investigation of the impact of various chemical substances on the properties of palm fiber reinforced polyethylene composites	NOUIOUA Nour Elhouda	Virtual\Poster	151
Traitement du composé aromatique Para Xylène par encapsulation	BENAISSA Amina	Virtual\Oral	152
Apport des méthodes indexées dans l'évaluation de la qualité de la nappe de la Mitidja (Nord-Algérie)Apport des méthodes ndexées dans l'évaluation de la qualité de la nappe de la Mitidja (Nord-Algérie)	ZAMICHE Samira	Virtual\Oral	153
Groundwater contamination in agricultural areas: case of the Hennaya plain, Tlemcen	LAOUFI Abdessalam	Virtual\Oral	154
Synthesis of copper oxide/zinc oxide nanocomposites thin films and their photodegradation properties	MAHROUG Abdelhafid	Virtual\Oral	155
SYNTHESIS AND CHARACTERIZATION OF A PHOTOCATALYTIC SEMICONDUCTOR MATERIAL	KSOURI Ahlem	Virtual\Oral	156

<b>Photodegradation of Rhodamine B by nanocomposite Co-Doped BTO/ZW synthesized by molten salt method</b>	<b>OUNIS Amina</b>	<b>Virtual\Oral</b>	<b>157</b>
<b>ETUDE SUR LES REPONSES METABOLIQUES DES RATS MALES WISTAR DANS UN ENVIRONNEMENT NOCICEPTIF</b>	<b>RETEM Chahira</b>	<b>Virtual\Oral</b>	<b>158</b>
<b>Removal of Cationic Dye in Aqueous Solution by Photocatalytic Degradation Using Natural and Modified Clays by Vanadium(V) Oxide Under Sunlight Irradiation</b>	<b>MESSAOUDI Zakarya Ayoub</b>	<b>Virtual\Oral</b>	<b>159</b>

# **Waste Assessment and Valorization**

### A plant extract as an eco-friendly corrosion inhibitor for zinc

Kamilia Ksir a, b, Mina Boulkroune a, b, Lamis Touati a, b

a Research Unit in Structural Molecular and Environmental Chemistry/University of Mentouri Brothers,  
Constantine, 25000, Algeria

b Department of Chemistry/University Mentouri Brothers, Constantine, 25000, Algeria

#### Abstract

Plants are rich in natural organic substances and are considered a renewable source that can provide an alternative to synthetic organic molecules, which are widely used in various industrial sectors. Recycling plants, and especially plant waste, remains one of the solutions with considerable economic and environmental benefits.

In industry, organic molecules are used in the pickling process as corrosion inhibitors to control and reduce metal corrosion. These molecules are generally costly and harmful to the environment and human health.

In this study, we evaluated the anti-corrosive properties of a plant extract from the Moraceae family on zinc in an acidic environment using weight loss and open-circuit potential measurements.

The study showed that the evaluated extract contains active substances that reduce metal corrosion and can be considered a green inhibitor. The thermodynamic parameters and the evolution of the potential of the studied system revealed that corrosion inhibition results from the formation of a protective layer resulting from the adsorption of the active substances present in the extract onto the metal surface.

**Keywords:** Corrosion, green inhibitors, pickling inhibitors, zinc, acidic solutions.

### Caractérisation environnementale des métaux lourds issus des rejets phosphatiers de Djbel Onek, Tébessa – Algérie

YAHIAOUI Younes<sup>1, a</sup>, NETTOUR Djamel<sup>1, b</sup>, MERCHICHI Amira<sup>2, c</sup>

<sup>1</sup> L3M Laboratoire Mines Métallurgie et Matériaux, Ecole Nationale Supérieure des Mines et Métallurgie, Annaba – Algérie.

<sup>2</sup> Laboratoire de recherche de génie minier, Ecole Nationale Polytechnique, Alger – Algérie.

a younes.yahiaoui@ensmm-annaba.dz, b djamel.nettour@ensmm-annaba.dz

c amira.merchichi@g.enp.educ.dz

#### Résumé

Dans l'industrie minière, tous les procédés de séparation et d'enrichissement génèrent non seulement un concentré riche de l'espèce minérale, mais aussi une quantité importante des rejets sous forme de liquide ou de solide. Leurs stockage à l'air libre dans des parcs à résidus peuvent provoquer plusieurs impacts environnementaux.

Les métaux lourds sont les micropolluants métalliques qui peuvent contaminer l'environnement. Ces derniers constituent un problème préoccupant lorsqu'ils sont impliqués dans la pollution de l'eau et le sol, leur toxicité peut être forte dommageable pour le milieu, mais leur accumulation au fil de la chaîne alimentaire pourrait avoir des effets néfastes sur la santé humaine, la faune et la flore.

Notre travail porte sur la caractérisation des rejets phosphatiers de Djbel Onek, Tébessa – Algérie qui confirme une contamination des sols et des plantes de la région essentiellement par le Pb, Zn et Cd. L'évaluation des risques liés aux métaux lourds a montré que les phosphates bruts et leurs rejets miniers produisent des éléments traces métalliques ETM dangereux dépassant les normes pour les sols (par exemple, U, Cd, Cr, Mo, V et Tl). Par conséquent, en raison de l'exposition aux rejets miniers et de la mobilisation des particules les plus fines par le vent et les pluies, ces métaux dangereux pourraient avoir des effets néfastes sur l'environnement et la santé humaine.

**Mots Clés:** Industrie minière, Rejets miniers, Métaux lourds, Impacts environnementaux, Toxicité.

## TOPIC 01: Waste Assessment and Valorization

---

### Numerical modeling of the behavior of sandwich panels based on E-glass fibers waste core under flexural loading

MEDDOUR Mohammed<sup>1, \*</sup>, SI SALEM Abdelmadjid<sup>1&2</sup> and AIT TALEB Souad<sup>2</sup>

<sup>1</sup> Laboratory LCCA, Faculty of Technology, University of Bejaia, 06000 Bejaia, ALGERIA

<sup>2</sup> Civil engineering Department, University Mouloud Mammeri of Tizi Ouzou, 15000 Tizi Ouzou, ALGERIA

\*(mohammed.meddour@univ-bejaia.dz)

#### Abstract

Nowadays, the use of fiberglass has largely increased to become an essential composite material. The E-glass filament recognized for numerous features i.e. durable, light, waterproof, insulating... is mainly used to improve the performances of concrete and polymers. Indeed, this novel composite material was subjected in-depth research in order to better understand its recycling and recovery. In this perspective, the objective of this study is the development of an industrial process based on a demonstration scale for the recycling of fiberglass waste in the form of core materials intended for insulated sandwich panels. Therefore, a numerical modeling of the mechanical behavior of laminated sandwich structures loaded under monotonic bending was carried out using ABAQUS. The proposed script takes into account the orthotropic behavior of the constituent materials as well as the adhesion between the different components of the panel. The different obtained results in terms of comparison of stress-strain curves and damage mapping show the effectiveness of the proposed model in terms of strength and deformability prediction. Certainly, the analysis of the bending behavior of the simulated sandwich panels allowed us to optimize the design of the core for optimal recycling of the E-glass fibers.

**Keywords :** Numerical modeling, E-Fiberglass waste, Sandwich panels, Waste-based core, Mechanical behavior.

### Sewage sludge industrial waste assessment characterization and valorization

Walid Rezig 1, Mohammed Hadjel 2

1 Laboratory of Sciences, Technology and Process Engineering ; Depatment of Chemical Engineering ;  
Faculty of Chemistry ; University of Sciences and the Technology of Oran Mohamed Boudiaf USTO-MB ;  
BP 1505 El M'naouer Bir El Djir 31000 Oran ; Oran ; Algeria.

2 Laboratory of Sciences, Technology and Process Engineering ; Depatment of Physical Chemistry ;  
Faculty of Chemistry ; University of Sciences and the Technology of Oran Mohamed Boudiaf USTO-MB ;  
BP 1505 El M'naouer Bir El Djir 31000 Oran ; Oran ; Algeria.

Corresponding autor E-mail: walidrzg@gmail.com

#### Abstract

Sludge treatment is a difficult phase for the fight against pollution. The main objective of this study is to heat treat oily sludge from the oil industry at the RA1/Z refinery and then characterize this sludge by: x-ray fluorescence (XRF) to determine the mineralogical composition in percentages in the form of oxides for example (% SiO<sub>2</sub>, % CaO, % Fe<sub>2</sub>O<sub>3</sub>, % K<sub>2</sub>O, etc.). We are interested in identifying the different sectors of valorization other than the agricultural spreading with the use of material a very abundant and inexpensive natural aluminosilicate adsorbent material as a catalyst support called diatomite which is a rock formed mainly by the accumulation of diatomaceous frustules called "Kieselg  hr" in the Sig deposit of western Algeria presenting the advantage of being locally available and less expensive. The crude diatomite of Sig "DB" that will be modified by ferrihydrite "the deposit of ferrihydrite on crude diatomite DB by ferric chloride tetrahydrate FeCl<sub>2</sub>.4H<sub>2</sub>O with the different concentrations and surface modification by treatment with sodium hydroxide (NaOH) to increase the surface area specified. The resulting products are named (DMF3). The results of analyzes which are: x-ray fluorescence (XRF), X-ray diffraction (XRD), infrared spectroscopy to transform Fourier in attenuated total reflection mode (FTIR -ATR) for: Ferrihydrite-modified diatomites (DMF3) contain ferric oxides in different phases which are: ferrihydrite, maghemite, lepidocrocite, goethite, schwertmannite, ferroxhyte, akaganeite, ferroxide, and magnetite. Scanning electron microscopy (SEM) observation shows that DMF3 core particles have diameters of approximately 3-6 µm, and pinnate particles of DMF3 have lengths of approximately 4-9 µm.

**Keywords :** Sludge, agricultural spreading , diatomite, ferrihydrite.

### La Gestion Intégrée et la Valorisation des Déchets en Algérie

AUTEUR: CHICHOUNE Malika Maître assistant 'B'

Département histoire et géographie -Ecole supérieure ENS ,Leghouat .Algerie

Laboratoire de géomorphologie et géorisques USTHB-Alger.

Email: malikamiky@yahoo.fr

CO AUTEUR :TAIBI Ibrahim – Maître-assistant 'B'

Département histoire et géographie Ecole supérieure ENS ,Leghouat .Algerie

Email: b.taibi@ens-lagh.dz

#### Résumé

En Algérie, de fortes pressions sur l'environnement ont été enregistrées notamment dans le domaine de service de déchets municipaux. Cette situation se caractérise par une dégradation de plus en plus d'hygiène et de salubrité publique malgré la volonté et les grands efforts déployés par l'État. La gestion des déchets regroupe la collecte, le transport, la valorisation et l'élimination et, plus largement, toute activité participant de l'organisation de la prise en charge des déchets depuis leur production jusqu'à leur traitement final, y compris les activités de négoce ou de courtage et la supervision de l'ensemble de ces opérations. Progressivement, l'élimination des déchets à créer leur valorisation de la matière (recyclage) ou organique (compostage, méthanisation) et énergétique (incinération), qui permet de minimiser l'impact de leur abondons. Pour cela une gestion intégrée des déchets est une voie primordiale ou la valorisation est considéré comme filière productif.

**Mots clés :** déchet, Algérie, gestion intégrée, valorisation, primordiale, productif



### FILTRATION OF PURIFIED WASTE WATER FOR IRRIGATION

D. OULHACI <sup>1</sup>, M. ZAHAF <sup>2</sup>, R.K BENLARBI <sup>3</sup>

<sup>1</sup> Exploiting and valorization laboratory of natural resources in arid zones- Ouargla- Algeria

<sup>2,3</sup>University Kasdi Merbah – Ouargla- Algeria

[toulhaci.dalila@univ-ouargla.dz](mailto:toulhaci.dalila@univ-ouargla.dz)

#### Abstract

The farmer in Ouargla often finds himself facing problems in developing his irrigated land, due to the salinity of the water and the rise in the water table. On the other hand, the increase in the quantity of waste water discharged following the increase in population poses a problem of environmental pollution. The solution would therefore be to opt for an efficient irrigation technique with purified waste water. In this context, the objective of this work is to reuse water from the Ouargla wastewater treatment plant for the irrigation of neighboring areas. In view of these results, the majority of the parameters at the outlet of the station are more or less compliant with the Algerian irrigation standards indicated by the official journal, apart from the electrical conductivity which remains much higher than the standard. To overcome this drawback, we use for irrigation waste (metal boxes) cans with a volume (1) dcm<sup>3</sup> which are pierced with holes of 2 mm in diameter spaced 2 cm apart in the four directions. These cans are filled with sand of dune which will allow the filtration of the elements of pollution of the purified water for its use in the agricultural field. Analyzes taken out of the boxes show an 80% reduction in electrical conductivity. This proves that the sand retained the salts. In this context, the use of these wastes (metal boxes) as a sand filter for waste water from the treatment plant allows the safeguarding of water resources.

**Keywords:** Waste ; Metal boxes ; Water; Irrigation, Purification.

### STUDY AND CHARACTERIZATION OF THE HOUSEHOLD WASTE OF THE CITY OF MOSTAGANEM (the WEST ALGERIA)

N. Guermoud\* ; M.C .Terkhia ; N. Benderdoucheb

a Department of Process Engineering, Laboratoire des Sciences et techniques de la valorisation ( STEVA), email : mcterkhi@yahoo.fr.

b Department of Process Engineering, Laboratory of Structure, Development and Application of Molecular Materials (SEA2M), email:benderdouchen@yahoo.fr

\*Department of Process Engineering, Laboratory of Structure, Development and Application of Molecular Materials (SEA2M), University Abdelhamid Ibn Badis of Mostaganem, BP 227 Route de Bel-hacel Mostaganem, Algeria

E-mail\* : guermoud27000@yahoo.fr

Tel; 00213776158057

#### Abstract

Our study focuses on the characterisazation of municipal solid waste in the city of Mostaganem (West Alegria) and this in order to introduce one of serval recovery processes (valorisation). For this purpose, the study was made by area (sector) and season.The collect was performed by the cleaning service of the city of Mostaganem and forwarded to the place of our work. Manual and meticulous sorting is performed for waste characterization.

Analysis of physico-chemical parameters (density, fire loss, electric conductivity, the average pH, moisture level, lower calorific value, organic carbon and nitrogen) was performed on samples by applying the method of quartering. Waste generation per inhabitant and per day for the citizens of Mostaganem is 0.82 kg.inhab-1 day-1. The organic matter represents 64,6 % from the waste, paper and cardboard 15,9 %, plastic 10,5 %, glass 2,8 %, metals 1,9 %, textile 2,3 % and diverse 2 %.These figures are comparable to those of contries being development. The study according to the seasons showed that the organic matter went to 80,3 % in summer which is justified by the consumption of vegetables and fruits while the paper fall to 8,3 %.Municipal solid waste of the city of Mostaganem are rich in organic matter (loss on ignition of about 63 % of the dry mass) and nitrogen (1.5 %) and have a relatively high moisture content (the around 58,9 % of the gross weight). from these data, we showed that 31.3 % were potentially recyclable waste, and die the most appropriate valuation for waste from the city of Mostaganem is composting. This preliminary study incite the local authority to take better care of the problem of waste and its valorization.

**Keywords:** Municipal solid waste, Mostaganem, characterization, valorization

### Predicting Treated Wastewater Quality at Illizi WWTP Using Machine Learning and Remote Sensing.

Kouadri Saber<sup>1\*</sup>, Mekhloufi Nabil<sup>1</sup>, Bellatar Bilal<sup>2</sup>, Ouledzid Mohamed<sup>2</sup>

<sup>1</sup>Laboratory of Water and Environment Engineering in Sahara Milieu (GEEMS). University of Kasdi Merbah, Ouargla, 30000 Algeria.

<sup>2</sup>University of Kasdi Merbah, Ouargla, 30000 Algeria.

Corresponding author: [kouadri.saber@univ-ouargla.dz](mailto:kouadri.saber@univ-ouargla.dz)

#### Abstract

This study investigates wastewater characteristics and employs machine learning models to predict water quality at the Illizi Wastewater Treatment Plant (WWTP) in Algeria. The 38-month dataset (February 2020 to March 2023) revealed seasonal variations in parameters like chemical demanded oxygen (COD), biological demanded oxygen (BOD5), suspended materials (SM), and total nitrogen (TN), with summer and spring witnessing significant efficiency drops due to sandstorms and high light intensity. Notably, the efficiency stabilized after the November 2021 where the wastewater pumping station has been renovated. Machine learning models, including Multiple Linear Regression, Random Tree, and Random Forest, were employed with remote sensing indices (NDVI, NDTI, NDCI) from satellite imagery. While Linear Regression had limited predictive capacity, Random Tree and Random Forest models exhibited strong correlations during calibration (coefficients of determination reaching 1.0). However, their performance decreased during testing, indicating the need for a larger dataset. Finally, this study highlights the potential of machine learning and remote sensing for predicting wastewater quality at the Illizi WWTP. Seasonal efficiency variations and the importance of the pumping station's operational state were noted. While promising results were achieved during calibration, out-of-range predictions in testing emphasize the need for an expanded dataset to enhance model robustness. Further research should focus on dataset enrichment for practical implementation in wastewater treatment systems at Illizi WWTP.

**Keywords:** Wastewater; Machine Learning; Illizi WWTP; Remote Sensing; Modeling.

### References:

- [1] Eibe Frank (2014). Fully supervised training of Gaussian radial basis function networks in
- [2] WEKA. Département of Computer Science, Université of Waikato.
- [3] FNDAE, 2005. Dysfonctionnement biologique des stations d'épuration : origines et solutions.
- [4] F.Bonn and G.Rochon. 'Précise de télédétection : principe et méthode'. Presses de l'Université du Québec 2875, 1996.
- [5] KOUADRI, SABER. Etude hydro-chimique et modélisation de la qualité des eaux souterraines (Cas de la Wilaya d'ILLIZI). Diss. Université KASDI-MERBAH Ouargla, 2022. (Chapitre 4), page (40-54-55-56)
- [6] Racault Y. et al. (1997), Le lagunage naturel : les leçons tirées de 15 ans de pratique en France, CEMAGREF, SATESE, ENSP, Agences de l'Eau.

### A plant extract as an eco-friendly corrosion inhibitor for zinc

Kamilia Ksir a, b, Mina Boulkroune a, b, Lamis Touati a, b

a Research Unit in Structural Molecular and Environmental Chemistry/University of Mentouri Brothers,  
Constantine, 25000, Algeria

b Department of Chemistry/University Mentouri Brothers, Constantine, 25000, Algeria

#### Abstract

Plants are rich in natural organic substances and are considered a renewable source that can provide an alternative to synthetic organic molecules, which are widely used in various industrial sectors. Recycling plants, and especially plant waste, remains one of the solutions with considerable economic and environmental benefits.

In industry, organic molecules are used in the pickling process as corrosion inhibitors to control and reduce metal corrosion. These molecules are generally costly and harmful to the environment and human health.

In this study, we evaluated the anti-corrosive properties of a plant extract from the Moraceae family on zinc in an acidic environment using weight loss and open-circuit potential measurements.

The study showed that the evaluated extract contains active substances that reduce metal corrosion and can be considered a green inhibitor. The thermodynamic parameters and the evolution of the potential of the studied system revealed that corrosion inhibition results from the formation of a protective layer resulting from the adsorption of the active substances present in the extract onto the metal surface.

**Keywords:** Corrosion, green inhibitors, pickling inhibitors, zinc, acidic solutions.

### Valorisation des déchets agricoles par procédé d'extraction de la silice

Meriem Khelif 1, Naima BOUCHENAFSA-SAIB 2

Université Saad Dahleb Blida, Faculté science et technologie, Département de génie des procédés,  
Laboratoire chimie physique des interfaces des matériaux appliqués à l'environnement

Université Saad Dahleb Blida, Faculté science et technologie, Département de génie des procédés,  
Laboratoire chimie physique des interfaces des matériaux appliqués à l'environnement

E-mail : [khelifmeriem.gp@gmail.com](mailto:khelifmeriem.gp@gmail.com)

#### Abstract

Les résidus solides des déchets agricoles sont abondants et peuvent créer des problèmes dans l'environnement en raison de la génération d'odeurs, de l'attraction de parasites qui peuvent affecter la santé humaine...etc. Il est donc nécessaire d'adopter une stratégie appropriée pour réduire ces déchets. D'autre part l'un des éléments potentiels présents dans ces déchets solides est la silice qui a une large application industrielle. Le dépôt de silice dans les résidus agricoles dépend de la quantité et de la disponibilité du silicium dans le sol.

Donc pour la génération de ces déchets dans notre cas est porté sur l'extraction de la silice à partir d'une plante. Les feuilles de notre plante ont été collectées, triées et nettoyées correctement avant d'être brûlées dans un four à moufle à 630°C pendant 8 heures pour produire d'une poudre de cendre dans une première étape ensuite cette poudre a été synthétisée en silice par une attaque chimique d'acide nitrique  $\text{HNO}_3$  avec une concentration bien déterminée pour former une poudre de silice. Les caractéristiques physico-chimiques de la poudre synthétisées ont été analysées par diffraction des rayons X, spectroscopie infrarouge à transformée de Fourier (FTIR), les résultats obtenus indiquent que la poudre de silice a une structure amorphe.

**Les mots clés :** des déchets agricoles ; silice ; extraction ;...

### VALORIZATION AND RECYCLING OF DATE PALM WASTE

KADDOURI Nawal<sup>1\*</sup>, BELHACHEMI Merieme<sup>1</sup>, BERRICH Emna<sup>2</sup>

<sup>1</sup>Laboratory of Chemistry and Environmental Science (LCSE)-University Tahri Mohamed Bechar, 08000, Algeria

<sup>2</sup>Laboratory of Process Engineering, Environment, Energy, Agri-food, Sea (GEPEA) University of Nantes, Nantes, France

Email\*: kaddouri.nawal@univ-bechar.dz

#### Abstract

The use of biomass as an energy source has become increasingly popular in recent years due to the decreasing sources of fossil fuels on the one hand and the many benefits of biofuels on the other. Most research has focused on using biomass to make biofuels and biochar, helping to recycle agricultural waste and protect the environment, through several thermochemical processes including pyrolysis; hydrothermal treatment.

The Hydrothermal process is broadly classified into carbonization, liquefaction, and gasification. In this work, Hydrothermal Carbonization will be conducted in the intermediate temperature range of 180–220°C for 10 h using different weights of Biomass. An elemental analyzer was used for the final examination of the biomass to calculate the weight percentages of carbon, hydrogen and nitrogen in the samples. In order to study the functional groups of the Hydrochar and the liquid phase as well as to understand the likely reaction processes of the process, FTIR spectra were acquired in the wavenumber range of 500–4000 cm<sup>-1</sup>. The results showed the carbon content of biomass was about 39.54%; and in the spectra FTIR of Hydrochar, it can be clearly see a wide absorption band around 3500–3000 cm<sup>-1</sup> attributed to the vibration of stretching of the hydroxyl group, indicating the presence of carboxylic acid and phenol groups.

**Keywords:** Bio-char; Biofuels; hydrothermal carbonization; date palm waste

### The use of plant waste as a source of pickling inhibitors

Lamis Touati a, b, Mina Boulkroune a, b , Kamilia Ksir a, b

Research Unit in Structural Molecular and Environmental Chemistry/University of Mentouri Brothers,  
Constantine, 25000, Algeria

Department of Chemistry/University Mentouri Brothers, Constantine, 25000, Algeria

#### Abstract

Recycling and valorization of plant waste is one of the most important areas of green chemistry research, both from an environmental and an economic point of view. The use of natural products in various industries to replace toxic chemicals represents a challenge for humanity.

In this study, we used waste from a plant in the Apiaceae family as a source of corrosion inhibitor for industrial applications. Replacing synthetic inhibitors used in the metal pickling process with green inhibitors aims to protect the environment and human health.

The tests were carried out on metallic zinc, one of the most sensitive materials to acid corrosion. The inhibitor studied was prepared by the extraction of the skin of the plant root, which is considered a vegetable waste product.

Evaluation of the anticorrosive properties of the prepared extract was carried out using the gravimetric technique and open-circuit potential measurements.

The results of the study showed that the extract presents a very satisfactory efficacy and that it contains active substances that act by adsorption on the metallic surface.

**Keywords:** Corrosion, acid, zinc, inhibition, plant extract.



### Calcium phosphate Biomaterials from Agricultural Waste: bovine bone - based Hydroxyapatite

Saida Bouyegh \*1, Samira Tlili 1, Mohamed Grimet 2

Research Center in Industrial Technologies CRTI P.O.Box 64, Cheraga 16014 Algiers, Algeria

Chemistry Department, Badji Mokhtar -Annaba University

E-mail \*: sbouyegh@yahoo.fr

#### Abstract:

The increase in population and economic expansion leads to the increase of waste material from the food industry as the one of source to generate the pollution. Waste materials should be recycled, reused, and directed toward the creation of products with value additions. The preparation of the raw material consists of several steps: preparation of the powder, the forming then a specific treatment. This research presents a method to extract calcium phosphate particularly HAp from bovine bones, including physical processes without using hazardous chemical reagents; furthermore, the material obtained will be compared with synthetic HAp powders, to determine the efficiency of the proposed method. The produced materials were characterized using x-ray diffraction (XRD), Fourier transformed infrared spectroscopy (FTIR), scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS). The use of bovine bone to generate calcium phosphate based biomaterials will reduce the pollution effect of the waste and the subsequent conversion of the waste into a highly valuable product.

**Keywords:** Agro-industry, Calcium phosphate, Bovine bone, valuable product, Thermal decomposition.

## TOPIC 01: Waste Assessment and Valorization

---

### Enhancing Cement Brick Properties Through Incorporation of Plastic Bag Strips

AUTHORS: Kaoutar Babouri 1, Abdelkader Fidjah2

AFFILIATIONS: 1Laboratory of Mining Materials and Metallurgy (L3M)/ Materials science and engineering Department -National School of Technology and Engineering - ENSTI Annaba, 23000, Algeria

2 Laboratory of Development in Mechanics and Materials (LDMM)- University of Djelfa, 17000, Algeria

Kaoutarbabouri23@gmail.com1 ; fidjah.abdelkader@univ-djelfa.dz2

#### Abstract.

The development of science made humanity more use of plastic for recycling. It is used in most industries: cars, electronic devices, home appliance industry. Plastic contains polyethylene, and it is used in the manufacture of plastic bags that we use in our daily lives. Most plastics do not biodegrade and remain in the environment for long periods. Its accumulation in abundance will lead to many environmental and health hazards and risks to humans. In this research, we will present a solution that reduces the spread of plastic bag waste, where we combine strips of plastic bags [PBS] with cement bricks, and this brick consists of gravel, sand and cement. We study the effect of adding strips of plastic bags to these bricks. We change the ratio from 1% to 5%. We measure some physical and mechanical properties of the samples. Such as density, sound speed, stress strength required to break the samples, and the change in thermal conductivity. The final results showed that the plastic bags [PBS] strips increased in density between 4% to 10%. The speed of sound increases from 1.3% to 13%. The stress strength increases between 12% to 20%. The thermal conductivity increases from 4% to 25%. We conclude that adding strips of plastic bags in the cement bricks makes them lighter and more sound-transmitting with an increase in thermal insulation.

**Keywords:** Plastic recycling, Mechanical properties, Environmental impact, Polyethylene.

### Etude du phénomène d'adsorption d'un colorant cationique le Bleu de Méthylène (BM) sur les coquilles de noix de coco modifiées.

T. BELAID<sup>1</sup>\*, S. OUKHEMAMOU<sup>1</sup>, Z. CHEMACHE<sup>1</sup>, S. BEY<sup>1</sup>, M. BENAMORI

<sup>1</sup>Laboratoire des Procédés Membranaire et Technique de Séparation et de Récupération, faculté de Technologie, Université de A/Mira de Bejaia 06000

\*email: btaous@yahoo.fr

#### Résumé:

L'objectif principal de ce travail est de valoriser un matériau naturel de récupération (la coquille de noix de coco) à travers une étude expérimentale sur sa capacité d'adsorption d'un colorant cationique le Bleu de Méthylène (BM) en solution aqueuse en vue d'une application aux traitements des eaux. Les résultats obtenus lors de cette étude ont pu mettre en évidence les constatations suivantes:

L'adsorption du bleu de méthylène sur la coquille de noix de coco a montré que sa rétention est rapide. La taille des particules joue un rôle très important. Plus la taille est très fine, plus il adsorbe. Le pH initial et la masse de l'adsorbant donnent des pourcentages importants de la rétention du colorant. Le modèle de Freundlich décrit mieux le phénomène d'adsorption du bleu de méthylène sur la coquille de noix de coco. La poudre de la coquille de la noix de coco est un biomatériau ayant des capacités d'adsorption intéressantes

Une simple étude du phénomène de la désorption a été effectuée afin de voir le taux de désorption qui a été vraiment remarquable.

**Mots-clés:** Adsorption, bleu de méthylène, Isothermes, La coquille de noix de coco

## TOPIC 01: Waste Assessment and Valorization

---

### Predicting Treated Wastewater Quality at Illizi WWTP Using Machine Learning and Remote Sensing.

Kouadri Saber<sup>1\*</sup>, Mekhloufi Nabil<sup>1</sup>, Bellatar Bilal<sup>2</sup>, Ouledzid Mohamed<sup>2</sup>

<sup>1</sup>Laboratory of Water and Environment Engineering in Sahara Milieu (GEEMS). University of Kasdi Merbah, Ouargla, 30000 Algeria.

<sup>2</sup>University of Kasdi Merbah, Ouargla, 30000 Algeria.

Corresponding author: [kouadri.saber@univ-ouargla.dz](mailto:kouadri.saber@univ-ouargla.dz)

#### Abstract:

This study investigates wastewater characteristics and employs machine learning models to predict water quality at the Illizi Wastewater Treatment Plant (WWTP) in Algeria. The 38-month dataset (February 2020 to March 2023) revealed seasonal variations in parameters like chemical demanded oxygen (COD), biological demanded oxygen (BOD5), suspended materials (SM), and total nitrogen (TN), with summer and spring witnessing significant efficiency drops due to sandstorms and high light intensity. Notably, the efficiency stabilized after the November 2021 where the wastewater pumping station has been renovated. Machine learning models, including Multiple Linear Regression, Random Tree, and Random Forest, were employed with remote sensing indices (NDVI, NDTI, NDCI) from satellite imagery. While Linear Regression had limited predictive capacity, Random Tree and Random Forest models exhibited strong correlations during calibration (coefficients of determination reaching 1.0). However, their performance decreased during testing, indicating the need for a larger dataset. Finally, this study highlights the potential of machine learning and remote sensing for predicting wastewater quality at the Illizi WWTP. Seasonal efficiency variations and the importance of the pumping station's operational state were noted. While promising results were achieved during calibration, out-of-range predictions in testing emphasize the need for an expanded dataset to enhance model robustness. Further research should focus on dataset enrichment for practical implementation in wastewater treatment systems at Illizi WWTP.

**Keywords:** Wastewater; Machine Learning; Illizi WWTP; Remote Sensing; Modeling.

## TOPIC 01: Waste Assessment and Valorization

---

### References:

- [1] Eibe Frank (2014). Fully supervised training of Gaussian radial basis function networks in
- [2] WEKA. Département of Computer Science, Université of Waikato.
- [3] FNDAE, 2005. Dysfonctionnement biologique des stations d'épuration : origines et solutions.
- [4] F.Bonn and G.Rochon. 'Précise de télédétection : principe et méthode'. Presses de l'Université du Québec 2875, 1996.
- [5] KOUADRI, SABER. Etude hydro-chimique et modélisation de la qualité des eaux souterraines (Cas de la Wilaya d'ILLIZI). Diss. Université KASDI-MERBAH Ouargla, 2022. (Chapitre 4), page (40-54-55-56)
- [6] Racault Y. et al. (1997), Le lagunage naturel : les leçons tirées de 15 ans de pratique en France, CEMAGREF, SATESE, ENSP, Agences de l'Eau.

## TOPIC 01: Waste Assessment and Valorization

---

### Assistance de quelques villages de la commune de bouzeguene (Tizi-Ouzou) pour le perfectionnement de leur schéma de gestion des déchets ménagers

METNA Fatiha, HAMMOUM Arezki, KANANE Melissa & SLIMANI Rachid

Laboratoire de Production, sauvegarde des espèces menacées et des récoltes. Influence des variations climatiques.

Faculté des Sciences Biologiques et des Sciences Agronomiques, Université Mouloud Mammeri de Tizi Ouzou, B.P. 17 R.P., Tizi Ouzou, DZ-15 000, Algérie. e-mail : [metnafatiha@yahoo.com](mailto:metnafatiha@yahoo.com)

#### Résumé

Notre étude consiste à accompagner trois villages (Taourirt, Ahrik, Sahel) de la commune de Bouzeguène, (Tizi-Ouzou) pour consolider leur schéma de gestion des déchets ménagers. Pour cela, nous avons ciblés les comités des villages, les associations, les femmes, les élèves au niveau de l'école primaire et l'employeur chargé de la gestion du centre de tri. Nous nous sommes impliquées comme agents de changements des comportements et des visions vis-à-vis de la gestion de ces déchets en organisant des actions de sensibilisation et d'éducation à la gestion écologique participative et durable des déchets ménagers. Enfin, les acteurs institutionnels étant les autorités locales et régionales, ils ont le pouvoir de mettre en œuvre un plan de gestion durable des déchets ménagers. Les résultats obtenus sont les suivants :

- Pour le village Taourirt, nous avons pu déterminer la tâche de chaque acteur pour une bonne organisation et une gestion durable des déchets et nous avons élaboré un règlement intérieur du centre de tri pour son bon fonctionnement. Après avoir identifié les problèmes liés au traitement des bio-déchets au niveau du centre, nous avons envisagé un autre mode de traitement de ces déchets qui est le compostage en tas.
- Pour le village Ahrik, afin d'y remédier et régler les problèmes que nous avons identifié au niveau du centre de tri nous avons élaboré un règlement intérieur du centre de tri pour son bon fonctionnement.

**Mots clés :** Assistance, consolidation du tri/compostage, villages de Bouzeguène, Tizi-Ouzou, Algérie.

## TOPIC 01: Waste Assessment and Valorization

---

### Valorization of agricultural wastes from orange peels by adsorption of organic pollutants

Department of matter sciences, Faculty of sciences and technology

University of Tamanghasset; ALGERIA

meziane.ouahiba@yahoo.com

#### Abstract

Recently, many researchers have proven the ability of agricultural wastes and by-products as adsorbent materials to remove many types of pollutants including dyes, due to their low cost and abundance in nature. The industrial extraction of orange juice produces a large quantity of biomass considered waste. These wastes are the cause of many environmental problems, including pollution.

To take full advantage of this biomass, we carried out this work as a contribution to the valorization of extracted waste. which focuses on the adsorption of a cationic dye: methylene blue (BM), on an Algerian agricultural waste of orange peels in its natural form without any physical or chemical treatment (EO).

A comprehensive study of the influence of different operating parameters on the dye removal capacity of the two adsorbents (contact time, initial dye concentration, amount of adsorbent, pH and temperature) was also carried out including a kinetics analysis. Two kinetic models including pseudo-first order and pseudo second order were used to analyze the experimental data of adsorption kinetics. The results showed that the kinetics are pseudo-second order for the adsorbent studied.

### Valorisation d'une biomasse végétale -Application à l'adsorption des colorants-

FEDDAL IMENE<sup>a,b</sup>, Mimanne Goussemb,

Abdel Hamid Ibn Badis University of Mostaganem 27000

Laboratory of Materials & Catalysis, Faculty of Exact Sciences Djillali LIABES University (UDL)

E-mail: fimene22@hotmail.com

#### Abstract

L'eau est l'élément central de tous les processus socio-économiques, quel que soit le degré de Développement de la société. L'augmentation des activités industrielles engendre une pression grandissante sur les réserves en eau douce de la planète. En effet, ces activités génèrent une grande diversité de produits chimiques qui se déversent dans le cycle de l'eau, mettant en péril Le fragile équilibre naturel qui a permis à la vie de se développer sur la terre. L'utilisation accrue de certains produits chimiques d'origine industrielle est à la base de nombreux cas de pollution des eaux, des sols, de l'air ou d'intoxication accidentelles ou volontaires, et, suscite à l'heure actuelle une attention particulière à l'échelle mondiale. De nombreux scientifiques s'intéressent, de plus en plus, à l'identification et à l'élimination des polluants. A cet effet, on recourt souvent à l'adsorption. Notre travail s'inscrit dans cette optique. Il porte sur la valorisation de la sciure de bois dans l'élimination des colorants textiles.

L'objet de ce travail est, dans un premier temps, de caractériser l'adsorbant par FTIR, détermination du pHZPC et la détermination des fonctions par la méthode de Boehm. Dans un deuxième temps, d'étudier l'adsorption de deux colorants, le Vert de Méthyle et le Rouge bémacid. Une optimisation de certains paramètres influençant le processus d'adsorption, a été effectuée afin d'améliorer le taux de rétention des colorants. L'étude des paramètres thermodynamiques a montré que ce processus de dépollution est exothermique. L'application des modèles de Langmuir, Freundlich, Temkin, ont permis de décrire correctement les isothermes d'adsorption.

**Keywords:** Valorisation, Biomasse Végétale, Elimination, Environnement.



### Propriétés mécaniques et absorption d'eau de Mortier autoplaçant avec de la poudre de verre recyclé et de la brique calcinée

Bouleghebar Yasmina<sup>1</sup>, Bentchikou Moahmed<sup>2</sup>

<sup>1</sup>Laboratoire Matériaux et Environnement (LME), Université de Médéa, Algérie.

<sup>2</sup> Laboratoire de Physique Mécanique et Modélisation Mathématique (LMP2M), Faculté de Technologie, Université de Médéa, Algérie.

correspondence E-mail: yasmineboulegbar.93@gmail.com

#### Résumé :

L'utilisation de la poudre de verre (PV) et de la poudre de brique (PB) comme matériaux cimentaires supplémentaires fournit une approche efficace pour récupérer les déches de verre et les déchets de construction et de démolition. Cette recherche montre l'évolution de la préparation d'un mortier écologique avec divers niveaux de finesse et taux de remplacement de PV et PB. Le ciment a été remplacé par 8%, 12%, 16%, 20% et 24% de la (PV) et de 4%, 8%, 12%, 16% et 20% de la (PB), avec différentes finesses Blaine pour les deux déchets. La résistance à la compression, la résistance à la flexion et l'absorption d'eau du mortier durci ont été étudiées.

Les résultats montrent que lorsque la finesse de PV et PB est supérieure à la finesse du ciment, la résistance à la compression avec 12% de PV et 8% de PB est supérieure à celui de 100% ciment, tandis que la résistance à la compression diminue avec l'augmentation de la teneur en PV et PB. L'incorporation d'une teneur appropriée en PV diminue l'absorption d'eau du mortier par contre l'absorption d'eau augmente avec l'augmentation de niveau de remplacement et la finesse des particules de BP et diminue avec le temps de durcissement de 28 à 365 jours. La valeur la plus faible d'absorption d'eau a été trouvé pour les mortiers contenant 24% de PV et 20% de PB. L'utilisation des déchets de verre et de la brique comme matériaux cimentaires supplémentaires il s'avérerait une solution rentable et écologiquement durable.

## TOPIC 01: Waste Assessment and Valorization

---

### Synthesis and characterization of high surface area mesoporous activated carbon from pomegranate processing solid waste by chemical activation

Fatiha Benmahdia\*, Ahlem Khelalia, Mounira Kollib, Sami Khettaf a

a Laboratory of Chemistry and Environmental Chemistry (LCEE), Department of Chemistry, Faculty of Matter Sciences, University of Batna1, route de Biskra, Batna-05000, Algeria

b Laboratory of Environmental Processes Engineering (LIPE), University of Constantine 3, Faculty of Process Engineering, BP 72 Ali Mendjeli, Nouvelle Ville 25000, Constantine, Algeria.

Corresponding author: [fatiha.benmahdi@univ-batna.dz](mailto:fatiha.benmahdi@univ-batna.dz)

#### Abstract

Pomegranate processing solid waste was used as an economical and readily available precursor to produce high-surface-area activated carbon (AC) using phosphoric acid as the activation agent. The AC was characterized by BET surface area analysis, pore size, SEM imaging, XRD analysis, FT-IR analysis, Boehm titration, pH at the point zero charge (pHPZC), proximate analysis, CHNS-O analysis, methylene blue (MB) number, and iodine number. The results revealed that the AC had a mesoporous structure (78.82%), a BET surface area of 1089.08 m<sup>2</sup>/g, a total pore volume of 1 cm<sup>3</sup>/g, a yield of 44.57%, an average pore diameter of 3.7 nm, and various functional groups. The MB number and iodine number were 496 mg/g and 635 %, respectively. These results suggest that the AC can be used as a low-cost adsorbent for the removal of small and large environmental pollutants.

**Keywords:** Agro-waste; Pomegranate processing solid waste; valorization; activated carbon; chemical activation.

# **Water treatment**

## TOPIC 02: Water treatment

---

### Treatment of industrial water from the textile factory, SAFILCO Ain Djasser Batna

1 Laboratoire de Chimie des Matériaux. et des Vivants: Activité & Réactivité. (LCMVAR) université de batna 1

E-mail : abdellatif\_chimie\_05@yahoo.fr – abdellatif.aouragh@univ-batna .dz

#### Abstract

Dyes are widely used in printing, food, cosmetic and clinical industries, but particularly in the textile industries for their chemical stability and ease of synthesis and variety of colors. However, these dyes cause pollution once released into the environment.

This work focuses on the study of the influence of different experimental parameters on adsorption by commercial activated carbon: pH, mass of adsorbent and temperature.

The experiments, carried out in (JAR-test) with agitation of 100 revolutions/minute, contact time 2 hours. The analysis is done by COD meter

The experimental results show that the orpiment doses are pH=2; the mass of activated carbon m=1.5, the temperature

Then study the degradation of methyl violet textile dye by the Fenton process in an aqueous medium in the presence of an oxidant, hydrogen peroxide and iron as catalyst.

This study makes it possible to monitor the influence of certain parameters such as pH; dye concentration, oxidant concentration, catalyst concentration and temperature on degradation kinetics.

The results show that the best dose for good degradation are: pH=3, [Fe<sup>2+</sup>]=7mg/l, [H<sub>2</sub>O<sub>2</sub>]=10 mg/l Finally, apply these optimal doses obtained on the actual textile water to know the effect of salts

**Keywords:** Dyes, adsorption, methyl violet, Fenton process

## TOPIC 02: Water treatment

---

### ETUDE DE LA QUALITE DES EAUX SOUTERRAINES DANS LA REGION DE DJELFA

Ismail Ghibeche<sup>1</sup>, Blel Azouzi<sup>2</sup> et Tarik Hartani<sup>3</sup>

<sup>1</sup>Hydraulique, Sciences et technologie, Université de Biskra.

<sup>2</sup>Département, Sciences de la Nature et de la Vie Université de Djelfa.

<sup>3</sup>Génie Rural, Ecole Nationale Supérieure Agronomique.

Ismail.ghibeche@univ-djelfa.dz

#### Résumé.

L'objectif de cette article est la gestion des ressources en eau par l'étude de la qualité des eaux souterraines de la région de Djelfa par la répartition spatiale des paramètres physico-chimiques dans le cadre d'un SIG sur la base de la géostatistique en utilisant la variographie et le krigeage comme outil d'interpolation, pour arriver à la gestion des ressources en eau. On a constaté que la zone la plus affectée par une élévation excessive de l'ensemble des valeurs des éléments que nous avons étudié sont localisés dans les parties nord-est, le centre et sud-est caractérisées par des activités agricoles et le plus important leurs structures géologiques salines. Les résultats obtenus de l'étude physico-chimique ont permis de mettre en évidence que la quasi-totalité des points d'eaux étudiés sont caractérisés par la prédominance des faciès chimiques chloruré et sulfaté calcique et magnésiennes. Dans l'ensemble, les résultats escomptés de cette régionalisation ont montré que la qualité des eaux souterraines dans la majorité de la zone d'étude est convenable à l'irrigation et que la zone nord-ouest et quelques poches dans le centre est dans sa majeure partie caractérisée par des eaux potables.

**Mots-clés :** Qualité, Djelfa, SIG, Géostatistique.

## TOPIC 02: Water treatment

### Study of the Thermodynamic Parameters Affecting the Removal of a Cationic Pollutant.

Samira Chebba\*<sup>1</sup>, Asma Boudaoud<sup>2</sup>, Mebrouk Djedid<sup>1</sup>, Benalia Mohtar<sup>1</sup>, Soltani Amel<sup>3</sup>

<sup>1</sup>Department of Process Engineering / Faculty of Technology, Amar Telidji University of Laghouat, Algeria

<sup>2</sup>Department of Science and Technology core curriculum / Faculty of Technology, Amar Telidji University of Laghouat, Algeria

<sup>3</sup>Laboratory of Process Engineering / Higher Normal School of Laghouat, Algeria

\*E-mail address of Corresponding author: s.chebba@lagh-univ.dz

#### Abstract

This study concerns the removal of a colored pollutant using the adsorption technique on the surface of local agricultural waste from southern Algeria specifically in the Laghouat region. In this context, we prepared this material, and tested its efficiency on a discontinuous adsorption of a cationic dye a methylene blue (MB) in water. The effect of various physico-chemical factors was examined, in particular adsorbent mass, medium pH, concentration, contact time and temperature. Experimental results on the effect of temperature change on adsorption were used to calculate thermodynamic parameters such as enthalpy ( $\Delta H^\circ$ ), free energy ( $\Delta G^\circ$ ) and entropy ( $\Delta S^\circ$ ), which can be measured using the Van't Hoff equation. Absolute values of  $\Delta H^\circ$  is negative indicate that the adsorption phenomenon is exothermic in nature with a value of  $\Delta H^\circ$  equal to -25.109 kJ.mol<sup>-1</sup>.

The positive values of free energy  $\Delta G^\circ$  equal to 3.652, 3.756 and 4.797 KJ.mol<sup>-1</sup> for temperatures 298, 308, 318 respectively show that  $\Delta G^\circ$  increases with increasing temperature, meaning that the adsorption phenomenon is non-spontaneous for methylene blue (MB), and the negative values of  $\Delta S^\circ$  equal to -95.2 J.mol<sup>-1</sup> indicate that the adsorbed species are more ordered on the surface during adsorption.

**Keywords:** Adsorption; Methylene blue; Agricultural waste; Thermodynamic parameters.

## TOPIC 02: Water treatment

---

### L'effet des conditions opératoires sur le traitement des eaux usées par micro algue

Rezzag Sara, 1\*, Hadj kouider Mohamed<sup>1</sup>, Khelifi Omar<sup>1</sup>, Lasmi faouzi<sup>2</sup>

<sup>\*1</sup>Laboratoire d'énergie, d'environnement et de systèmes d'information. Département des hydrocarbures et des énergies renouvelables, Faculté de Technologie, Université Ahmed Draia, Adrar 01001, Algérie

<sup>2</sup> Laboratoire d'analyse fonctionnelle des procédés chimiques. Département de Génie des Procédés, Faculté de Technologie, Université Saad Dahlab Blida<sup>1</sup>, Blida 09000, Algérie.

\* L'adresse E-mail: [rezzag.sara@univ-adrar.edu.dz](mailto:rezzag.sara@univ-adrar.edu.dz)

#### Résumer

Le traitement des eaux usées est devenu un défi mondial urgent, en raison de l'urbanisation rapide, de l'industrialisation et de la dégradation de l'environnement. Le traitement biologique par les micro algues constitue une solution innovante à la pollution de l'environnement. Les micro algues ont la capacité de capturer et de métaboliser les nutriments et les composés indésirables présents dans les eaux usées, en transformant ces substances en biomasse. Le fonctionnement conditionnel englobe une série de stratégies qui manipulent les paramètres environnementaux tels que l'intensité lumineuse, la disponibilité des nutriments, la température et le pH afin d'influencer la croissance des microalgues, et les capacités d'élimination des nutriments. Ce résumé explore les effets de ces ajustements opérationnels dynamiques sur les activités des microalgues.

**Mot clés :** eaux usées, Le traitement biologique, micro algues, biomasse

## TOPIC 02: Water treatment

### Diagnosis of the physicochemical quality of groundwater and its preservation

Asma Behilil<sup>\*1</sup>, Ilham Laroussi<sup>2</sup> and Asma Lakhri<sup>2</sup>

<sup>1</sup> Laboratory of Chemistry and Environmental Sciences, University TAHRI Mohamed Bechar, Faculty of Sciences, Department of Technologies, BP 417 Kenadsa Road, Bechar 08000, Algeria

<sup>2</sup> Ahmed DRAIA University, Faculty of Sciences and Technologies, Hydrocarbon Department, Ahmed Daraya University, National Road No. 6, Adrar 01000, Algeria

\*Corresponding author e-mail: BEHILIL Asma behilildz@yahoo.fr

#### Abstract

The water resources in the Adrar region (Algeria) are mainly represented by the water level that supplies all the oases with water through ancient techniques called Foggara, knowing that the "Foggara" is a hydraulic complex for storing and distributing water. This system has a triple interest: the heritage, the ecological system, and the socio-economic landmarks of the area. The main objective of this work is the development of natural water resources and the treatment and preservation of groundwater in the Adrar region (Algeria). A sampling campaign was carried out in March 2023 at the water point level of the foggaras in this area. These samples are preserved according to the methods described [1]. More than fifteen parameters were analyzed. This study showed that these waters are characterized by a very highly mineralized content, which equals 2095.6 mg/l. This study also revealed contamination by nitrates in certain wells, where we observed values of the order of 65.21 mg/l, which exceeds the standard of 50 mg/l [2].

**Keywords:** Foggara, Water, Treatment, Mineralization.

#### References

[1] J. Rodier, B. Legube, et N. Merlet, « L'Analyse de l'eau 9ème édition », Entièrement Mise À Jour Dunod Paris, 2009.

[2] MRE, « Décret exécutif N° 11-125 du 17 Rabie Ethani 1432 correspondant au 22 mars 2011 relatif à la qualité de l'eau de consommation humaine. Journal officiel N° 18 du 23 mars 2011, p 6-9 », 2011.



## TOPIC 02: Water treatment

---

### Advanced Eco-friendly Method for Synthesizing Iron Nano Particles using Plant Extract for Industrial Wastewater Treatment

Ahlem KHELALI\*, Fatiha BENMAHDI\*

\*Laboratory of Chemistry and Environmental Chemistry (LCEE), Department of Chemistry,

Faculty of Matter Sciences, University of Batna1, Batna-05000, Algeria

Ahlem.khelali@univ-batna.dz; fatiha.benmahdi@univ-batna.dz ,

#### Abstract

In this study, a plant-based approach was employed to synthesize iron oxide nanoparticles ( $\text{Fe}_3\text{O}_4$ -NPs) using an extract as a reduction agent. This method is not only environmentally friendly but also cost-effective. The green synthesized nanoparticles exhibited remarkable performance in removing reactive yellow 145 dye from tannery wastewater in batch adsorption experiments. The adsorption equilibrium data were accurately described by the Langmuir isotherm model, suggesting a high monolayer adsorption capacity of 289.01 mg/g at 20 °C. The adsorption process followed pseudo-second order kinetics. Furthermore, thermodynamic analysis confirmed the spontaneous and exothermic nature of the adsorption process. These findings emphasize the potential of plants extract as a novel agent for nanoparticle synthesis and the efficient removal of dyes from industrial wastewater.

**Keywords:** Green synthesis; iron oxide nanoparticles; wastewater treatment; adsorption; dyes.

## TOPIC 02: Water treatment

---

### Electrochemistry study of Enhanced counter-ion transport through anion exchange membranes in electromembrane processes

TIMMAOUI Abdallah, FERHAT Mahmoud, ZERDOUMI Ridha

Mechanics Laboratory - University of Amar Telidji Laghouat.

Email: a.timmaoui@lagh-univ.dz

#### Abstract:

Membrane technology has become increasingly popular and important for separation processes in industries, as well as for desalination and wastewater treatment. It has substantial roles in industries such as food processing, pharmaceuticals, and petrochemicals. Over the last two decades, membrane technology has also been increasingly employed to address water scarcity issues through wastewater reclamation and desalination. Electrodialysis (ED) is one of the most used membrane separation processes controlled by an electric field gradient that allows the separation of minerals from feed water solution. It moves dissociated ions through ion-permselective membranes and forms two different flows - desalinated flow called diluate and a concentrated flow called concentrate. In electrodialysis, operational problems may occur, such as the inorganic salts precipitation on the membrane surface, destruction of the membranes and an increase in the energy consumption decreasing the process efficiency due to the concentration polarization phenomena occurs at membrane solution interface during mass transport. So, a better understanding of concentration polarization can help to improve the membrane performance, the process efficiency, and in the reduction the process operation cost. In this research, we enhanced the mass transport through the membrane using the ammonia buffer ( $\text{NH}_3/\text{NH}_4^+$ ). The results showed that the ammonia addition facilitates the counter-ion transfer and gives a total elimination of the system polarization, and that the water dissociation reaction in the boundary layer is catalytically enhanced by ammonia. It shifted the overlimiting current regions towards the ohmic regions by destruction and elimination of the diffusion boundary layer.

**Keywords:** Ion exchange membrane, Electrodialysis, Concentration polarization, Limiting current, overlimiting current.

## TOPIC 02: Water treatment

---

### kinetic and thermodynamic studies of gentian violet adsorption on natural and modified bentonite

Nour elhouda BRICHI 1, Fatima zohra BATANA 2, Mebrouk DJEDID 3

1,3Laboratory of process engineering, Department process engineering, Laghouat University, P.O Box 37C, Ghardaia road , 03000, Laghouat, Algeria.

2 Physical Chemistry of Materials Laboratory, Department science of the matter, Laghouat university P.O Box 37C, Ghardaia road, 03000, Laghouat, Algeria.

E-mail : n.brichi@lagh-univ.dz

#### Abstract:

Since a long time ago, man has tried to exploit dyes in many sectors, such as paper, textiles, cosmetics, leather, and food industries. The dyes from these processes are discharged with liquid effluents to the receiving environment often without prior treatment. Because of their potential toxicity to human health, many of them have been classified as hazardous pollutants. Adsorption is one of the most effective and expensive methods for dye removal. In this work, we studied the adsorption of gentian violet dye on natural and modified bentonite. The effect of contact time showed that the time needed to reach equilibrium is 30 minutes, and in order to predict the involved adsorption mechanism, we studied the kinetic adsorption using pseudo first order, pseudo second order and the intraparticle diffusion model. the parameters of each model were calculated. From these parameters, we concluded that the pseudo second order is the best model for describing kinetic adsorption data, with correlation coefficients  $R^2 = 0.999$  and  $R^2 = 0.998$  for natural and modified bentonite, respectively. Moreover, we came to the conclusion that the PID is not the only limiting step. Thermodynamic studies were investigated using the effect of temperature. As a result, the adsorption process is spontaneous and exothermic, and the system is organized.

**Key words:** Adsorption, dye, kinetic, bentonite, thermodynamic, gentian violet.

## TOPIC 02: Water treatment

---

### Valorisation of Nuclei and Bark of Ziziphus Jujuba in waste water treatment

Lamia Bouziane<sup>#1</sup>, Lamia Allat<sup>\*2</sup>, Farida Bendebane <sup>+3</sup>, Fadhel Ismail<sup>+4</sup>, Nadjette Alaounia <sup>\*5</sup>

<sup>#</sup>Department of Civil and Hydraulic engineering, University Kasdi Merbah of Ouargla, Algeria  
lbouzianelamya@yahoo.fr

<sup>\*</sup> Department of process engineering, University of Badji-Mokhtar, Annaba, Algeria

2lamiaallat@yahoo.fr

5salaounianadjette@yahoo.fr

<sup>+</sup>LOMOP, Laboratoire de Synthèse Organique, Modélisation et Optimisation des Procédés Chimiques,  
University of Badji-Mokhtar, Annaba, Algeria

3ismail.fadhel@univ-annaba.org

4bendebanefarida@yahoo.com

#### Abstract:

The adsorption of Heavy metals within the ligno-cellulosic material of agricultural and agro-food waste is always the subject of several research studies. In this objective, our work aimed to removal from an aqueous solution two heavy metals representing different degrees of toxicity which are cadmium and zinc. The adsorbants used are the bark and nuclei of the jujube gotten from region of Annaba whose name is Balad Al Annab and that means the city of Jujube because of the large number of jujubes in its territory. Using a fractional factorial design 25-1, Five operating parameters were chosen to study their effects on the metal removal efficiency, namely: adsorbent and adsorbate types, initial metal concentration, initial pH and temperature. The statistical treatment has shown that the quantity of metals removed from the aqueous phase decreased at low pH and as the temperature increased. The elimination yield of the bark was greater compared to that of jujube nuclei. The removal of zinc and cadmium was done in the same manner and quantity on both materials. The mathematical model and the metal removal optimum conditions were developed. The role of functional surface groups onto the metal removal mechanism was also discussed. Finally, by studding the significant effect of the interaction adsorbante-adsorbates, the statistical experimental design indicated that there is no relative affinity between adsorbents and adsorbates

**Keywords** Heavy metals, jujube bark, jujube nuclei, adsorption, DOE.

## TOPIC 02: Water treatment

---

### Contribution à l'amélioration de la qualité des eaux traitées de station de déshuilage Haoued Berkaoui par deux procédés

Bouziane Lamya\*

\*Department of Civil and Hydraulic engineering, University Kasdi Merbah of Ouargla, Algeria  
bouzianelamya@yahoo.fr

#### Résumé

Dernièrement, l'unité de déshuilage de Haoued Berkaoui- Oaurgla créée en l'an 2000 dans le but de récupérer de l'huile et de l'eau à partir du borbier a connu des problèmes de rendement accompagnés par une augmentation dans la consommation des produits chimiques utilisés dans le procédé de coagulation floculation appliqué actuellement au niveau de l'unité, d'où vient la nécessité d'optimiser les conditions opératoires du procédé actuel ou bien de le changer carrément. Notre travail présente les deux solutions en optimisant en premier lieu le procédé actuel par la méthodologie des plans d'expériences et en appliquant en deuxième lieu la technique d'adsorption sur les boues carbonisées de la station d'épuration des eaux usées de la région. La dose du coagulant a un effet majoritaire sur les paramètres de pollution tels que la turbidité, les MES, et les hydrocarbures. L'analyse statistique des résultats des différents effets et interactions entre facteurs intervenant dans la réaction coagulation - floculation nous a permis d'étudier la modélisation des paramètres de pollution en fonction des paramètres opératoires, leurs carrées et leurs interactions et de choisir les conditions opératoires optimales du procédé du coagulation-floculation. D'autre coté, la carbonisation à 600°C des boues à la station d'épuration a été donnée les meilleurs abattement de la pollution. En comparant les deux méthodes de traitement entre eux, on a trouvé que l'adsorption avec sa simplicité a donné le meilleur rendement de traitement.

## TOPIC 02: Water treatment

---

### Study of Synergistic Systems based on TOPO-Aliquat 336 for Selective Separation of Copper-Magnesium

Samir MESROUK<sup>1</sup> and Fatma SADI<sup>1</sup>

<sup>1</sup> Laboratory of Electrochemistry, Corrosion, Metallurgy, and Mineral Chemistry, Faculty of Chemistry, University of Science and Technology Houari Boumediene. BP 32 Bab Ezzouar, 16111 - Algiers, Algeria

\*(samirmesrouk10@gmail.com) Email of the corresponding author

#### Abstract :

In this study, our focus was on examining a synergistic system characterized by the blend of two extractants: "tri-n-octylphosphine oxide" (TOPO) and "N-methyl-N, N-diethyloctan-1-ammonium chloride" (Aliquat 336). These extractants were dissolved in kerosene. We conducted an investigation into how the volume ratio of TOPO to Aliquat 336, the concentration of sulfuric acid, and variations in pH influenced the process. Our study of these chemical variables aimed to identify the optimal conditions that would yield the highest extraction efficiency. Additionally, we explored the separation of Copper (II) and Magnesium (II) within the TOPO-Aliquat 336 mixture. The outcomes of our research hold promise for the potential applications and synergistic combinations in the purification process, especially for treating low-concentration metal-bearing solutions. This unit operation not only offers economic and technological advantages but also contributes to effective environmental protection.

**Keywords:** Synergism, Copper, Magnesium, TOPO, Aliquat 336, Sulfuric Acid.

## TOPIC 02: Water treatment

### The adsorption of a food coloring the Yellow Tartrazine

Nour-Elhouda Brahmi<sup>1\*</sup>, Fatiha Ahmed Chekkat<sup>2</sup>, Mahdi Chiha<sup>2</sup>, Khadidja Kahoul<sup>1</sup>

<sup>\*</sup> Laboratory of Anticorrosion-Materials, Environment and Structures (LAMES-E1061500/E1061503),  
University of 20 Aout 1955-Skikda, P.O.BOX 26,21000 Skikda, Algeria

<sup>1</sup> Department of Chemistry, Faculty of Science, University of 20 Aout 1955-Skikda, P.O.BOX 26, 21000  
Skikda, Algeria

<sup>2</sup> Chemical Engineering Department, Faculty of Technology, University of 20 Aout 1955-Skikda, P.O.BOX  
26, 21000 Skikda, Algeria

\*Email: brahminour26@gmail.com, phone: +213.06.57.92.44.83

Type of Presentation: En ligne

Topic 04: Water treatment

#### Abstract:

In recent decades, there has been an increase in the use of certain adsorbents from natural waste (sawdust, orange peel or wheat waste) for the treatment of water contaminated with dyes. Among existing techniques of wastewater treatment, adsorption is one of the most efficient methods because of its simplicity in design and operation, indifferent sensitivity towards toxicants and low operational cost. The objective of this study is to study a practical and economical method for the batch removal of Tartrazine Yellow Dye (TRZ) from water by adsorption on commercial Activated Carbon grain of organic origin (GAC) (type Norit GAC 1240 W for potable water processing) used in this work was purchased from Sigma-Aldrich in aqueous medium. The GAC has a mean granulometry of 1 mm. The influence of certain parameters on the adsorption of the dye on our solid support, namely the adsorbent-adsorbate, contact time, the temperature, the pH of the solution and the initial concentration of Tartrazine was determined. The first order pseudo model and the second order pseudo model were tested. The kinetic study showed that the adsorption equilibrium is reached after the first 90 min of contact. The results obtained show that the adsorption of Tartrazine on the CAG is of order 2. The decrease of PH gives the best elimination of TRZ with the increase of the temperature, on the other hand we obtain that the variation of PH in basic medium (10-14) has no effect on the elimination of our dye which remain almost constants.

**Keywords:** wastewater, adsorption, batch, Tartrazine, activated carbon.

## TOPIC 02: Water treatment

### Jujube stones based highly efficient activated carbon for industrial textile wastewater decolorization: comparative study between two effluents

BOUCHELKIA Nasma<sup>1,2</sup>, Mameri Amal<sup>2</sup>, BELKACEMI Hayet<sup>3</sup>, MOUNI Lotfi<sup>2</sup>

<sup>1</sup>Département de génie des procédés, faculté de technologie, Université de Bejaia, 06000 Bejaia, Algeria. URL : [www.univ-bejaia.dz](http://www.univ-bejaia.dz)

<sup>2</sup>Laboratory of Management and Valorization of Natural Resources and Quality Assurance, SNVST Faculty, Akli Mohand Oulhadj University, Bouira 10000, Algeria. URL: [www.univ-bouira.dz](http://www.univ-bouira.dz)

<sup>3</sup>Technology Laboratory of Materials and Process Engineering (LTMGP), University of Bejaia, 06000 Bejaia, Algeria. URL : [www.univ-bejaia.dz](http://www.univ-bejaia.dz)

The speaker's email address: [asma.bouchelkia@univ-bejaia.dz](mailto:asma.bouchelkia@univ-bejaia.dz)

#### Abstract:

This study had a focus on using inexpensive, abundant and unexploited agricultural waste; jujube stone, for preparing an activated carbon as an adsorbent to treat a textile wastewater. the preparation of the activated carbon involved three main steps: (1) pretreatment including washing, drying, grinding and sieving, (2) chemical activation with pure phosphoric acid at and finally (3) carbonization at a temperature of 600 °C. A variety of physicochemical methods, including FTIR, SEM, X-ray diffraction, the methylene blue index, Boehm titration, iodine index and pH point of zero charge, served to characterize the produced adsorbent. Multiple parameters, including BOD, COD, turbidity, suspended particles, and dissolved solids, were examined to investigate the quality and the physicochemical properties of the two studied textile effluents (Mustard and Violet) before and after treatment with the produced activated carbon. Untreated wastewater analysis revealed high values for almost all parameters: pH>9, COD of 302.72 mg/L and 230.68 mg/L for Mustard and Violet effluent, respectively. Both effluents have a COD/BOD ratio higher than 3, which restricts their biodegradability. The study of the effect of contact time and activated carbon dosage on the decolorization of the two effluents showed that 4g/L of activated carbon and 60 minutes of contact were sufficient for maximum decolorization percentages of 81.03 and 84.65% for the Violet and Mustard effluents respectively. After adsorption, the pH decreased from 9.19 to 7.38 for the Mustard effluent and from 9.24 to 7.44 for the Violet effluent. BOD values recorded were 40 and 20 mg/L respectively. COD values decreased from 302.72 mg/L to 96.04 mg/L for the Mustard effluent and from 230.68 mg/L to 80.51 mg/L for the Violet one, and suspended solids were almost completely eliminated (percentage of elimination>99%). The results of this research highlight the efficiency of activated carbon derived from jujube stones as a cost-effective adsorbent for the treatment of textile wastewater.

**Keywords:** Activated carbon; adsorption; bio-resource; industrial textile effluent; Jujube stones.



## TOPIC 02: Water treatment

---

### CuO nanostructures as photocatalyst: An approach to water treatment of organic pollutants

Oussama Bacha\*<sup>1</sup>, Ouidad Baka<sup>1</sup>,

<sup>1</sup>Univ. Ouargla, Fac. des Sciences Appliquées, Lab. Dynamique, Interactions et Réactivité des Systèmes, BP 511 Ouargla, Algeria.

(\*bacha.oussama@gmail.com / bacha.oussama@univ-ouargla.dz) Email of the corresponding author

#### Abstract

Cupric oxide (CuO) nanostructures have been synthesized on FTO glass substrate using an electrochemical deposition method followed by heat treatment at 500 °C. CuO nanostructures were elaborated from electrodeposited Cu<sub>2</sub>O on FTO (F: SnO<sub>2</sub>) glass substrate from an equimolar aqueous solution (0.05 M) of copper sulfate and citric acid. pH of the solution, temperature, deposition potential and deposition time were fixed at 11, 60 °C, -0.6 V/ SCE and 5 min, respectively. The obtained film was annealed at 500 °C for 1h. Various analytical techniques were used to investigate the microscopic structure and optical properties of the elaborated sample. The formation of the tenorite structure of CuO was established by XRD analyses. According to SEM analysis, the FTO surface was completely covered by a granular structure of CuO. UV-visible spectra of the obtained CuO nanostructures show an absorption band edge in UV region at 580 nm, corresponding to which the calculated band gap of CuO is found to be 1.75 eV. In addition, photoelectrochemical measurements showed a high photocurrent response, confirming the CuO film quality improvement. Photodegradation of methylene blue (MB) using CuO as a photocatalyst have also been studied. Experiments revealed that CuO nanostructures with a high aspect ratio can degrade 75% of the initial concentration of MB in 1 h.

**Keywords:** Electrochemical deposition, Nanostructures, Photodegradation, CuO.

## TOPIC 02: Water treatment

---

### Synthesis and characterization of multilayer ceramic membranes for wastewater treatment

Amina Boulkrinat<sup>2</sup>, Ferhat Bouzerara<sup>1,2</sup>, Amira Sabah<sup>3</sup>

<sup>1</sup>Faculty of Exact Science, Physics department, ceramics lab., costantine university 1, costantine 25000, Algeria.

<sup>2</sup>Faculty of Exact Science, Physics department, Laboratory of Condensed Matter Physics and Nanomaterials, Jijel University 18000, Algeria.

<sup>3</sup>Faculty of Exact Science, Chimie department, Laboratoire d'Etude sur les Interactions Matériaux-Environnement (LIME), Jijel University 18000, Algeria.

Corresponding author: Ferhat Bouzerara

#### Abstract:

In this work, multilayer membranes for the water purification have been prepared from ceramic materials. Tubular supports for membranes were prepared from quartz sand and calcite (natural materials) using extrusion method. The effect of the calcinations temperature on the structure of the membrane supports was studied to get an appropriate pore size and porosity. Using slip casting technique, two layers were deposited on the supports. Both titania (TiO<sub>2</sub>) intermediate layer and aluminosilicate nanotubes (kawlan DD3) top-layer were sintered at 1050 and 580 °C, respectively. Structural studies by (by mercury intrusion porosimetry )means of porosity, pores size distribution, mechanical properties, water permeability and scanning electron microscopy (were studied) has been carried out on membranes. The average pore size of the top-layer membranes was about 40 nm. The prepared ultrafiltration The ceramic membrane was determined in order to evaluate both the water permeability and rejection. it seems that the prepared membranes are suitable for such waste water treatment.

**Key Words:** Membrane; Microfiltration; Ultrafiltration; Tubular supports

## TOPIC 02: Water treatment

---

### EVALUATION OF GROUNDWATER QUALITY FOR IRRIGATION WATER PURPOSES IN THE INSALAH REGION

KADRI ABDELAZIZ<sup>1</sup>\*; KOUADRI SABER<sup>1</sup>

<sup>1</sup> Laboratory of Water and Environment Engineering in Saharan Environment, University of Kasdi Merbah-Ouargla, PB 147 RP, 30000 Ouargla, Algeria

\*kadiabelaziz1440@gmail.com

#### Abstract

Groundwater is a major source for the satisfaction of human agricultural and industrial needs. These sources are part of the large basin (SASS) Aquifer System of the Northern Sahara encompasses three countries Algeria, Tunisia, Libya which covers an area of one million square km<sup>2</sup>. The region of In Salah, located at the southern limit of the western basin, of the SASS in the outcrops is based only on the Continental Intercalary water table. In this paper a total of 53 groundwater samples were collected from wells at the INSALAH region, aimed at assessing the suitability of groundwater for agricultures. The groundwater samples were analyzed for their physical and chemical properties using standard laboratory methods. The physical and chemical parameters of groundwater such as pH, electrical conductivity, total dissolved solids, Na, K, Ca, Mg, Cl, HCO<sub>3</sub>, and SO<sub>4</sub> were determined. Various water quality indices like SAR, SSP, PI, RSC, MHR and KR were calculated for each water sample to identify the irrigational suitability standard. Five chemical parameters were used including Electrical Conductivity (EC), Cl, HCO<sub>3</sub>, Na % and Sodium Absorption Ratio (SAR) to create the database of water quality. The r<sub>1</sub> and r<sub>2</sub> indices show that groundwater of the study area is Na<sup>+</sup>-SO<sub>4</sub><sup>2-</sup> and deep meteoric percolation type. Majority of the wells are fall under moderate to unsuitable category of water for irrigation purposes. Further, wells water has also been classified on the base of meteoric genesis index.

**Keywords:** Groundwater; Insalah region; irrigation purposes, water quality indices.

## TOPIC 02: Water treatment

---

### Biosorption performance of pomegranate peel wastes for toxic lead ions removal

Abdelhamid Addala<sup>1</sup>, Moussa Boudiaf<sup>2</sup>, and Embarek Bentouhami<sup>3</sup>

<sup>1</sup>Department of Process Engineering, University of Ferhat Abbas Setif 1, Setif 19000, Algeria

<sup>2</sup>Department of Process Engineering, University of Hamma Lakhdar, El Oued 39000, Algeria

<sup>3</sup>Department of Process Engineering, University of Ferhat Abbas Setif 1, Setif 19000, Algeria

a.addala@univ-skikda.dz

#### Abstract

The ability of pomegranate peel wastes (PGP) to biosorb toxic lead ions ( $Pb^{2+}$ ) ions from synthetic wastewater was investigated. On the effectiveness of  $Pb(II)$  ions removal by PGP, the impact of biosorption parameters including pH, biosorbent dosage, contact time, and initial feed concentration was carefully assessed. Batch biosorption studies showed that an optimal lead removal capacities of 63.76mg/g was recorded by the PGP biosorbent for pH 6, dosage 0.05 g, 100 rpm agitation speed, 60 min contact time, 50 mg/L initial feed concentration and 30 °C operational temperature. In conclusion, the findings demonstrated unequivocally that PGP biowaste appears to be an effective, affordable, and environmentally friendly biosorbent for the long-term removal of toxic  $Pb(II)$  ions from domestic and industrial wastewater streams.

**Keywords:** pomegranate wastes; lead; biosorption; biosorption parameters; waste-to-value.

## TOPIC 02: Water treatment

### Study of methylene blue adsorption process on Algerian soil by column method

Ghania Abid<sup>1</sup>, Zoubir Benmaamar<sup>2</sup>, Mohamed Kadari<sup>3</sup>

<sup>1</sup> University Saad Dahleb -Blida- B.P 270 Route Soumâa -BLIDA-

<sup>2</sup> University Saad Dahleb -Blida- B.P 270 Route Soumâa -BLIDA-

<sup>3</sup> University Saad Dahleb -Blida- B.P 270 Route Soumâa -BLIDA-

E-mail: abid\_ghania@univ-blida.com

#### Abstract:

Water pollution with dyes is a major problem due to its detrimental effects on human and animal health. This study aimed to use Algerian soil samples as a matrix for studying the efficiency of adsorbing methylene blue dye as a method for treating industrial wastewater. In this study we investigate the factors that affect the process, such as dye concentration, acidity coefficient, temperature, and flow rate. The results showed the effectiveness of the samples in fixing the dye and removing colors from the aqueous solution. Two methods were used, the column method and the batch method. The adsorption process using a column method was proven to be a cost-effective and promising alternative for wastewater treatment.

**Keywords :** methylene blue, adsorption, column method, wastewater treatment.

#### References:

- 1.M.Auta,B.H.Hammed.Chitosan-Clay composite as highly effective and low-cost adsorbent for batch and fixed-bed adsorption of methylene blue.Chemical Engineering journal 237(2014)352-361.
- 2.M.J.Ahmed,B.H.Hammed.Removal of emerging pharmaceutical contaminant by adsorption in fixed-bed column.A review Ecotoxicology and environmental safety 149 (2018) 257-266.
3. M.Auta,B.H.Hammed.Chitosan-Clay composite as highly effective and low-cost adsorbent for batch and fixed-bed adsorption of methylene blue.Chemical Engineering journal 237(2014)352-361
4. Mustafa.T.Yagub,Tushakantisen.SharmeenAfroze,H.M.Ang.Fixed-bed dynamic column adsorption study of methylene blue onto pine cone.Desalination and water treatment .17 January 2015.

## TOPIC 02: Water treatment

---

### VALORISATION OF BIOMATERIAL FOR REMOVAL OF CATIONIC DYES FROM WASTEWATER

Rafik El Arslene.DRA,<sup>a</sup> Malika. MEDJAHDI<sup>a</sup>, Amira.Chislaine DRA,<sup>b</sup> Nadia RAMDANI<sup>a</sup>

<sup>a</sup> Department of energy and process engineering, University DJILLALI LIABES, Sidi Bel Abbès.

<sup>b</sup> Department of Biology Sciences, University DJILLALI LIABES, Sidi Bel Abbès

#### Abstract:

The proposal of this work was the preparation of a powdered activated carbon obtained from jujube cores to apply as adsorbents in the removal of organic dye contaminants from wastewater. The activated carbons were produced with a combination of chemical activation and pyrolysis processes. When applied as adsorbents in the removal of methylene blue and methyl orange from wastewater, the maximum removal values obtained were up to 95 %. The adsorption results showed that the adsorption was faster in the beginning and reached maximum around 120 min. The kinetic model presented the best fit to experimental data. The production of activated carbons from jujube cores is an efficient adsorbante to the removal of methylene blue and methyl orange dyes.

**Keywords:** activated carbon, jujube cores, wastewater, adsorption, kinetic

## TOPIC 02: Water treatment

---

### Optimisation de la coagulation/floculation de l'aluminium pour l'élimination de la DCO et de la turbidité des eaux usées dans la province de Biskra

Mansoura BENAKCHA<sup>1</sup>, Toufik MASMOUDI<sup>2</sup>

<sup>1</sup>Laboratoire de Recherche en Hydraulique Souterraine et de Surface -LARHYSS- Département de Génie Civil et d'Hydraulique, Faculté des Sciences et de la Technologie Université Mohamed Khider de Biskra, BP. 145. R.P.7000 Biskra Algérie,

[mansoura.benakcha@univ-biskra.dz](mailto:mansoura.benakcha@univ-biskra.dz)

#### Résumé

Le processus de coagulation démontre une grande efficacité d'élimination de différents paramètres, principalement la demande chimique en oxygène (DCO) et la turbidité. L'aluminium dans l'eau potable coagulée et dans les effluents d'eaux usées a été considéré comme un sujet de préoccupation pour la santé humaine et l'environnement.

L'objectif de cette étude était d'optimiser le traitement des eaux usées par coagulation-floculation en utilisant le sulfate d'aluminium comme coagulant. L'efficacité de la coagulation conventionnelle a été considérablement réduite, d'où la nécessité de développer des processus de coagulation améliorés en optimisant les conditions de fonctionnement (principalement la quantité de coagulant et le pH). Ce traitement réduit la DCO, la couleur et la turbidité des eaux usées, en indiquant les contaminants organiques et inorganiques, mais à des niveaux acceptables pour les eaux usées traitées rejetées dans le milieu récepteur. Les résultats montrent que la coagulation-floculation avec le sulfate d'aluminium conduit à une élimination de 74 % de la matière organique de la DCO, à une élimination de 65 % de la turbidité et à une nette réduction de la couleur de l'eau. Selon les résultats obtenus pour la plupart des paramètres testés, la dose optimale de sulfate d'aluminium est de 150 mg/l. En effet, les résultats obtenus ont montré que l'ajout de doses de coagulant allant de 50 à 200 mg/l a conduit à des réductions significatives de la turbidité et de la DCO, atteignant ainsi l'objectif de notre étude.

**Mots clés:** DCO, NTU, coagulation-floculation, coagulant, eaux usées, Jar-test.

## TOPIC 02: Water treatment

---

### Caractérisation et adsorption de l'Acid Blue 40 par Charbons actifs en poudre préparés à partir de Ficus Carica L.

Baassou ZOHRA 1\*, Abdelbaki REFFAS 1, Benmahdi FATIHA 2

1 Inorganic Materials Laboratory, LMI, Department of Chemistry, Faculty of Science, University of Mohamed Boudiaf, M'sila 28000, Algeria.

2 Department of Chemistry, Faculty of Science, University of Elhadj Lakhdhar , Batna, Algeria

\*Baassou ZOHRA: PhD student in Environmental Chemistry from M'sila University, Algeria.

Tel : (+213) 665943631 ; E-mail : zohra.baassou@univ-msila.dz

#### Résumé :

Le charbon actif en poudre a été préparé à partir des feuilles de Ficus carica par imprégnation dans 85% H<sub>3</sub>PO<sub>4</sub> pendant 3 heures puis carbonisation à 600°C. Le charbon actif préparé a été utilisé pour l'élimination du bleu acide 40 par adsorption. L'équilibre d'adsorption a été représenté par les modèles isothermes de Langmuir et Freundlich. Les PAC ont été caractérisés par leur chimie de surface à l'aide d'une analyse thermogravimétrique (TGA), de mesures au point de charges nulles (pHPZC), de l'indice d'iode et de l'indice de bleu de méthylène pour leurs structures poreuses.



## TOPIC 02: Water treatment

---

### Epuration des eaux usées par filtration sur sable (cas des bains maures à Adrar ville)

M. Yakoubi<sup>1,2\*</sup>,

<sup>1</sup>Laboratoire Molécules Bioactives et Séparation Chirale, Université de Béchar, Algérie

<sup>2</sup>Ecole Normale Supérieure de Béchar, Département des sciences exactes, Algérie

\*Email : amounyak@yahoo.fr

#### Résumé

L'étude présentée vise à réutiliser les eaux usées traitées dans d'autres domaines tels que l'agriculture, les stations de lavage, ou autres. De cette façon, nous répondrons au problème de la pénurie d'eau, en particulier dans les zones qui ont un climat aride ou semi-aride, comme le climat de la Wilaya d'Adrar.

L'étude dépend de l'effet de la filtration des eaux usées sur une colonne de sable, en particulier les sables de la région de Bouda, état d'Adrar. et évaluer le changement qui a eu lieu,

La qualité physique, chimique et microbiologique des eaux usées des bains traditionnels (Hammam Qalloum) a été évaluée et il en ressort que l'eau est modérément acide et riche en substances organiques (DBO5, DCO) et en chlorures. Les échantillons analysés ont montré la présence de micro-organismes indiquant la présence d'une contamination.

Au final, il s'est avéré que l'eau était polluée, et après l'avoir purifiée par filtration sur sable, des changements importants se sont produits dans les valeurs, et nous avons conclu qu'il est possible de la réutiliser pour fournir et conserver de l'eau par simple, moyens disponibles, et sans trop d'efforts.

**Mots clés :** Eaux usées, Traitement, Filtration sur sable, sud ouest Algérien

## TOPIC 02: Water treatment

---

### ELIMINATION OF MALACHITE GREEN BY ADSORPTION OF AGRICULTURAL BY-PRODUCTS (ROSMARINUS OFFICINALIS)

Badis.d1\*, Hamad.t2

1. Center University of Tipaza Morsseli Abdellah
2. university of Khemis meliana Djellali Bounaama

\* Mail : dalilabadis7@gmail.com

#### Abstract

The technique of adsorption is the most favorable method for the elimination of dyes has become an analytical method of choice, very effective and simple in its use. Research is focused on the use of low cost adsorbents, available locally, biodegradable adsorbent, made from natural sources, in recent years, activated carbons synthesized from agricultural residues have been widely used as an adsorbent to treat colored effluents due to their very large porous structure, large specific surface area and their high adsorption capacity.

The recovery of agricultural residues, without generating pollutants, is a great challenge and is recommended for sustainable industrial development in order to preserve the environment.

The objective of our study is to prepare activated carbons from agricultural waste in order to obtain a product applicable in water treatment and in particular for the discoloration of effluents used in the textile industry.

Experimental study of the adsorption of cationic malachite green dyes. We studied the influence of certain parameters of the aqueous medium, such as the pH (6 to 8), the mass of the adsorbent (2g/l), the temperature (20 to 60°C), and the concentration of the medium. As well as kinetics and adsorption isotherms. The present work has shown that the plant *Rosmarinus officinalis* can be used as a low cost adsorbent for the removal of malachite green from water.

**Keywords:** Adsorption, , malachite green, *Rosmarinus officinalis* , Modelling.

## TOPIC 02: Water treatment

### Removal of Methyl Violet 2B Dye from Water Using Modified Carob Fruit

Bouchra Mekidiche<sup>1,2\*</sup>, Mounir MEKIDICHE<sup>1</sup>, Laila Bouchenaki<sup>2</sup>, Salima Merghache<sup>2</sup>, Khadidja KHALDI<sup>3</sup>, Ilhem REKKAB.HAMMOUMRAOUI<sup>1</sup>

<sup>1</sup> Laboratory of Catalysis and Synthesis on Organic Chemistry LCSCO. University of Tlemcen. Algeria

<sup>2</sup> Laboratory of Inorganic Chemistry and Environment LICE. University of Tlemcen. Algeria

<sup>3</sup> Center of Scientific Research and Technique in Physicochemical Analysis (CRAPC), BP 384, Bou-Ismaïl, RP 42004, Tipaza, Algeria.

\*( bouchra.mekidiche245@yahoo.com)

#### Abstract

Textile dyes are a major contributor to water pollution in industrial waste. To address this issue, our study focuses on developing an activated carbon adsorbent from Algerian natural carob (fruit of *Ceratonia siliqua* L) to remove methyl violet 2B (MV2B) dye from wastewater. We investigate the adsorbent's properties and performance, and test its efficiency under different parameters such as adsorbent weight, initial dye concentration, pH, temperature, stirring speed, and contact time. Our results show that optimal conditions for adsorption occur at a 50mg adsorbent weight, 10ppm initial dye concentration, pH 9, 20°C temperature, and stirring speeds between 200 and 300 rpm. The activated carbon exhibits a high absorption capacity, achieving 98% adsorption for an initial concentration of 10 mg/L of methyl violet 2B. The adsorption process is exothermic, spontaneous, and well-modeled by the pseudo-second-order, S-sigmoid isotherm, and Langmuir or Temkin models.

**Keywords** Carob (fruit of *Ceratonia siliqua* L), Adsorption, Activated carbon, Methyl violet 2B (MV2B), water depollution

## TOPIC 02: Water treatment

### Dégradation photocatalytique du bleu de méthylène à l'aide de CuO en couches minces

Omar Meglali<sup>1,2,\*</sup>, Abdelkrim Naas<sup>1</sup>, Ahmed Belkheiri<sup>1</sup>

<sup>1</sup> Faculté des Sciences, Univ. Mohamed Boudiaf M'sila, Algérie

<sup>2</sup> Laboratoire des sciences et informatique des matériaux, Université de Djelfa, Algérie.

\*Auteur correspondant : omar.meglali@univ-msila.dz

#### Résumé

Dans le présent travail nous avons choisis les couches minces d'oxyde de cuivre CuO pour éliminer et dégrader le bleu de méthylène (MB). Les films de CuO ont été déposés sur des substrats d'ITO à deux différentes températures  $T=45^{\circ}\text{C}$  et  $T=75^{\circ}\text{C}$  par la technique d'électrodéposition. Après le dépôt, les échantillons ont subi un recuit thermique sous air à  $500^{\circ}\text{C}$  durant 60 min. L'efficacité de la photodégradation de nos deux échantillons a été étudiée par la décomposition de  $1.5 \times 10^{-4}$  mol/l de solution de BM sous irradiation UV et sous irradiations des rayons solaires.

Les diagrammes DRX ont confirmé la formation uniquement de la phase CuO sous sa structure monoclinique. La spectroscopie UV-visible a montré que la transmittance des films est relativement faible; dans le domaine visible, elle est inférieure à 20 % pour le film déposé à  $45^{\circ}\text{C}$  et inférieure à 5 % pour le film déposé à  $75^{\circ}\text{C}$ . Le coefficient d'absorption des deux films est supérieur à  $10^4 \text{ cm}^{-1}$ . Nous avons constaté également que l'efficacité de dégradation du bleu de méthylène par le film déposé à  $45^{\circ}\text{C}$  pour une irradiation par la lumière UV durant 3h est égale à son efficacité pour une irradiation de 4h par les rayons solaires. D'autre part, l'efficacité de dégradation du BM par le film déposé à  $45^{\circ}\text{C}$  est inférieure à celle du film déposé à  $75^{\circ}\text{C}$ , ceci est dû à la différence entre les propriétés optiques des deux films.

Pour une irradiation de 3h, l'efficacité photocatalytique du film déposé à  $75^{\circ}\text{C}$  est de 68%.

**Mots clés:** Photocatalyse, CuO, bleu de méthylène, Électrodéposition.

## TOPIC 02: Water treatment

---

### Imidazolium-Based Ionic Liquid for Ethyl acetate Separation from Water

RABHI Fadhila<sup>1\*</sup>, SIFAOUI Hocine<sup>1</sup>

<sup>1</sup> Laboratoire de physico-chimie des matériaux et catalyse, Université A. MIRA, Route de Targa-Ouzemour, 0600 Bejaia.

[Fadhila\\_rabhi@yahoo.fr](mailto:Fadhila_rabhi@yahoo.fr)

#### Abstract

ionic liquids as green solvents have received increasing attention due to their remarkable characteristics such as thermal and chemical stability, low vapor pressure, hydrophobic and hydrophilic. In this context, the separation of Ethyl acetate from water was investigated using imidazolium-based ionic liquid rather than the traditional organic solvents. The selectivity and the capacity at infinite dilution were determined for the separation problem (Ethyl acetate/water) at 323.15 K. The results indicate that the Imidazolium-based ionic liquid examined in this work showed good removal selectivity for Ethyl acetate, which confirm the efficacy of this ionic liquid in the Ethyl acetate separation from water.

**Key words:** Ionic Liquid, extraction, organic compounds.

## TOPIC 02: Water treatment

---

### Heterogeneous Photocatalytic Degradation under UV Irradiation of pharmaceutical pollutant

Aoudjit Farid<sup>1</sup>, Zaabar Aida<sup>1</sup>, El Hanafi Nawel<sup>1</sup> and Hamani Siham<sup>2</sup>

1.Laboratoire Matériaux et Développement Durable, Faculté des Sciences et Sciences Appliqués,  
Université de Bouira, 10 000 Bouira, Algeria

2.Faculté des Sciences et Sciences Appliqués, Université de Bouira, 10 000 Bouira, Algeria

f.aoudjit@univ-bouira.dz

#### Abstract

Recently, the industrialization and using of an increasing number of chemicals are responsible for the dissemination in the environment of a variety substances that are persistent, toxic and biorefractory, named "emerging pollutants".In this study, we applied heterogeneous photocatalysis for the treatment of contaminated water by an pharmaceutical pollutant namely Métronidazole in a zinc oxide aqueous suspension (ZnO) and titanium oxide (TiO<sub>2</sub>) using a UV lamp as an artificial radiation.

In order to evaluate the process performances, the influence of some parameters such as : the catalyst concentration, pollutant initial concentration and solution pH was examined. Parametric study showed that the Métronidazole degradation was improved with decrease of the pollutant initial concentration.

From the comparative study between the both oxide, several observation can be drawn : the zinc oxide is more effective for the Métronidazole degradation, a degradation rate of about 100% can be achieved under certain conditions. And the Langmuir-Hinshelwood model adequately describe the experimental results for the considered system.

**Keywords:** pollutants, photocatalysis, pharmaceutical, removal

### STRATEGIES ET TECHNIQUES DE DEVELOPPEMENT DURABLE DES RESSOURCES EN EAU

#### EN ALGERIE PAR LE TRAITEMENT ET LE RECYCLAGE DES EAUX USEES

Z. Bounaadjia 1\*, H. Cherf 2

1\* Département d'hydraulique, Université Badji-Mokhtar- Annaba, Algérie. E-mail :zouzouboukouba@gmail.com

2 Département d'hydraulique, Université Badji-Mokhtar- Annaba, Algérie. E-mail : razanesadjida2020@gmail.com

#### Résumé

La rareté des ressources établie par le stress hydrique s'exprime à travers plusieurs aspects : La demande en croissance permanente en eau, La dégradation de l'infrastructure hydraulique, Les inondations et divers phénomènes extrêmes. Et pour faire face à ces phénomènes, des pratiques d'adaptation sont déjà utilisées, on citant la valorisation de gestion des eaux par : le recours aux techniques d'économie d'eau en particulier en agriculture ; mobilisation des eaux non mobilisées à ce jour ; amélioration de modes de gestion d'eau industrielle (Recyclage, réutilisation) ; l'accélération de construction de barrages ; lancement de programmes de forage supplémentaires ; amélioration des stratégies de planification et de préparation en vue des sécheresses et inondations sévères et l'utilisation des eaux saumâtres.

Dans le présent travail nous allons étudier les déférente solutions et stratégies dans le domaine de l'eau pour conserver les ressources hydriques. Les objectifs assignés à l'utilisation, à la gestion et au développement durable des ressources en eau visent à assurer :

- L'approvisionnement en eau à travers la mobilisation et la distribution d'eau en quantité suffisante et en qualité requise;
- La préservation de la salubrité publique et la protection des ressources en eau et des milieux aquatiques contre les risques de pollution à travers notamment la collecte et l'épuration des eaux usées domestiques et industrielles;
- La recherche et l'évaluation des ressources en eau superficielles et souterraines ainsi que la surveillance de leur état quantitatif et qualitatif;
- La valorisation des eaux non conventionnelles de toutes natures pour accroître les potentialités hydriques.

**Mot clé :** Eau ; Développement Durable; valorisation ; Traitement Des Eaux ;

## TOPIC 02: Water treatment

---

### Etude de l'adsorption du Vert acide 20 par le charbon actif commercial

KOLLI & Mounira\*1, BENMAHDI & Fatiha2

1 Université Salah Boubnider- Constantine3- B.P. 72 Ali Mendjeli Nouvelle Ville Constantine-Algérie

2 Université de Batna 1- route de Biskra, 05000 Batna, Algérie

kollimounira@gmail.com

#### Abstract:

L'objectif de ce travail est d'étudier l'élimination du colorant vert acide 20 par le charbon actif. Ce colorant est un colorant anionique et la présence de ce dernier dans les eaux usées présente une menace majeure pour l'environnement et la santé humaine. Le procédé utilisé dans cette étude pour éliminer ce produit est le procédé d'adsorption qu'est un procédé physico- chimique pratique et non couteux. Les résultats obtenus montrent que l'élimination de ce produit est maximale à un pH très acide puis elle diminue avec l'augmentation du pH. La modélisation d'isotherme d'adsorption montre que l'isotherme d'adsorption du vert acide 20 sur le charbon actif est décrite par le modèle de Dubinin-Radushkevich. La détermination des paramètres thermodynamiques du processus d'adsorption montrent que l'adsorption du colorant vert acide 20 sur le charbon actif est un processus spontané et favorable à des températures basses.

**Mots clés:** Colorant, Vert acide 20, Adsorption, Charbon actif, Isotherme.



## TOPIC 02: Water treatment

---

### Détection des résidus du ciprofloxacine dans les eaux usées

Souhila SAIM1\*

1\* PhD student at the Faculty of Natural and Life Sciences, Biology Departement, Membre in Laboratoire of Geomatic, Ecology and Environnement (LG2E). University of Mustapha Stambouli, Mascara.ALGERIA.29000.

Saim.souhila@univ-mascara.dz

#### Résumé

De nos jours, les résidus pharmaceutiques en tant que micropolluants dans les ressources en eau sont une préoccupation croissante. La communauté scientifique s'est concentrée et a donné la priorité à la recherche sur cette pollution, la contamination des ressources aquatiques par les résidus pharmaceutiques pouvant se produire tout au long de leur cycle de vie. Parce que c'est un médicament largement utilisé chez les humains et qu'il est excrété sous forme d'urine et de matières fécales, qui entrent dans les stations d'épuration des eaux usées (STEP). Les stations d'épuration des eaux usées sont l'une des principales sources de propagation de ces résidus dans l'environnement, en particulier dans les eaux de surface et souterraines, les lacs, les rivières et les eaux côtières, ce qui indique la pollution de ces habitats. Ils sont reconnus comme des micropolluants environnementaux en raison de leur présence ubiquitaire dans les corps d'eau à des concentrations allant de ng à µg/L, mais malgré leur dégradation dans une certaine mesure, des résidus pharmaceutiques de toutes catégories ont été détectés en premier lieu dans les traitements des eaux usées, ce qui contribue à leur décharge dans les environnements aquatiques, principalement dans les eaux de surface.

**Mots Clés :** ressources aquatiques, pollution, résidus pharmaceutiques, eaux usées, ciprofloxacine

## TOPIC 02: Water treatment

---

### Analyzing the physico-chemical properties of wastewater from the Bordj Bou Arreridj wastewater treatment facility

BOURAHLA Amel<sup>1,2\*</sup>

<sup>1</sup> Department of Agronomic Sciences, Faculty of Natural and Life Sciences and Earth and Universe Sciences. University of Mohammed El Bachir El Ibrahimi Bordj Bou Arreridj, 34000. Algeria

<sup>2</sup> Natural Biological Resources Valorization Laboratory (VRBN), (LVRBN)

\*amel.bourahla@univ-bba.dz

#### Abstract

This study consists in determining the physicochemical quality of the urban (domestic) and industrial wastewater of Bordj Bou Arreridj, intended for the irrigation and feeding of Oued k' sob. The latter is based on the analysis of physicochemical parameters (pH, conductivity, suspended matter, biochemical demand for oxygen, chemical demand for oxygen, temperature, oxygen below, nitrogenizes and its derivatives, phosphorus) Raw water and uncluttered. According to the results obtained, some of the purified water parameters are in the WHO standards (pH, temperature, conductivity) and the others are out of norms (DBO5, COD and TSS) due to industrial discharges.

**Key words:** wastewater, physicochemical quality, purified water, raw water, Bordj Bou Arreridj.

## TOPIC 02: Water treatment

---

### PROTECTING WATER AND THE ENVIRONMENT BY TREATING WATER FROM THE TEXTILE INDUSTRY - TLEMCEM (WESTERN ALGERIA).

ABDELMOUMENE Hanane 1\*, MAAMAR Boumediene 2, LALLAM Faiza 3

1, 2, 3 Laboratory EOLE- Department of Hydraulics-Faculty of Technology-University of Tlemcen-Algeria.

abdelmoumenehanane1996@gmail.com

#### Abstract:

The preservation of the environment as well as water resources such as water solicits particular attention with regard to industrial activities that degrade the quality of receiving environments through the introduction of polluting substances discovered in liquid discharges, the working environment in textile factories is extremely dangerous due to the use of dyes that are dramatic sources of pollution (Idrici H. 2019), This confirms that the essential task of the industrialist is not only to control his production, but he must also consider how to treat his liquid and solid waste(Djemaci B. 2012).

To address these issues, Algeria adopted a comprehensive wastewater treatment program, commissioning several wastewater treatment plants. These are reliable solutions for industrial plants that have been analyzing and controlling discharge quality since the 1980s (Boumediene M. 2013).

In order to study the efficiency of wastewater treatment plants, i.e. to monitor the purification performance of the textile plant (pollution elimination yields : BOD5, COD, TSS), and other parameters that can influence activated sludge treatment, temperature, organic load), for a series of data from the physico-chemical analyses of water (raw and treated) over a period of February (2018-2019), and confirm whether the data correspond to the standard of Algerian discharges, which show the effectiveness of WWTP in water depollution.

**Key words:** Environment, Industrial wastewater, treatment of wastewater, Textile WWTP, Physicochemical analysis.

# **Renewable Energies and Energy Efficiency**

## TOPIC 03: Renewable energies and energy efficiency

---

### Topologies of single phase photovoltaic inverters

#### Abstract

in photovoltaic installation the PV inverter allows transforming the DC power generated by the photovoltaic modules into an AC power, and to know and choose the right inverter, the different PV inverter designs and conceptions should be known. There exist many topologies and designs of photovoltaic inverters, the main differences between them lies in the output power quality ,the output sinewave type , the design complexity and the component counts , the efficiency , the capabilities for grid-connecting or/and off grid PV operations , the galvanic insulation in the case of grid-connected inverter and the capabilities of input voltage variations. In this paper we will present and compare three topologies of stand-alone single phase inverter by simulating them on ISIS Proteus software . The comparison will be about the presence and the type of the transformer: high frequency, low frequency or the transformer less topology , and see the influence of the frequency on the transformer's core and the efficiency of inverter.

**Keywords:** PV inverter, boost converter efficiency, circuit design, MPPT, galvanic isolation.

## TOPIC 03: Renewable energies and energy efficiency

### Faculté de Technologie, Mémoire fin d'étude « Conception d'une centrale photovoltaïque pour recharge de voitures

Adapté de : Université de M'sila

•Encadreur :

\* Amirat Belkacem »

#### Résumé

Dans le monde, la production d'énergie électrique vient principalement des énergies fossiles (le pétrole, le gaz et le charbon) et combustibles d'origine nucléaire.

L'énergie d'origine nucléaire, qui ne rejette pas directement de gaz carbonique. Par ailleurs, le traitement des déchets issus de ce mode de production est très coûteux : la radioactivité des produits traités reste élevée durant de nombreuses années, ce qui nuit à l'homme et à l'environnement (la faune et la flore)

Enfin, les réserves d'uranium sont comme celles du pétrole, limitées (moins de cent ans au rythme actuel de consommation) [1]. Pour remédier à tous ces problèmes, nous recourons aux énergies renouvelables .

Les énergies renouvelables sont des énergies qui peuvent être régénérées naturellement.

Il y a cinq familles principales d'énergies renouvelables. Dans l'ordre d'importance de leur exploitation actuelle, ce sont :

- l'énergie solaire
- l'énergie éolienne
- l'énergie hydraulique (hydroélectricité)
- la biomasse (avec le bois de chauffage, ainsi que biogaz...)
- la géothermie. [2]

Les sources :

[1]- Corinne ALONSO « Contribution à l'optimisation, la gestion et le traitement de l'énergie ». UNIVERSITÉ PAUL SABATIER – TOULOUSE III.) 2003.

[2]- KHADRAOUI ZAKARIA « Etude d'une centrale solaire thermique » MASTER GENIE MECANIQUE- UNIVERSITE BADJI MOKHTAR ANNABA-2017

## TOPIC 03: Renewable energies and energy efficiency

---

### Appropriate Diminution of the Magnetic Field Intensity Produces from the High Voltage Three Phase Overhead Transmission Lines

Salah-Eddine Houicher \*, Rabah Djekidel and Sid Ahmed Bessedik

Department of Electrical Engineering, LACoSERE laboratory, Ammar Telidji University, Laghouat, Algeria

\*Correspondant

email: [houichersalah@gmail.com](mailto:houichersalah@gmail.com)

#### Abstract

With the growth development and great increase in the power network systems have caused the continuous and rapid consumption of different resources of energy production. However, this need the construction and design of more power lines facilities. Increased demand for electrical energy and free business economies for electricity exchange, have pushed power suppliers to pay a great attention to quality and cost of the latter, especially in distribution networks. This work presents a simple method to determine and analysis the magnetic field generated by high voltage overhead transmission line at height 1 m above the ground level. The calculation of magnetic field takes into account the attenuation effects of passive loop that is installed under the conductors, including their optimal location on the power line of this study by applying the passive loop method, in order compare the obtained results before and after using the passive loop in considering the reduction factor. The simulation results of analytical calculation are validated using electromagnetic field analysis software obtained under MATLAB program codes.

**Keywords :** Overhead Transmission Line, High-Voltage, Magnetic Field, Mitigation, Passive Loop, Simulation

## TOPIC 03: Renewable energies and energy efficiency

### Advancing Sustainability: The Synergy of Renewable Energies and Energy Efficiency

Helifa Fatima Zohra<sup>1</sup>, Allal Farida<sup>2</sup>

<sup>1</sup>University of Ammar Thelidji Laghouat, Algeria

<sup>2</sup>Laboratory of mechanics, University of Laghouat, Algeria

#### Abstract:

Renewable energies and energy efficiency is at the forefront of our collective efforts to combat climate change, reduce our carbon footprint, and secure a sustainable energy future. These two pillars of modern energy solutions are driving transformative changes in the way we generate, consume, and manage power. It's not only relevant to decrease the energy consumption and environmental emissions, but is also a large opportunity in terms of job creation and development of new business areas that stimulate investment.

The synergy between renewable energies and energy efficiency emerges as a prominent subject in an era defined by the imperative of minimizing climate change and attaining energy sustainability. This project dives into the critical roles these interconnected concepts play in altering global energy systems, emphasizing their combined ability to result in a low-carbon future. Renewable energy such as solar, wind, hydropower, biomass, and geothermal have grown considerably in recent years. These technologies harness nature's abundance, providing clean and unlimited energy sources. Simultaneously, energy efficiency has become crucial in the pursuit of sustainability. Building design, transportation, and industrial processes innovations. Such measures not only reduce energy demand but also enhance economic competitiveness. In conclusion, these dynamic synergies offer a promising means to address the urgent challenges of climate change, energy security, and economic development. By advancing sustainability through the integration of renewable energies and energy efficiency, we can unlock a cleaner, more resilient and prosperous world for future generations.

**Key words:** renewable energies, energy efficiency, synergy, climate change

#### 1. Introduction:

Due to global demand, particularly in developed and developing countries, more sustainable energy solutions are necessary to replace conventional electricity generation resources such as fossil fuels (F. Rizzi *et al*, 2014). Fossil fuel-based energy sources are causing damage on the ecosystem, producing global warming and climate change (E. Vine, 2008). In the last few decades, greenhouse gas emissions from power generation have increased dramatically (S. Manish *et al*, 2006). To address the current environmental crisis, renewable energy (RE) technologies such as solar, wind, hydro, biomass,



## TOPIC 03: Renewable energies and energy efficiency

geothermal, and hydrogen energies have been introduced to create power (W.G. Santika et al,2019) Because of its environmentally beneficial properties and ability to generate power with little or no discharge of air pollution. RE is gaining popularity as society's understanding of the need of a clean environment grows (A. Qazi et al,2019). RE is not only beneficial to sustainability, but it is also economically significant. It aids the economy by lowering the cost of electricity generation because it uses natural, renewable resources. It can also be used as a secondary source of income because consumers can sell their generated electricity back to the power grid. The objective of this article is to define theoretical basis of renewable energies and energy efficiency, their sources and benefits, in addition of some methods of improving renewable energies.

### 2. Theoretical basis of renewable energies

Renewable energies are regarded as one of the most important sources of energy that can be relied on as an alternative to fossil energies because of the benefits they provide to the countries that use them, and on top of these benefits is the environmental drive to reduce the gases emitted, particularly carbon dioxide. Its origins.

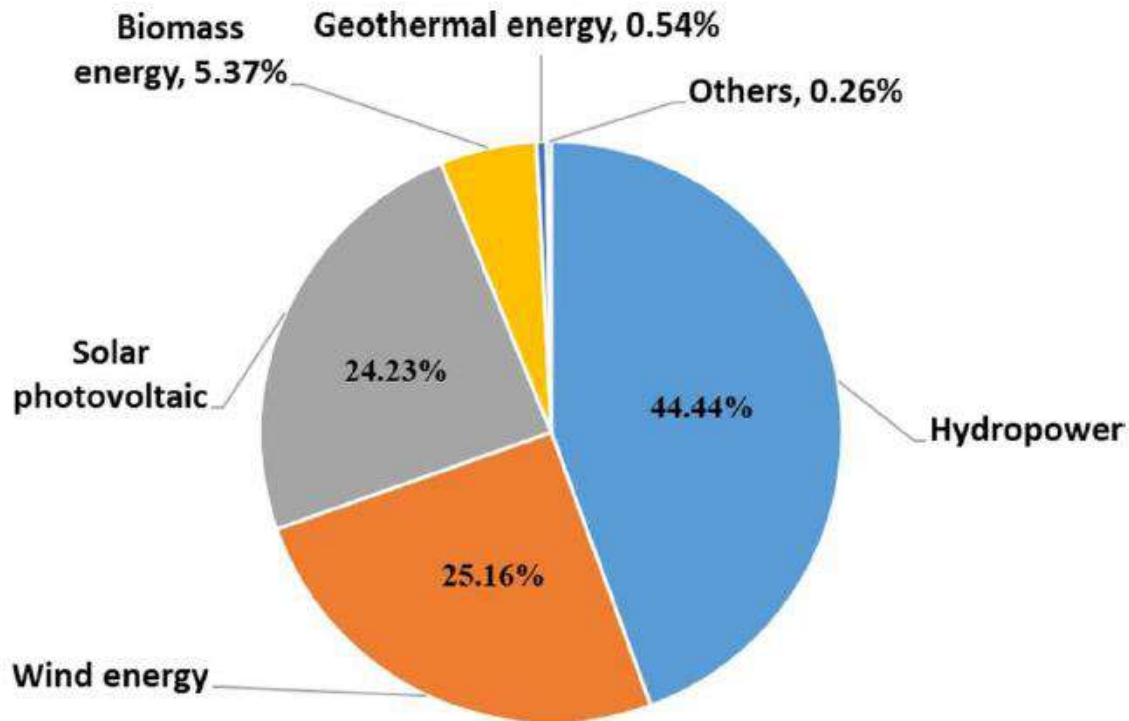
#### 2.1. Renewable energies definition

Renewable energies mean “those energies that re-exist in nature automatically and periodically, meaning that they are energy derived from natural resources that are renewed or that cannot be depleted. Renewable energy is also defined as energy that is generated from an inexhaustible natural source that is available everywhere on the ground surface and can be easily transformed (OPEC, 2007, p. 112).

In other words, renewable and sustainable energy is energy generated from natural sources such as sunlight, wind, water, rain and heat of the Earth's interior, in addition to the energy of biomass. Renewable energies are eternal and environmentally friendly, unlike non-renewable energies.

Fig. 1.Share of renewable energy sources in electricity generation in gigawatt% from a total of 2587.6 gigawatts.

## TOPIC 03: Renewable energies and energy efficiency



The largest contributor to electricity production is hydropower. Solar and wind energy together account for 50% of the total electricity share. Geothermal, ocean, and biomass-based power plants account for slightly more than 6% (Rahman et al,2022)

### 2.2. Renewable energy sources

There are numerous renewable energy sources, the most notable of which are listed below:

- Wind energy:** The wind is moving air and thus it possesses kinetic energy that can be converted into regular rotational turbine energy using wind turbines. These rotating turbines can be used to raise water, grind grains and generate electrical energy (Wakaa, 2019, p. 117). Wind turbines have been used for decades to pump water, grind grain, and chop wood, but their use has begun to decline since the discovery of traditional (fossil) energy sources and the Extensive use of power grids. Energy is generated from large movable panels fixed at a height by the action of air, and electrical energy is generated from the wind by engines or (turbines) with three rotating arms suspended on a pole convert wind kinetic energy into electrical energy. So when the wind passes through the arm it creates a pulse of air. A driving force causes it to rotate, and this rotation drives the turbine, generating electrical energy.
- Solar energy:** Solar energy is one of the clean, renewable energies that are inexhaustible as long as the sun is present, and all the energy sources on the earth have first originated from solar

## TOPIC 03: Renewable energies and energy efficiency

energy, and this energy can be converted directly or indirectly into heat, cold, electricity and motive power (Ferouhat, 2012, p. 150). The use of thermal energy from the sun has been known for thousands of years in warm regions, as it was used to heat water and dry certain crops to protect them from damage. Currently, research and experiments aim to exploit solar energy in electricity production, heating and air conditioning, metal smelting, etc. and solar energy varies depending on temperature and distance from the earth and it also reaches the ground by light or radiation, on clear days and when the sun is vertical it is an abundant source.

Photovoltaic panels capable of converting sunlight into electricity are also expected to be successful. Solar thermal energy is considered a relatively new and promising technology to a large extent, because its resources are abundant and its environmental impact is limited, and at the same time it offers the most sun-exposed countries in the world, to those currently provided by wind farms in European seas with the most vulnerable shores to wind.

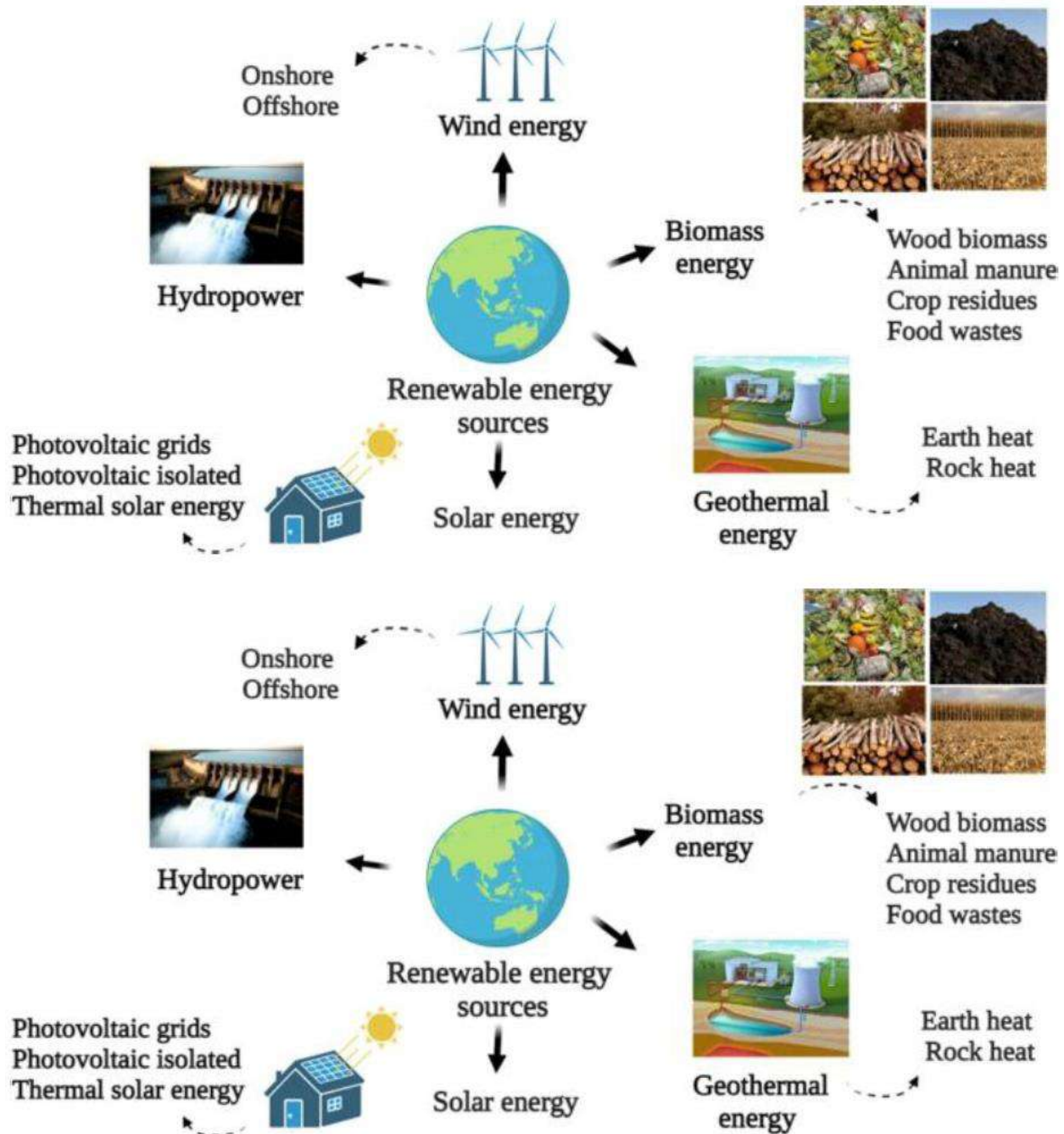
c) Geothermal energy: The principle of geothermal heat is to exploit energy from the ground for use in the form of heating or electricity, as the heat rises mainly from the surface of the earth towards its interior, and the temperature rise changes according to the depth, and this heat is produced mainly by radioactivity. This amount of heat is only obtained if the geological components inside the Earth have pores and permeability. Also, on water reservoir layers (aquifers with water or water vapor) (Muschet, 2000, p. 17).

d) Hydropower energy: Hydropower is a proven and cost-effective renewable energy, in which electrical energy is generated from the harvested energy of moving water from higher to lower elevations. Compared to other renewable energy sources, hydropower has the highest conversion efficiency of about 90% to produce electricity. Hydropower contributes 20% of electricity production worldwide. Hydropower systems can be renovated to meet load requirements with maximum capacity factor. Therefore, there are many different types of hydropower such as pumped storage hydropower, small hydropower and cascade reservoir hydropower.

e) Biomass: Biomass is what is collected from waste, such as dead trees, branches and leaves, crop residue, wood pieces, etc. Waste recycling is intended to be reused to produce other products of lower quality than the original product, while its purpose is reuse, for example, reusing plastic bottles for mineral water after sterilization (Khayyat, 2012, p. 12).

## TOPIC 03: Renewable energies and energy efficiency

Fig. 2. Renewable energy types.



Various renewable energy sources can be used to produce energy that can replace fossil fuels and as a tool for climate change mitigation strategies. The most common energy sources are solar, wind, geothermal, hydropower, and biomass. Hydrothermal is the leading energy source, with the capacity to generate 1,150 gigawatts of electricity (Ahmed I. Osman *et al*, 2019).

## TOPIC 03: Renewable energies and energy efficiency

---

### 3. Synergy between Renewable Energy and Energy Efficiency:

Renewable energy and energy efficiency complement one other. When pursued together, they can result in higher energy intensity and lower energy costs. Improved efficiency may reduce overall energy demand, allowing renewable energy to grow quicker in the energy mix. Renewable energy "energy efficiency" synergy investigates how this synergy influences the value of the energy system and technology, as well as the consequences on air pollution and the health of pollutants. Furthermore, as environmental concerns about fossil fuel generation and energy supply security have grown, there has been a greater focus on the development of cleaner renewable energy solutions. Renewable energies can supply cleaner energy, but economic pressures on module prices have resulted in significant losses for module producers and many failures in the area. Furthermore, the cost of completing technology development and commercialization is considerable, and funding opportunities have grown few. As a result, there is a genuine need to reconsider the concept of energy efficiency.

**3.1. Energy efficiency definition:** Energy efficiency simply refers to using less energy to complete the same work, therefore avoiding energy waste (EESI, 2020). According to another definition (Cleary & Palmer, 2020), energy efficiency refers to employing less energy to supply an energy service. LED light bulbs, for example, may produce the same amount of light as incandescent light bulbs while using 75 to 80 percent less electricity. Because energy production often produces pollutants and greenhouse gases, boosting the energy efficiency of some technologies has the potential to significantly decrease energy consumption and, as a result, energy sector emissions.

### 4. The benefits of energy efficiency and renewable energy:

Energy efficiency and renewable energy policies can reduce the demand for and supply of energy generated from fossil fuels (e.g., natural gas, oil, and coal-fired power plants). Although this reduction in demand can lead to negative impacts (i.e., losses in revenue to the fossil fuel industry)

**4.1. Electricity system benefits:** Energy efficiency and renewable energy initiatives—in combination with demand response measures—can help protect electricity producers and consumers from the costs of adding new capacity to the system and from energy supply disruptions, volatile energy prices, and other reliability and security risks.

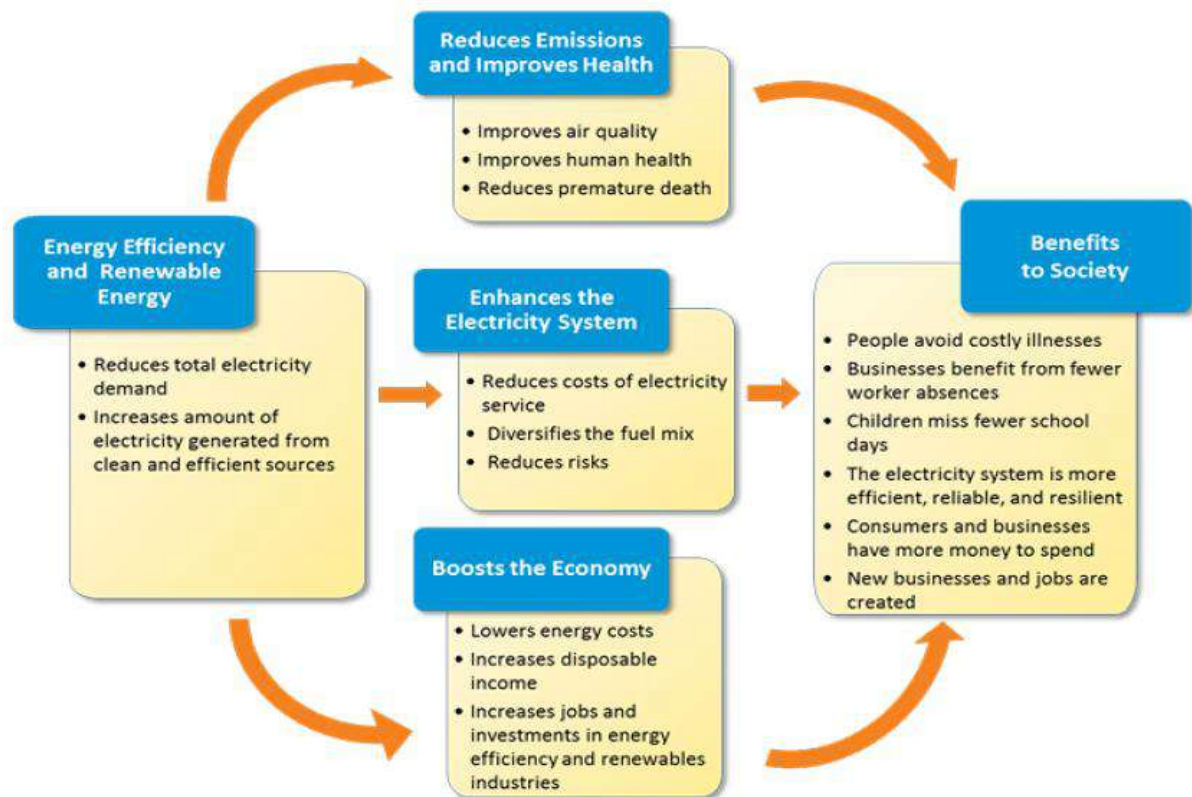
**4.2. Emissions and health benefits:** Fossil fuel-based electricity generation is a source of air pollution that poses risks to human health, including respiratory illness from fine-particle pollution and ground-level ozone (U.S. EPA, 2016). The burning of fossil fuels for electricity is also the largest source of greenhouse gas (GHG) emissions from human activities in the United States, contributing to global climate change (U.S. EPA, 2017). Improving energy efficiency and increasing the use of renewable energy can reduce fossil fuel-based generation and its associated adverse health and environmental consequences.



## TOPIC 03: Renewable energies and energy efficiency

4.3. Economic benefits: Many of the electricity system, emissions, and health benefits yield overall economic benefits to the state. These benefits include savings in energy and fuel costs for consumers, businesses, and the government; new jobs in, profits for, and tax revenue from companies that support or use energy efficiency and renewable energy, such as construction, manufacturing, and services; and higher productivity from employees and students taking fewer sick days.

Fig. 3. The Multiple Benefits of Energy Efficiency and Renewable Energy



Source: EPA. (2018). Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy. US: U.S. Environmental Protection Agency. P 7.

### 5. Methods for Improving Energy Efficiency:

Energy technologies convert energy sources into energy services including lighting, transportation, and heating. When any energy is converted, some energy is lost. When less energy is lost during conversion, the technology's energy efficiency improves. To improve energy efficiency in buildings and transportation regions, a variety of technologies and architectural features are available.

There are a range of energy-efficient devices, appliances, and other equipment available for many electricity end-uses that offer the same service using less energy, either through improvements in efficiency of appliances (such as stoves, air conditioners, and refrigerators). Or through the use of

## **TOPIC 03: Renewable energies and energy efficiency**

---

technologies that consume less fuel (such as hybrid or electric vehicles relative to gasoline cars). Other measures can also be taken to reduce energy consumption, such as improving the insulation of buildings (EESI, 2020).

Furthermore, the following energy-saving strategies can be implemented:

Use halogen incandescent bulbs, compact fluorescent lights (CFLs), since the CFLs produce the same light output and warm colors as incandescent bulbs and are very energy efficient. They consume up to 75% less energy and last up to ten times longer than standard incandescent light bulbs (NRC, 2014).

Using smart power trips; installing a programmable or smart thermostat; purchasing energy efficient appliances; reducing water heating expenses; installing energy efficient windows; upgrading heating, ventilation and air conditioning (HVAC) system, and streamline your energy bill.

### **6. Challenges and suggestions:**

Renewable energy is gradually becoming the major source of electricity generation in low-carbon energy economies. Appropriate alternatives should be integrated to current conventional energy system to allow corresponding RE sources to involve. It is undeniably challenging to implement the transition of energy from non-sustainable to RE as there are major technology challenges to overcome, although there is growing trend of RE applications (Ang, Tze-Zhang, et al, 2022). Essentially, most of the limitations of REs are due to their natural characteristics.

### **7. Conclusion:**

Environmental issues such as climate change, global warming, and ozone layer depletion have become more severe/catastrophic/devastating. To address the issue, more developing and developed countries are collaborating to expand the use of renewable energy technologies. In order to do so, numerous studies and innovations must be conducted, and the introduction of innovative technologies and components is highly encouraged for more efficient and cost-effective renewable energy-based power generation. Apart from technological advancement, to avail the benefits of renewable energy, affordable costing, incentives, friendly regulations, and social awareness and acceptance are required. Governments and non-governmental organizations need to play significant role in these aspects. Additional research is also required to integrate these elements in order to ensure appropriate selection and proper deployment of renewable energy resources based on geography.

### **8. Referrals and references:**

A. Qazi, F. Hussain, N. Abd Rahim, G. Hardaker, D. Alghazzawi, K. Shaban, K. Haruna, Towards sustainable energy: a systematic review of renewable energy sources technologies, and public opinions, IEEE Access

## TOPIC 03: Renewable energies and energy efficiency

7 (2019) 63837–63851. Ang, Tze-Zhang, et al. "A comprehensive study of renewable energy sources: Classifications, challenges and suggestions." *Energy Strategy Reviews* 43 (2022): 100939.

Cleary, K., & Palmer, K. Energy Efficiency 101. (2020, June 17), sur Resources for future: <https://www.rff.org/publications/explainers/energy-efficiency-101/>

E. Vine, *Breaking Down the Silos: the Integration of Energy Efficiency, Renewable Energy, Demand Respond and Climate Change*, vol. 1, Energy Efficiency, 2008, pp. 49–63.

EESI. Environmental and energy study institute, Energy Efficiency (2020).

EPA. Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy. US: U.S. Environmental Protection Agency (2018).

F. Rizzi, N.J. van Eck, M. Frey, The production of scientific knowledge on renewable energies: worldwide trends, dynamics can challenges and implications for management, *Renew. Energy* 62 (2014) 657–671.

Ferouhat, H. Renewable Energies as an Entrance to Achieving Sustainable Development in Algeria A study of the reality of the solar energy application project in the Great South in Algeria., *Al-Baheth Journal*, 11 (2012). (arabic reference).

Khayyat, M. *Energy: Its Sources, Types, and Uses*. Cairo: Publications of the Ministry of Electricity and Energy (2012). (arabic reference).

Muschet, D. *Principles of Sustainable Development*. Egypt: International House for Cultural Investments. (2000).

NRC. Enlighten yourself about energy-efficient light bulbs. (a. r. © Her Majesty the Queen in Right of Canada, Éditeur) (2014), sur Natural Resources Canada: <https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/energystar/Enlighten%20Yourself.pdf>

OPEC. Annual report, number 33(2007).

Osman, A.I., Chen, L., Yang, M. et al. Cost, environmental impact, and resilience of renewable energy under a changing climate: a review. *Environ Chem Lett* 21, 741–764 (2023). Rahman A, Farrok O, Haque MM. Environmental impact of renewable energy source based electrical power plants: Solar, wind, hydroelectric, biomass, geothermal, tidal, ocean, and osmotic. *Renew Sustain Energy Rev* (2022) 161:112279.



## **TOPIC 03: Renewable energies and energy efficiency**

---

S. Manish, I.R. Pillai, R. Banerjee, Sustainability analysis of renewables for climate change mitigation, Energy Sustain. Dev. 10 (4) (2006) 25-36.

W.G. Santika, M. Anisuzzaman, P.A. Bahri, G. Shafiullah, G.V. Rupf, T. Urmee, From goals to joules: a quantitative approach of interlinkages between energy and the Sustainable Development Goals, Energy Res. Social Sci. 50 (2019) 201-214.

Wakaa, M. Engineering Renewable and Sustainable Energy. Consulté le 01 21, 2021, sur Cultural Philadelphia (2019) : The article is available at

<https://www.philadelphia.edu.jo/philadreview/issue6/no6/17.pdf> . (arabic reference).

## TOPIC 03: Renewable energies and energy efficiency

### Theoretical study on the different HTM and ETM layers' effect on the solar cell efficiency using SCAPS-1D

A. Begagraa, M. Bouchnafaa, S. Hairecheb, M.S.Sarhanic

a University of Laghouat, Faculty of Sciences, Materials Laboratory for Applications and Valorisation of Renewable Energy, Laghouat, Algeria

b Laboratory of Physics for Experimental Techniques and Applications, University of Medea, Algeria.

c Materials physics laboratory

#### Abstract

Recently, chalcogenide perovskites have been considered environmentally friendly, non-toxic semiconductor materials. As a consequence of their exceptional optoelectronic properties, they gained the researchers' attention. Previously, the studies showed that BaZrS<sub>3</sub> has a perovskite-type structure with a perfect band gap for photovoltaic applications. Also, it shows a high tolerance to defects, carrier mobility, and a large absorption coefficient ( $> 10^5 \text{ cm}^{-1}$ ). In this work, we care about the effect of different hole transport materials (HTM) and electron transport materials (ETM) on the efficiency of the BaZrS<sub>3</sub> (absorber) in the solar cell. Then we optimized the thickness of the deposited layers to obtain an optimal structure with high power conversion efficiency. We used the SCAPS-1D simulator to calculate the solar cell efficiency.

**Keywords:** chalcogenide perovskites, BaZrS<sub>3</sub>, solar cells, photovoltaics, power conversion efficiency, Hole transport material (HTM), Electron transport material (ETM), SCAPS-1D.

\*Corresponding author

E-mail: an.begagra@lagh-univ.dz

## TOPIC 03: Renewable energies and energy efficiency

### A theoretical study on potassium germanium tri-chloride for perovskite solar cells

Mohammed ElSaid SARHANI a\*, Mohamed Lamine BELKHIR a, Bachir BENTRIAa, Anfal BEGAGRAB

a Materials physics laboratory, Amar Thlidji University; Laghouat, Algeria.

b Materials Laboratory for applications and valorization of renewable energy, Amar Thlidji University; Laghouat, Algeria

\*Corresponding author: E-mail: m.sarhani@lagh-univ.dz

#### Abstract

In this theoretical study, we investigate the potential of  $\text{KGeCl}_3$  as a lead-free perovskite active layer for perovskite solar cells. Using the generalized gradient approximation (GGA) within the wien2k package, we perform calculations of the structural, electronic, elastic, optic, and thermoelectric properties of  $\text{KGeCl}_3$  in its cubic, tetragonal, and orthorhombic phases. Our results show that the tetragonal phase of  $\text{KGeCl}_3$  has the lowest energy and is the most stable phase. We find that the electronic band structure of  $\text{KGeCl}_3$  exhibits a direct band gap of 0.92 to 1.88 eV from cubic to the orthorhombic system, making it a promising material for use as a photovoltaic absorber. Furthermore, we calculate the elastic properties of  $\text{KGeCl}_3$ , indicating that it possesses suitable mechanical stability for practical applications. Additionally, we examine the optical properties and thermoelectric performance of  $\text{KGeCl}_3$ , highlighting its potential for use in thermoelectric devices. Overall, our study demonstrates the potential of  $\text{KGeCl}_3$  as a promising alternative to lead-based perovskite materials for use in solar cells and other optoelectronic devices.

**Keywords:**  $\text{KGeCl}_3$ , PSCs, Lead-free based perovskite, first principle, thermoelectric

## TOPIC 03: Renewable energies and energy efficiency

### Efficiencies evaluation of various advanced meta-heuristic optimization techniques for the optimal configuration of distribution systems in the presence of PV and wind turbine hybrid systems

Terbah Hocine<sup>1</sup>, Chettih Saliha<sup>2</sup>

<sup>1</sup> Amar Telidji University of Laghouat, Algeria (UATL), BP 37G Laghouat 03000, Algeria Semiconductors and Functional Materials Laboratory (LSCMF).

<sup>2</sup> Amar Telidji University of Laghouat, Algeria (UATL), BP 37G Laghouat 03000, Algeria Semiconductors and Functional Materials Laboratory (LSCMF).\*

#### Abstract

The application of different meta-heuristic optimization techniques (MHOT) has recently received wide use from many researchers in the domain of electrical engineering, especially for the optimal insertion of renewable energy sources (RES) in the electrical distribution system (EDS). In this work, we faced two main challenges: first, adjusting the optimization parameters for each algorithm separately in order to increase the efficiency of research in the exploitation and exploration phases; and second, establishing a new optimization technique, the Hybrid Improved Whale and Sine Cosine Optimization Algorithm (HIWSCO), based on the randomly determined distance between each whale's current position and the best position using probabilistic-based sine and cosine functions. During the integration of RES, we chose a PV and wind turbine hybrid system (PVWTHS). In order to better manage the uncertainty of both sources, we have identified two main technical challenges during the optimal integration of the hybrid system: the correction of the average voltage deviation indicator (AVDI) and reducing the total active power losses (TAPL). We chose three test systems—the IEEE 33 and IEEE 69 standard EDS. Then the application of the most efficient optimization technique to overhead and undergrounding 63 bus systems using private data on the Algerian Electricity and Gas Distribution Company (AEGDC)

**Keywords:** meta-heuristic optimization techniques; Hybrid Improved Whale and Sine Cosine Optimization Algorithm; PV and wind turbine hybrid system; average voltage deviation indicator; total active power losses

## TOPIC 03: Renewable energies and energy efficiency

### Synthèse par électrodéposition du film ZnS utilisé comme couche tampon dans la cellule solaire à base de CIGSe

Amria Bencherif 1\*, Essaid Bousbiat 2, Assia Bouraiou 3 et Abdelhalim Zoukel 4,5

1 Département de physique, Université de Boumerdes, Algérie.

2 Département de physique, LSIC, École normale supérieure de Kouba, Algérie.

3 Laboratoire des sciences et informatique des matériaux, Université de Djelfa, Algérie.

4 Laboratoire de Physique-Chimie des Matériaux, Université de Laghouat, Algérie.

5 Centre de recherche scientifique et technique en analyse physico-chimique (PTAPC-Laghouat-CRAPC), Algérie.

\*Auteur correspondant : [a.bencherif@univ-boumerdes.dz](mailto:a.bencherif@univ-boumerdes.dz)

#### Résumé

La couche tampon des cellules solaires à base de CIGSe, est constituée généralement de CdS. Ce dernier matériau présente plusieurs inconvénients notamment la toxicité du cadmium et la faible énergie de son gap qui empêche les rayons lumineux de haute énergie de pénétrer dans la couche absorbante. Le sulfure de zinc ZnS est un candidat promoteur pour remplacer le CdS en obtenant un rendement de conversion équivalent.

Dans le présent travail, une couche mince de ZnS est déposée sur un substrat d'ITO par électrodéposition. La solution électrolytique est constituée de 0.05 M de (ZnSO<sub>4</sub>+7H<sub>2</sub>O) dissous dans de l'eau déminéralisée. Le dépôt est réalisé sous une tension de -7 V à 65 °C pendant 45 min. Après le dépôt, l'échantillon est enfermé avec 30 mg de soufre en poudre dans une capsule en verre remplie d'un mélange gazeux de 10 mbar d'argon-néon, et un recuit thermique est réalisé à 500 °C pendant 60 min.

Les propriétés structurales, morphologiques et optiques de la couche élaborée ont été étudiées. La DRX a montré la présence de la phase hexagonale ZnS avec une croissance selon la direction (102). Les paramètres de maille a et c calculés sont respectivement 3.80 et 18.64 Å. La spectroscopie Raman a montré également la ligne caractéristique de ZnS située à 345 cm<sup>-1</sup> et qui est assignée au mode LO, avec une constante de couplage de Fröhlich (I<sub>2</sub>LO/I<sub>1</sub>LO) égale à 0.77. Les images MEB ont montré une distribution homogène de nanoflakes sur la surface élaborée. Dans le domaine visible, la transmittance optique de la couche varie de 71 à 74%.

**Mots clés:** Photovoltaïques, Couche tampon, ZnS, Électrodéposition.

## TOPIC 03: Renewable energies and energy efficiency

---

### Numerical Analysis of the Efficacy of Turbulence Models in Predicting Aerodynamic Performance of Asymmetric Profiles

R. Boukaraoun, F. Brahimi, S. Mohandi

#### Abstract

Aerodynamic profiles play a pivotal role in the design and efficiency of energy systems, such as aircraft wings, turbomachine blades, and wind turbine blades. Asymmetric profiles are characterized by their unique features, making them especially intriguing for various applications. While the performance of these profiles has been studied from multiple perspectives, there remain ambiguities related to instabilities that can occur in an airflow, particularly the stall phenomenon at different angles of attack. In this light, the present study undertakes a detailed numerical analysis of asymmetric profiles, with a particular emphasis on the efficacy of various turbulence models, namely  $k-\omega$  SST,  $k-\omega$ ,  $k-\varepsilon$ , and Spalart-Allmaras in predicting stall. The numerical investigation is conducted using the ANSYS software, utilizing a specific mesh designed for an asymmetric aerodynamic profile. A comparison of the study's findings with experimental results was carried out. In summary, this study provides an in-depth insight into the behavior of asymmetric profiles in an airflow under various operating conditions and offers a comparative analysis of commonly used turbulence models.

**Keywords :** aerodynamic performance, asymmetric profile, CFD, stall, airflow.

## TOPIC 03: Renewable energies and energy efficiency

### Impact of ceramic tungsten oxide and diazonium salts chemistry on a polypyrrole-based ternary composite material's enhanced thermoelectric features

Nedjar Linda\*1, Mekki Ahmed1 and Bekkar Djelloul Sayah Zakaria1

1 Polytechnic Military School, BP17 - 16046 Bordj El-Bahri, Algiers, Algeria

\*Corresponding author e-mail: [nedjar.nedjarlinda@gmail.com](mailto:nedjar.nedjarlinda@gmail.com)

#### Abstract

Worldwide research is currently focused on methods for either producing or recovering wasted energy. For this aim, many systems have been built based on various operating concepts; amongst them, thermoelectric (TE) systems that rely on potent TE materials, that convert heat into electricity [1,2]. High-performance TE materials are presumed to have an increased thermopower ( $S$ ) coefficient and electrical conductivity ( $\sigma$ ) while exhibiting lower thermal conductivity ( $\kappa$ ). The dimensionless parameter  $ZT$  is designed as the combination of the three aforementioned coefficients through the following relationship,  $ZT = \sigma \times S^2 \times T / \kappa$ . The present contribution investigates the thermoelectric properties of ternary p-n heterojunction composites based on [p-type polymer/diazonium functionalized graphene/metal oxide in ceramic form]. Polymerization of pyrrole was performed in-situ in the presence of ceramic tungsten oxide ( $WO_3$ ) particles and diazonium salt surface-treated graphene frGO (DS-SO<sub>3</sub>H). Thermoelectric studies revealed that the PPy-frGO (DS-SO<sub>3</sub>H)- $WO_3$  composite based on functionalized graphene with diazonium salt (DS-SO<sub>3</sub>H) has the best thermoelectric properties. The improvement is attributed to combining functionalized graphene and the thermochemical treatment of tungsten oxide particles produced using the Sol-Gel method and sintering operations. The functionalization of graphene lowered thermal conductivity to the value of 0.127 W.m<sup>-1</sup>.K<sup>-1</sup> while the thermochemical treatment of  $WO_3$  enhanced electrical conductivity to reach the value of 1087 S/m, resulting in a figure of merit ( $ZT$ ) of roughly  $1.63 \times 10^{-4}$ . In addition, structural and morphological investigation were carried out by using different characterization techniques, including X-ray diffraction (XRD), diffuse reflectance UV-Vis spectroscopy, I-V characteristics, scanning electron microscopy - energy dispersive spectrometer (SEM-EDS) and Raman spectroscopy.

**Keywords:** thermoelectricity, p-n heterojunction, pyrrole ternary composite, tungsten oxide, diazonium salts.

## TOPIC 03: Renewable energies and energy efficiency

---

### References

1. Debnath, A., Deb, K., Bhowmik, K. L. & Saha, B. Reduced Hopping Barrier Potential in NiO Nanoparticle-Incorporated, Polypyrrole-Coated Graphene with Enhanced Thermoelectric Properties. ACS Applied Energy Materials (2020) doi:10.1021/acsaem.0c01174.
2. Debnath, A., Deb, K., Sarkar, K. & Saha, B. Low Interfacial Energy Barrier and Improved Thermoelectric Performance in Te-Incorporated Polypyrrole. J. Phys. Chem. C 125, 168-177 (2021).



## TOPIC 03: Renewable energies and energy efficiency

---

### ETUDE EXPERIMENTALE DES PERFORMANCES ENERGETIQUES D'UN SYSTEME SOLAIRE THERMIQUE DE PRODUCTION D'EAU CHAUDE A USAGE SANITAIRE

BOUGUERGOUR Yassine<sup>1</sup>, MOKHTARI Abderrahmane Mejedoub<sup>1</sup>, MENHOUDJ Sayeh<sup>1</sup>

<sup>1</sup>Laboratoire de Matériaux sols et thermique (LMST), Faculté d'Architecture et Génie Civil, Université des Sciences et de la Technologie d'Oran Mohamed Boudiaf, USTO-MB, BP 1505, El M'naouar, BP 1505, Bir El Djir 31000, Oran, Algérie

Email : [yassine.bouquergour@univ-usto.dz](mailto:yassine.bouquergour@univ-usto.dz)

#### Résumé

Ce travail porte sur l'étude expérimentale des performances énergétiques d'un système solaire thermique utilisé pour produire l'eau chaude à usage sanitaire (ECS). Il est composé d'un capteur solaire thermique plan 4,46m<sup>2</sup> de surface et d'un ballon de stockage d'eau chaude d'une capacité de 304 litres. Un réseau hydraulique de tuyau en multicouches assure la liaison des deux composants. Le puisage de l'eau chaude se fait dans un Lavabo, par moyen d'une vanne asservie commandée à distance. Un dispositif de mesure est installé pour suivre l'évolution des températures à différents points (température de l'air extérieure, température de l'eau dans le ballon à une hauteur de 60cm, température d'eau froide. Pour cela une stratégie de régulation et de gestion de l'énergie est utilisée pour gérer le système étudié. Les résultats obtenus montrent que le capteur solaire thermique mis en essai à des niveaux de couverture en besoin d'eau chaude non négligeable avec une moyenne journalier de 5,2 kWh en saison estivale.

**Mots-clés :** capteur solaire thermique ; ballon d'eau chaude ; stockage d'énergie ; régulation ; performance énergétique

## TOPIC 03: Renewable energies and energy efficiency

### Les propriétés structurales, optiques et électrochimiques des couches minces électrochimiques d'oxyde de cuivre

Halima Bensenouci <sup>1✉</sup>, Ahmed Hamdi <sup>2</sup>

<sup>1,2.</sup> Laboratoire de Physico-chimie des Matériaux, Université Amar Telidji de Laghouat, Algérie City

✉ [h.bensenouci@lagh-univ.dz](mailto:h.bensenouci@lagh-univ.dz)

#### Résumé

Dans cette étude, nous avons préparé des couches minces semi-conductrices d'oxyde de cuivre (II) sur des substrats de verre d'oxyde d'étain dopé au fluor (FTO), sur la base d'étapes d'électrodéposition et de post-recuit très simple. L'électrodéposition a été réalisée dans une solution aqueuse basique contenant des nitrates de cuivre hydratés et du nitrate d'ammonium à température ambiante à -0,9 V par rapport à l'ECS, ce potentiel a été choisi par voltammétrie cyclique et confirmé par Square WV. Ensuite, nous avons appliqué une méthode simple qui implique un dépôt chrono-ampérométrique pendant 5 min et une oxydation thermique ultérieure a été effectuée à 400 ° C dans l'air pendant 4 heures.

Les électrodes ont été caractérisées par des mesures SEM-EDS pour voir la morphologie du dépôt et sa composition, XRD pour déterminer plusieurs paramètres cristallographiques, UV-VIS pour déterminer l'énergie de gap.

L'objectif de cette étude est basé sur la caractérisation photo-électrochimique de l'électrode anodisé en présence et en absence de la lumière en utilisant des techniques purement électrochimiques à savoir la voltammétrie, la chronoampérométrie, et l'analyse Mott-Schottky.

**Mots-clés :** Oxyde de cuivre (II), semi-conducteur, électrodéposition, voltammétrie cyclique, SEM-EDS, XRD, UV-Vis.

## TOPIC 03: Renewable energies and energy efficiency

---

### Experimental study of horizontal and inclined solar radiation through empirical models applied in Photovoltaic power plants center , Ghardaïa state

#### Abstract

Throughout the day, the solar panels intercepted luminous flux level usually depends on the position of the sun, where the solar panels are set in various positions, such as the horizontal position ( $0^\circ$ ) and the incline position ( $30^\circ$ ), which are related to the area's inclination angle and height. This work aims to propose a comparative study using semi-empirical approaches for determining the horizontal and incline solar radiation in OUED-NECHOU Ghardaïa region. Moreover, to confirm that the model we used is accurate and produces a strong result in the area. For this, we have adopted the model of PERRIN DE BRICHAMBAUT to estimate the illumination which is hardly ever used and we will compare it with inclined and horizontal experimental radiation data of the region. The model is identified and assessed using MATLAB environment. The recorded data have been obtained from a weather station installed on OUED-NECHOU photovoltaic panels center, to investigate the variation in solar radiation in the area throughout specific days on particular months of the year .

Through comparison between calculated and measured values, it turns out that the findings of this study indicate that PERRIN DE BRICHAMBAUT model gives more effectiveness for estimating the total solar radiation on inclined and horizontal surface of clear sky over the city of Ghardaïa, Additionally correlation coefficient (CC) reach max value 0.9720 which is good outcome, the statistical analysis evaluates the absolute error (AE), mean absolute error (MAE) and mean squared error (RMSE) , correlation coefficient (CC) .

## TOPIC 03: Renewable energies and energy efficiency

### Electrochemical and optical investigations on Ag doped CdS thin films for solar cell application

Abla kamilia Madkour<sup>\*1</sup>, Ahmed Hamdi<sup>2</sup>, Fatiha Rogti<sup>3</sup>

<sup>1</sup>Department of electrotechnics, University of Amar Telidji, Laboratory of Analysis and Control of Energy Systems and Power Networks, Laghouat, Algeria.

<sup>2</sup> Department of Matter Sciences, University of Amar Telidji, Laboratory of Physico-Chemistry of Materials, Laghouat, Algeria.

<sup>3</sup> Department of electrotechnics, University of Amar Telidji, Laghouat, Algeria.

\*correspondance E-mail: [a.madkour@lagh-univ.dz](mailto:a.madkour@lagh-univ.dz)

#### Abstract

In this study, electrodeposition technique for depositing Ag-doped CdS thin films with varied Ag concentrations on FTO substrate has been described. The impact of doping on the optical and electrochemical characteristics of CdS thin film was discussed and analyzed. The deposition of the films was achieved under linear sweep voltammetry (LSV), square wave voltammetry (SWV) and chronoamperometry (CA) studies. The optical properties of the obtained samples were studied using UV-Vis spectroscopy. Electrochemical impedance spectroscopy (EIS) and the Mott Schottky analysis were performed to study the charge transfer mechanism over the electrode/electrolyte interface, also to evaluate the conduction behavior of the electrodeposited Ag doped cadmium sulfide thin films and moreover to determine the flatband potential and carrier density. According to the results, the optimal Ag ratio was obtained at Ag 2%, which encourages the usage of CdS in this ratio as an efficient buffer layer on photovoltaic devices.

## TOPIC 03: Renewable energies and energy efficiency

---

### EVAPORATION ESTIMATION FOR THE BREZINA RESERVOIR DAM- AL BAYADH A NOVEL MODEL INTEGRATING HAMON AND SCHENDEL APPROACHES.

Assia Mezian<sup>1</sup>

<sup>1</sup> Faculty of Technology, Department of Hydraulic and Civil Engineering, University of El-Oued, 39000 El-Oued, Algeria.

#### Abstract

The study introduces a novel model for the Brezina reservoir dam's evaporation estimation, integrating and enhancing conceptions from the Hamon and Schendel approaches. This model relies on three crucial climatic parameters, meaning air temperature ( $T_{moy}$ ), relative humidity ( $H_r$ ), and daylight duration ( $D$ ). Graphic representation of the model reveals remarkable confluence between measured and predicted evaporation curves. The proposed model exhibits monthly errors range from -11% to 10%. Specially, the annual estimation error for the Brezina dam's evaporation stands at 0 %. The model demonstrates a veritably good performance, as substantiated by performance indexes: Nash- Sutcliffe Efficiency (NSE) = 1.00, Root Mean Square Error (RMSE) = 10.78, Mean Bias Error (MBE) = 3.11, Coefficient of determination ( $R^2$ ) = 0.99, and Root Sum of Squares rate (RSR) = 0.01.

**Keywords:** Evaporation Estimation, Integrated Approach, Brezina Reservoir Dam, Hydrological Modeling, Algeria

## TOPIC 03: Renewable energies and energy efficiency

### Enhancing ZnX (X = O, Te, S) Compound Properties via LDA Approach and CASTP Program: Computational Investigation of Structural, Elastic, and Mechanical Aspects

Faiza Benlakhdar<sup>1,\*</sup>, Idris Bouchama<sup>2,3</sup>, Tayeb Chihi<sup>3,4</sup>, Ibrahim Ghebouli<sup>3,4</sup>, Zohra Zerrougui<sup>5</sup>

<sup>1</sup>Electronics Department, Faculty of Technology, University of Setif 1, 19000, Algeria.

<sup>2</sup>Electronics Department, Faculty of Technology, University of Msila, Msila, 28000, Algeria.

<sup>3</sup>Research Unit on Emerging Materials (RUEM), University Ferhat Abbas of Setif 1, Setif, 19000, Algeria.

<sup>4</sup>Laboratory for Elaboration of New Materials and Characterization (LENMC), University of Ferhat Abbas, Setif 19000, Algeria.

<sup>5</sup>Laboratory of Surfaces and Interfaces Studies Solid Materials (LESIMS), Department of Technology, Ferhat ABBAS Setif1 University, Setif, Algeria.

\*(benlakhdar228@gmail.com) Email of the corresponding author

#### Abstract

This investigation undertakes a comprehensive exploration into the inherent structural, elastic, and mechanical attributes exhibited by ZnX compounds, with a specific focus on instances where X corresponds to O, Te, and S. Employing the robust framework of density functional theory (DFT) in conjunction with the CASTEP software, this study employs the Local Density Approximation (GGA) to meticulously scrutinize the cross-correlation function. The computational outcomes encompass a thorough analysis of lattice modulus and mechanical elasticity traits, which are meticulously validated against empirical observations and theoretical predictions. These findings collectively underscore the tantalizing potential of ZnX compounds (where X embodies O, Te, and S) within the realm of optoelectronic applications, notably encompassing solar cell technologies, as a result of their intrinsically favorable attributes. Furthermore, the integration of intricate insights concerning elastic and mechanical properties offers an enriched comprehension of the applicability of these compounds, particularly in the context of flexible solar cell advancements. The prowess of the CASTEP program as an indispensable tool for attribute estimation is notably evident through the application of GGA-based cross-correlation function calculations. The amalgamation of theoretical insights and computational advancements achieved in this study contributes substantively to the expanding domain of materials science. In conclusion, this work serves as a pivotal stepping stone towards refining material design strategies for

## TOPIC 03: Renewable energies and energy efficiency

---

cutting-edge optoelectronic devices, thereby paving the way for innovation and advancement in this technologically pivotal field.

**Keywords:** ZnX compounds; Structural properties; Elastic properties; Mechanical properties; Density functional theory (DFT); CASTEP software; Local Density Approximation (GGA); Lattice modulus;

## TOPIC 03: Renewable energies and energy efficiency

### Study the impact of bulk traps on an IZTO/Ga<sub>2</sub>O<sub>3</sub>/ITO solar-blind photodetector

Rima Cherroun

Laboratory of Semiconducting and Metallic Materials (LMSM), Mohammed Khider University, Material sciences Department, Biskra, Algeria

Afak Meftah

Laboratory of Semiconducting and Metallic Materials (LMSM), Mohammed Khider University, Material sciences Department, Biskra, Algeria

\*Corresponding Author: [rima.cherroun@univ-biskra.dz](mailto:rima.cherroun@univ-biskra.dz)

#### Abstract:

InZnSnO<sub>2</sub> (IZTO)/β-Ga<sub>2</sub>O<sub>3</sub> Schottky solar barrier photodetector (PhD) exposed to 255 nm was simulated and compared to the measurement. Numerical simulations successfully reproduced the photocurrent at reverse bias and response by taking into account several factors such as conduction mechanisms and material parameters. By adopting reducing the density of the trap as an improvement. The effect of reducing the bulk trap densities on the photocurrent, response, and time-dependent (continuous conductivity) was studied. As the trap density decreased, the photocurrent increased. The response was 0.04 A/W for the low Ga<sub>2</sub>O<sub>3</sub> trap density. The estimated decay time for the lowest intensity ET (0.74, 1.04 eV) is 0.05 s and is shorter at ~0.015 s for ET (0.55 eV). This indicates that the shallow traps had the dominant effect (ET = 0.55 eV) on the continuous photoconductivity phenomenon. Furthermore, with decreasing trap densities, this PhD can be considered as a self-powered solar-blind photodiode (SBPhD).

**Keywords:** Bulk traps, IZTO/β-Ga<sub>2</sub>O<sub>3</sub>., Numerical Simulation, Self-powered solar-blind photodetector.



## TOPIC 03: Renewable energies and energy efficiency

---

### Supplying electricity from a hybrid PV/wind turbine system to an isolated house

Ait Amrane Ouardia<sup>1</sup>, Aris Abdelkader<sup>1</sup>, Benabdallah Tawfik<sup>2</sup>

<sup>1</sup> LARTFM Laboratory , Department of Mechanical engineering, Ecole Nationale Polytechnique d'Oran- Maurice Audin Oran, Algeria

<sup>2</sup> IPSIL Laboratory, Department of Mechanical engineering, Ecole Nationale Polytechnique d'Oran-Maurice Audin, Oran, Algeria

#### Abstract

This paper presents a study on the coverage of electricity needs carried out on a simple house in which a family of 6 lives. This house is located in an isolated area in the town of Bechar in southern Algeria, where power lines stretching for hundreds of kilometres cannot solve the problem. To this end, the installation of renewable energy systems has become a good solution due to the availability of different, renewable and free sources. Thus, the proposed work consists of a hybrid installation (photovoltaic panel/wind turbine) to supply electricity to such houses, for which the TRNSYS simulation software is used to size the system and optimise the possible solutions (number of PV/number of wind turbine) taking into account the daily electricity consumption data. The results obtained show that to cover the electricity needs of this house, it is necessary to install either 2 wind turbines or 8 photovoltaic panels, for the hybrid combination 1 wind turbine will be assembled with 4 photovoltaic panels.

## TOPIC 03: Renewable energies and energy efficiency

### First-principles Calculations of Optical Properties of $\text{Bi}_2\text{S}_3$

Kacemi Nourelhouda<sup>1</sup>, Benbertal Djamel<sup>2</sup>, Hamdi Ahmed<sup>2</sup>, Mohammed Ouled Ali<sup>3</sup>

1. Material sciences department, University of Tamanrasset, Materials and Energies Research Laboratory , Tamanrasset, Algeria
2. University of Amar Téliidji, Materials physico-chemistry research laboratory (LPCM), Laghouat , Algeria
3. Faculty of Material Sciences, Mathematics and Computer Science (FMSMI), University of Ahmed Draia Adrar, Laboratory of Micro and Nanophysics (LaMiN), National Polytechnic School Oran, Algeria

E-mail (Auteur communiquant) kacemihouda@yahoo.fr

#### Abstract:

Despite of various applications in photoelectronic , photoelectrochemical, thermoelectric devices and solar selective ect; group V-VI materials are very interested for investigators, in order to exam their suitable applications[1]Among these compounds bismuth sulfide  $\text{Bi}_2\text{S}_3$  has band gap around 1.3-1.45eV near to the optimal bandgap for the light-absorber matters in the single junction solar cells, and very high optical absorption coefficient,  $>10^4\text{cm}^{-1}$  for  $\lambda < 780\text{ nm}$  and  $>10^5\text{ cm}^{-1}$  for  $\lambda < 500\text{ nm}$ [2] . The structural, electronic and optical properties of orthorhombic  $\text{Bi}_2\text{S}_3$  compound have been investigated by means of first principles calculations. The calculations were performed by using the full-potential linearized augmented plane-wave(FP-LAPW)method implemented in WIEN2K package. The exchange correlation functional was described by local density approximation LDA. For structural properties, the calculated lattice parameters were  $a= 11.24\text{\AA}$ ,  $b=3.97\text{\AA}$  and  $c=10.93\text{\AA}$ , they are in very good agreement with the theorytical finding. The optical properties such as absorption coefficient, refractive index and reflexion coefficient have been computed.

**Keywords:** Metal chalcogenide, band structure, optical properties, absorption coefficient, refractive index.

#### References

1. V.V Killedar, S.N Katore, C.H Bhosale. Preparation and characterization of electrodeposited  $\text{Bi}_2\text{S}_3$  thin films prepared from non aqueous media. Materials chemistry and physics 64 166-169(2000)
2. Dan Han, Mao-Hua Du, Chen-Min Dai, Deyan Sun, Shiyu Chen. Influence of defects and dopants on photovoltaic performance of  $\text{Bi}_2\text{S}_3$ : First Principles Insights. Journal of Materials Chemistry A. 1-22(2017)

## TOPIC 03: Renewable energies and energy efficiency

### Geochemistry evaluation of phosphorite deposits in Ain Dibba and Ain Kissa (NE Algeria)

Diab Ibtissam 1, Laouar Rabah 1, Degaichia Amor 2, Bouhlel Salah 3, Tlili Ali 4

1 Département de Géologie, Laboratoire de Recherche en Géologie, Faculté des Sciences de la Terre, Université Badji Mokhtar Annaba. 23000 Annaba, Algérie

2 Département des Sciences de la Terre et de l'Univers, Laboratoire de recherche : Environnement sédimentaire, ressources minérales et hydriques de l'Algérie orientale, Université Larbi Tébessa, 12000 Tébessa, Algérie

3 Department of Geology, Faculty of Sciences of Tunis, El Manar University, 2092 Tunis, Tunisia

4 Department of Earth Science, Faculty of Science of Sfax, Sfax University, Sfax, Tunisia

ibtissamgeologie2019@gmail.com

#### Abstract.

Algerian phosphorites are considered among the richest Paleocene-Eocene phosphorites in north Africa, due to are paramount for both paleo-environment reconstructions and economic targets. The present investigation is focused on the poorly studied trace elements (TE) in the Ain Kissa and Ain Dibba phosphorites, NE Algeria. Representative samples were characterized and analyzed using several methods, including petrographic description and XRF analysis.

The geochemical whole-rock data show high CaO content that exceed 50%. P<sub>2</sub>O<sub>5</sub> with an average of 18.35%, indicates high apatite content and presence of calcite minerals. The higher CaO/P<sub>2</sub>O<sub>5</sub> ratio in the studied phosphorites (1.82–3.67) suggests an excess of carbonates (i.e., calcite) most likely as a cement of the phosphatic particles.

Trace elements show high Sr content can excess 2400 ppm, U: from 44.27 to 110.25 ppm (average 68.77 ppm). The enrichment and strong correlation with P<sub>2</sub>O<sub>5</sub> indicate incorporation in CFA during the formation of deposits replacing Ca cations. V and Cr display high content in samples enrichment in glauconites particles and positive correlation with Al<sub>2</sub>O<sub>3</sub>, suggest incorporated or adsorption on surface during diagenesis consistent with changing redox and productivity conditions. Therefore, the V/Cr ratio < 2.00 indicates an oxygen-rich environment.

We conclude that the major processes controlling the distribution and enrichment of the trace elements in the phosphorites studied are the substitution with Ca<sup>+2</sup> in CFA, glauconite or a cause adsorption on surface during diagenesis, indicating the paleo-depositional environment in northern basin is more connected to an open sea.

**Keywords :** Phosphorites, Geochemistry, Trace elements, Paleocene-Eocene, Ain Dibba, Ain Kissa, Tébessa.

## **TOPIC 03: Renewable energies and energy efficiency**

### **ETUDE DES PARAMETRES ET PERFORMANCES D'UN DISTILLATEUR SOLAIRE SYMETRIQUE**

Adel Deliou\*<sup>1</sup>, Meriem Dehbi<sup>2</sup>, Khmissi Belkaid<sup>3</sup>

<sup>1</sup> Département de Génie Mécanique, FST, Université Mohamed Seddik Benyahia de Jijel UMSBY,  
BP98, Ouled Aissa, Jijel, Algérie

<sup>2</sup> Scientific and Technical Research Center on Arid Regions CRSTRA, 07000 Biskra, Algeria

<sup>3</sup> Laboratoire de physico-chimie des matériaux et environnement, Université de Djelfa, 17000,  
Algérie

\*Corresponding author E-mail: deliouadel15@gmail.com

#### **RESUME**

Notre travail consiste à étudier expérimentalement et théoriquement un distillateur solaire de type chapelle. Des essais de production d'eau distillée ont été réalisés avec de l'eau de puits ayant une conductivité. L'étude numérique du système par l'application de la méthode des différences finies, nous a permis de mieux voir l'évolution temporelle des températures, la variation des caractéristiques de fonctionnement du distillateur telles que le rendement interne, le rendement global, le rendement et le facteur de performance .

Le programme développé a été validé par l'étude comparative de résultats théoriques et expérimentaux pris dans les mêmes conditions. Les mesures effectuées par notre programme dans les mêmes conditions en ce qui concerne les températures, le flux solaire ont été vérifiées par des mesures effectuées expérimentalement sur un distillateur réalisé au niveau du laboratoire dans les conditions climatiques de la ville de Tipasa.

Le jour du 15 juillet a été choisi pour le calcul, de la productivité journalière en eau distillée. Au cours de cette journée, la production a atteint 5,2 litres ; sous un rayonnement de 1015,75 w/m<sup>2</sup> induisant une température ambiante de 37,5°C avec une saumure atteignant 70,9°C, le rendement interne nominal est de 35,23% avec un rendement global de 53,42% et un facteur de performance de 2,33.10<sup>-4</sup> l/kJ.

**Keywords:** Distillateur solaire; Différences finis; Méthodes des nœuds; Efficacités; Températures

## TOPIC 03: Renewable energies and energy efficiency

### Comparison between absorber materials $\text{CH}_3\text{NH}_3\text{GeI}_3$ and $\text{CsSnGeI}_3$ in n ip perovskite solar cell

D.Abdallaoui<sup>1,a\*</sup>, AF. MEFTAH<sup>2,b</sup> and M.Abdallaoui<sup>3,c</sup>

<sup>1</sup>email address <doua.abdallaoui@univ-biskra.dz>

<sup>2</sup> email address <af.meftah@univ-biskra.dz>

<sup>3</sup> email address <maroua.abdallaoui@univ-biskra.dz>

#### Abstract

In this work, lead halide perovskite solar cell (PSC), is studied and optimized using SCAPS software in order to enhance the efficiency, two different absorber layer are:  $\text{CH}_3\text{NH}_3\text{GeI}_3$  and  $\text{CsSnGeI}_3$  hole transport materials (HTL)  $\text{Cu}_2\text{O}$  and electron transport material (ETL)  $\text{TiO}_2$ .

**Keywords:** hole transport materials , electron transport materials , perovskite solar cell , SCAPS, Numerical simulation, PSCs

#### References

##### Reference to a journal article:

- [1] M. S. Rahman, S. Miah, M. S. W. Marma, and T. Sabrina, "Simulation based investigation of inverted planar perovskite solar cell with all metal oxide inorganic transport layers," in 2019 International Conference on Electrical, Computer and Communication Engineering (ECCE), 2019, pp. 1-6.
- [2] N. Singh, A. Agarwal, and M. Agarwal, "Numerical simulation of highly efficient lead-free all-perovskite tandem solar cell," *Solar Energy*, vol. 208, pp. 399-410, 2020.
- [3] R. A. Burgelman, S. W. Floyd, T. Laamanen, S. Mantere, E. Vaara, and R. Whittington, "Strategy processes and practices: Dialogues and intersections," *Strategic management journal*, vol. 39, pp. 531-558, 2018.
- [4] T. Minemoto and M. Murata, "Device modeling of perovskite solar cells based on structural similarity with thin film inorganic semiconductor solar cells," *Journal of applied physics*, vol. 116, p. 054505, 2014.
- [5] F. Azri, M. Labed, A. Meftah, N. Sengouga, and A. Meftah, "Optical characterization of a-IGZO thin film for simulation of a-IGZO (n)/ $\mu$ -Si (p) heterojunction solar cell," *Optical and Quantum Electronics*, vol. 48, pp. 1-16, 2016.

## TOPIC 03: Renewable energies and energy efficiency

### Investigation of Lead-Free FASnI<sub>3</sub>-Based Perovskite Solar Cell Performance Using phenyl-C61-butyric acid methyl ester (PC61BM) as an Electron Transport Layer

Moussaab Belarbi 1\*, Oussama Zeggai 2, Meziane Chekkal 1, and Abdesslam Bouhenna 3

1 Laboratory of Micro and Nanophysics – LaMiN, Department of FPST- Ecole Nationale  
Polytechnique d’Oran-Maurice Audin, BP 1523, Oran 31000, Algeria

2 Department of Common Core, Faculty of Exact Sciences and Informatics, Hassiba Ben Bouali  
University, BP 151, Chlef 02000, Algeria

3 Laboratory for Theoretical Physics and Material Physics, Department of Physics, Faculty of  
Exact Sciences and Informatics, Hassiba Benbouali University, BP 151, Chlef 02000, Algeria

\*Corresponding author: [moussaab.belarbi@enp-oran.dz](mailto:moussaab.belarbi@enp-oran.dz)

#### Abstract

In the current context of an unceasing quest for sustainable and environmentally friendly energy solutions, perovskite-based solar cells emerge as promising candidates. In this study, we analyzed the efficiency of lead-free FASnI<sub>3</sub> perovskite solar cells utilizing the phenyl-C61-butyric acid methyl ester (PC61BM) as an electron transport layer. Our research was conducted numerically using the SCAPS-1D software. Special attention was given to the optimization of various crucial parameters to enhance the device's efficiency. The parameters studied include the active layer thickness, the back contact materials (Copper, Silver, Nickel, and Gold), and the impact of temperature variations on the performance of the proposed structure (FTO/PC61BM/FASnI<sub>3</sub>/Spiro-OMeTAD/Ni). The in-depth analysis identified optimized configurations, leading to a remarkable efficiency of 21.58%. The introduction of PC61BM as an electron transport layer showcased a notable improvement in the solar cell performance, suggesting its potential role as an optimal electron transport material for this type of solar cells, thus paving the way for promising advances in the field of environmentally friendly solar technologies.

**Keywords:** Lead-Free FASnI<sub>3</sub> Perovskite; PC61BM; SCAPS-1D; Efficiency.

## TOPIC 03: Renewable energies and energy efficiency

### Study of morphological, semi conducting and electrochemical characteristics of the brownmillerite $\text{Ca}_2\text{Fe}_2\text{O}_5$ , used as photocatalyst for hydrogen production

Sara Benallala, \*, Souhila Boumazaa, Razika Brahimib and Mohamed Trarib

aLaboratory of Chemistry of Natural Gas, Faculty of Chemistry (USTHB), BP 32, 16111 Algiers, Algeria.

bLaboratory of Storage and Valorization of Renewable Energies, Faculty of Chemistry (USTHB), BP 32, 16111 Algiers, Algeria.

Email: sara.m.benallal@gmail.com (Sara Benallal)

#### Abstract

The present work is devoted to the synthesis and characterization of the ferrite oxide  $\text{Ca}_2\text{Fe}_2\text{O}_5$ , crystallizing in the brownmillerite structure, as photocatalyst for the hydrogen production upon visible light. Various characterization techniques have been employed such as X-ray diffraction (XRD), scanning electron microscopy (SEM) equipped with an energy dispersive X-ray spectrometer (EDX), X-Ray photoelectron spectroscopy (XPS) and electrochemical study. The sol-gel auto combustion route was used to synthesize  $\text{Ca}_2\text{Fe}_2\text{O}_5$  oxide. A stoichiometric amounts of  $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$  and  $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$  were used as Ca and Fe sources and citric acid as a gelling agent. The X-ray diffraction (XRD) revealed a single-phase crystallizing in orthorhombic symmetry. The SEM micrographs exhibit an inhomogeneous structure formed by agglomeration of irregular shaped grains. The EDX spectrum confirms the presence of Ca, Fe and O elements with percentages close to the stoichiometric formulation of the synthesized oxide. The p-type behavior of the oxide was determined by photo-electrochemistry characterizations. A flat band potential ( $E_{fb} = 0.93 \text{ VSCE}$ ) was obtained from the capacitance-potential (C-2 - E) measurements. The cathodic potential of the conduction band ( $E_{BC} = -1.06 \text{ V}$ ) showed the feasibility of the water reduction under visible light. Consequently,  $\text{Ca}_2\text{Fe}_2\text{O}_5$  was positively tested as photocatalyst for the  $\text{H}_2$ -production and the rate of  $\text{H}_2$  production reached  $0.048 \mu\text{mol mg}^{-1} \text{ min}^{-1}$  in alkaline solution NaOH ( $10^{-3} \text{ M}$ ).

**Keywords:**  $\text{Ca}_2\text{Fe}_2\text{O}_5$ ; Brownmillerite; Hydrogen; Visible light.

## **TOPIC 03: Renewable energies and energy efficiency**

---

### **Nanotechnology Boosting Solar Efficiency: A Sustainable Energy Revolution**

Assia ARABI , Khaled ALIANE<sup>1</sup> , Zakaria SARI-HASSOUN<sup>1</sup>

<sup>1</sup> MECACOMP Laboratory ;department of mechanical engineering ; Aboubaker Belkaid University- Tlemcen .

#### **ABSTRACT:**

Due to the continuous growth of the world's population, there has been an increasing demand for fossil fuels, exacerbating the problem of carbon emissions and global warming due to the greenhouse effect. Consequently, it has become imperative to utilize renewable energies, with solar energy being one of the most prominent sources.

Solar energy faces various challenges in its utilization, including optimizing the absorption of solar radiation by both photovoltaic and solar thermal panels. Additionally, issues such as the accumulation of dirt on panels and high panel temperatures that reduce efficiency pose significant hurdles. In recent years, researchers have focused on harnessing nanotechnology to address these challenges. Remarkable results have been achieved through the application of nano-coatings or nanofluids to enhance solar panel absorption. Furthermore, the use of extremely thin nano-membranes on panel surfaces has resolved the issue of dirt accumulation, enabling self-cleaning without continuous human intervention.

A novel technique called "spectral splitting" has also been developed to manage panel temperature effectively, diverting hot radiation for thermal applications and capturing cool radiation for electricity generation. These research efforts signify significant progress in the field of solar energy. They contribute to making solar energy utilization more efficient and sustainable, which is crucial for achieving energy sustainability goals and reducing carbon emissions in the future.



## TOPIC 03: Renewable energies and energy efficiency

### Characterisations of New Material Based on Phenyl Vinyl Acrylonitril, Used as Precursor in Solar Cells

MOSBAH Salima

1Laboratoire de chimie des matériaux constantine

Université frères Mentouri Constantine 1, Département de Chimie, Constantine-ALGERIE

Email:salimacne@yahoo.fr

salima.mosbah@umc.edu.dz

#### Abstract :

Organic  $\pi$ -conjugated oligomers and polymers constitute an important class of functional materials in organic electronics.

In the last few years, the scientists seek to synthesize organic molecules having gaps similar to those of metals. Recent studies showed that the family of the poly (thienylenevinylene) (PTV) presents a gap electronic  $E_g$  lower than that of polythiophene. Other work showed that the introduction of an acceptor group into the combined chain has an advantage in the control of this forbidden band. Indeed, the substitution of the electron-withdrawing cyano group in the double connection of the poly (thienylenevinylene) leads to a polymer with a great electronic affinity. We have synthesized monomer to study a class of soluble low band gap conjugated polymers based on heterocyclic units and cyano vinylenes. The poly E 2, 3di (thiophenyl) acrylonitrile film was synthesized electrochemically by anodic way. The polymer formed was characterized by spectroscopic methods.

**Keywords :** ( Organic polymers, band gap)

## TOPIC 03: Renewable energies and energy efficiency

---

### Evaluating the Thermal Behavior of Pitched and Flat Roofs with Natural Convection Ventilation: A Comparative Study

Tarek Djeldjeli\*<sup>1</sup>, Nabil Benamara<sup>1</sup>, Miloud Aminallah<sup>1</sup>, Abdelkader Lahcene<sup>1</sup>

<sup>1</sup> Laboratory of Materials and Reactive Systems, University of Sidi-bel-Abbes, Algeria

Djeldjelitarek@gmail.com

#### Abstract.

Improving the energy efficiency of buildings is crucial for reducing their environmental impact, as they account for a significant share of global energy consumption and greenhouse gas emissions. One effective way to enhance energy efficiency is by designing buildings to utilize natural ventilation. This experimental study aims to compare the thermal performance of pitched and flat roofs, along with the impact of natural convection ventilation on temperature dynamics within a room measuring 750 x 750 x 870 mm<sup>3</sup>. The room features chipboard walls and floor, with a reinforced concrete ceiling (slab). A plasterboard separates the room into a "living" area and a ventilated space created by the false ceiling. A constant heat flow is applied to the upper surface of the ceiling, and natural convection occurs in the ventilated space through windows in opposing walls. Temperature data is collected using thermocouples. The findings indicate that natural convection ventilation between the roof and false ceiling has a positive effect on both roof types, with better results observed for the pitched roof.

**Keywords:** Natural convection, thermal masse, thermal comfort, ventilation.

## TOPIC 03: Renewable energies and energy efficiency

### Winter heating of air via an earth-air heat exchanger

MERDASSI Mustapha Department of Mechanical Engineering, University of Amar Thelidhji Mechanical laboratory Laghouat, Algeria [mustapha158@yahoo.com](mailto:mustapha158@yahoo.com)

Aouissi Mokhtar Department of Mechanical Engineering, University of Amar Thelidhji Mechanical laboratory Laghouat, Algeria [m.aouissi@mail.lagh-univ.dz](mailto:m.aouissi@mail.lagh-univ.dz)

#### Abstract

In the winter season, an Earth-Air Heat Exchanger (EAHE) can provide a sustainable and efficient way to heat indoor spaces by utilizing the constant temperature of the ground. The system works by drawing in cold outdoor air and passing it through a network of buried pipes, or ground heat exchangers, where it is warmed by the soil's heat. The warmed air is then directed into the building, providing a steady and comfortable supply of heat.

**Keywords** (EAHE, Winter, Heat)

#### I. INTRODUCTION

To reduce the energy demand for heating and cooling buildings in both hot and cold weather, the use of geothermal energy is a promising green solution. However, this solution is underutilized in our country. Recent studies [1-2] have shown that exploiting geothermal energy for air cooling is particularly effective in hot areas with temperatures of up to 50°C. In this study, we focus on using the earth as a source of heating energy through an earth-air heat exchanger (EAHE).

We perform a numerical simulation of the airflow through the EAHE using the ANSYS FLUENT 20.0 computational fluid dynamics (CFD) platform. To ensure the reliability of our numerical 3D model, we compare our simulation results to experimental data [3], which show good agreement. Our main objective is to evaluate the performance of the EAHE under cold weather conditions (specifically, the winter season in the Laghouat area) through a parametric analysis of the EAHE, investigating the effects of diameter, depth, pipe length, and inlet air velocity on the outlet air.

The numerical simulation has been done by taking into consideration the following assumptions:

- the used pipe in EAHE is made of polyvinyl chloride (PVC).
- the thickness of the pipe is very small, so the thermal resistance of the pipe material is negligible.
- the surface's pipe temperature is constant in the axial direction because the soil's temperature surrounding is considered constant

## TOPIC 03: Renewable energies and energy efficiency

### II. RESULTS AND DISCUSSIONS

Figure 1 illustrates the air temperature obtained from our numerical model for various lengths of the EAHE under specific conditions: a soil temperature of 19.6°C at a depth of 2m, an inlet air velocity of 2m/s, and an inlet air temperature of 6.1°C (January 2020 in Laghouat). We observed that the temperature follows an increasing trend along the length of the air/ground exchanger pipe due to heat transfer between the earth and the air. Moreover, we found that an EAHE length of 35m is sufficient, as there is no significant increase in temperature beyond this length.

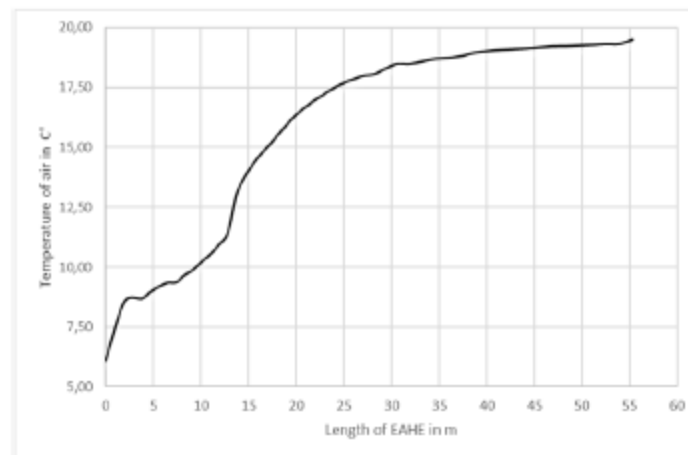


Figure 1. The temperature of air depends on the length of the EAHE.

### III. CONCLUSION

The present study aims to predict the performance of the Earth-to-Air Heat Exchanger (EAHE) in increasing the indoor temperature of a building during the winter season. The results were promising and confirmed the EAHE's ability to heat the air, with its capacity being dependent on various parameters such as depth, air inlet velocity, air inlet temperature, and length of the EAHE.

### IV. REFERENCES

- [1] Moummi, N., Benfatah, H., Hatraf, N., Moummi, A., Youcef, A.: 'The cooling by geothermal energy: a theoretical and experimental study in the Biskra site', *RevEnergRen*, 13(3), 399-406. J. Clerk Maxwell, *A Treatise on Electricity and Magnetism*, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.
- [2] Sehli, A., Hasni, A., Tamali, M.: 'The potential of earth-air heat exchangers for low energy K. Elissa, "Title of paper if known," unpublished cooling of buildings in South Algeria ', *Energy Procedia* 18 (2012) 496 – 506.
- [3] Trilok S., Anul, K., Prashant, B.: ' Heating potential evaluation of earth-air heat exchanger system for winter season', *Journal of Building Physics* 2015, Vol. 39(3) 242-260.

## TOPIC 03: Renewable energies and energy efficiency

---

[4] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Trans. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetism Japan, p. 301, 1982].

IEEE conference templates contain guidance text for composing and formatting conference papers. Please ensure that all template text is removed from your conference paper before submission to the conference. Failure to remove template text from your paper may result in your paper not being published

## TOPIC 03: Renewable energies and energy efficiency

### Deposition of thin films from copper-based $\text{Cu}_2\text{ZnSnS}_4$ nanopowders

N. KESSENTINI<sup>1</sup>, H. REKKACHE<sup>1</sup>, N. BENSLIM<sup>1</sup>, L. BECHIRI<sup>1</sup>

<sup>1</sup> Laboratoire d'Etude des surfaces et Interfaces de la Matière Solide LESIMS, Physics Department, Badji Mokhtar University, B.P. 12 Annaba, Algeria

Email: kessentini.nour-elhouda@univ-annaba.org

#### Abstract:

The compound  $\text{Cu}_2\text{ZnSnS}_4$  is a kesterite-type semiconductor, which is a promising candidate for photovoltaic conversion due to its attractive physical properties. It is mainly used as a thin-film absorbing layer in the fabrication of solar cells. In this work, we synthesized  $\text{Cu}_2\text{ZnSnS}_4$  nanopowders by mechanosynthesis.

Analysis of these compounds (powder) by X-ray diffraction (XRD) led us to determine the crystal parameters ( $a=5.41\text{\AA}$ ,  $c=10.93\text{\AA}$ ) with a crystallite size of (15.451 nm)

The ground powders are used to deposit  $\text{Cu}_2\text{ZnSnS}_4$  thin films by thermal evaporation in a secondary vacuum ( $10^{-6}$  Torr) on corning glass substrates. X-ray diffraction (XRD) analysis of the thin films revealed that the crystal structure of our thin films is of kesterite type with parameters ( $a = 5.44$ ,  $c = 10.465$ ) and a band gap of 1.42 eV.

**Keywords:**  $\text{Cu}_2\text{ZnSnS}_4$ , thin films, semiconductor

## TOPIC 03: Renewable energies and energy efficiency

### Structural and Optical properties of $\text{CuIn}_3\text{Se}_5$ / $\text{Cu}_2\text{SnSe}_3$ thin films

H.Rekkache, H. Kessentini, L. Bechiri, N.Benslim

Laboratoire d'Etude de Surfaces et Interfaces de la Matière Solide (LESIMS), Département De Physique,  
Faculté des Sciences, Université Badji Mokhtar- Annaba, Algérie

Phone : (+213) 06.67.28.34.41

Mail : rekkache.hadjer@univ-annaba.org

H. Kessentini

Laboratoire d'Etude de Surfaces et Interfaces de la Matière Solide (LESIMS), Département De Physique,  
Faculté des Sciences, Université Badji Mokhtar- Annaba, Algérie

Phone : (+213) 06.76.65.00.63

Mail : kessentini.nour-elhouda@univ-annaba.org

L.Bechiri

Laboratoire d'Etude de Surfaces et Interfaces de la Matière Solide (LESIMS), Département De Physique,  
Faculté des Sciences, Université Badji Mokhtar- Annaba, Algérie

Phone : (+213) 07.77.33.16.57

Mail : bechiri@hotmail.com

N.Benslim

Laboratoire d'Etude de Surfaces et Interfaces de la Matière Solide (LESIMS), Département De Physique,  
Faculté des Sciences, Université Badji Mokhtar- Annaba, Algérie

Phone : (+213) 07.76.06.86.70

Mail : benslimc8@gtmail.com

#### Abstract

$\text{CuIn}_3\text{Se}_5$  /  $\text{Cu}_2\text{SnSe}_3$  thin films were synthesized on glass substrate by thermal evaporation method at  $T_s=500^\circ\text{C}$ , starting from elemental powders Cu, Sn, In and Se mixed by a mechanical alloying process. The Powders and films were analyzed by X-ray diffraction (XRD), and revealed that the first  $\text{CuIn}_3\text{Se}_5$  powder is chalcopyrite structure with the orientation (112) while the second  $\text{Cu}_2\text{SnSe}_3$  powder has the cubic structure of preferred orientation (111) and with an additional binary phase  $\text{Cu}_3\text{Sn}_2$ . The optical measurements were carried out in the [250- 3000nm] wavelength range and were determined from spectral transmission data. Optical measurements of  $\text{CuIn}_3\text{Se}_5$  /  $\text{Cu}_2\text{SnSe}_3$  semiconductors showed that the deposited layers had a relatively high absorption coefficient of  $10^4 \text{ cm}^{-1}$  and the direct energy band gap was found to be around  $E_g \approx 1.49 \text{ eV}$ .

**Keywords:**  $\text{CuIn}_3\text{Se}_5$  /  $\text{Cu}_2\text{SnSe}_3$  layer- XDR- Chalcopyrite -Thin films - semiconductors -Optical properties- Band gap.

## TOPIC 03: Renewable energies and energy efficiency

---

### Effect of Annealing Temperature on Structural Properties of Spin-coated Ga<sub>2</sub>O<sub>3</sub> Thin Films

Lobna Messeddek 1\*, Louiza Arab 2, and Nouredine Sengouga 3.

\* Email: Lobna.messeddek@univ-biskra.dz

#### Abstract

$\beta$ -Ga<sub>2</sub>O<sub>3</sub> has been considered as a promising candidate for solar-blind photodetector owing to its extremely wide bandgap. In this paper,  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> thin films were grown on ( SiO<sub>2</sub>/Si) using the Sol-Gel method with different annealing temperatures.

**Keywords:** ultrawide-bandgap semiconductors, Sol-Gel method, Gallium oxide films, X-ray analysis.



## TOPIC 03: Renewable energies and energy efficiency

---

### Unlocking Efficient Bioethanol Production from lignocellulosic biomass through Enzymatic Hydrolysis and Yeast Fermentation

Kernani Ridha<sup>1,\*</sup>, Hadiouche Dalila<sup>1</sup>, Saoudi Hacene<sup>1</sup>, Aouaidjia Youcefi<sup>1</sup>

<sup>1</sup> Department of Process Engineering, Faculty of Sciences and Applied Sciences, Akli Mohand Oulhadj University, Drissi Yahia Street, 10000, Bouira, Algeria

#### Abstract

This study focuses on optimizing the bioconversion of olive pomace, a lignocellulosic waste, into bioethanol, a valuable biofuel. Enzymatic hydrolysis is employed as a key step to release fermentable sugars from the complex lignocellulosic matrix. Three different enzymes, Amyliz Max, OptiFlow Beta-Glucanase, and Filtrase NLC, are evaluated both individually and synergistically to enhance sugar liberation. The hydrolysis process is thoroughly characterized at various substrate concentrations over a 4-day period. The results indicate successful sugar release, with the highest concentrations observed at 15% substrate concentration. However, the combination of the enzymes does not significantly improve sugar release compared to individual enzymes. Fermentation trials with brewing yeast further demonstrate the bioconversion potential. Initially, a rapid reduction in sugar concentration confirms active yeast metabolism. However, a slight increase in residual sugar levels on subsequent days suggests complex interactions influencing fermentation efficiency. In conclusion, enzymatic hydrolysis effectively liberates sugars from olive pomace, and subsequent fermentation by brewing yeast shows promise for bioethanol production. The study underscores the importance of enzyme selection, hydrolysis optimization, and understanding enzyme interactions during fermentation for improved biofuel yield. This research contributes to sustainable waste utilization and biofuel production.

**Keywords:** enzymatic hydrolysis, lignocellulosic biomass, olive pomace, bioethanol, fermentation, brewing yeast.

## TOPIC 03: Renewable energies and energy efficiency

---

### Solar Energy Prediction in Algeria: A Supervised Machine Learning Approach

Yacine Kouhlane

L.A.S.M.A Laboratory, Department of Physics, Faculty of Sciences, University Badji Mokhtar, Annaba,  
23000, ALGERIA

Corresponding author: yacine.kouhlane@gmail.com; yacine.kouhlane@univ-annaba.dz

#### Abstract:

This research investigates the influence of climatic variables on the performance of photovoltaic (PV) modules using supervised machine learning techniques. The dataset is taken from the Photovoltaic Geographical Information System (PVGIS) and focuses on the city of Tamanrasset, Algeria. MATLAB is used for model development and evaluation. Different models are compared using R-squared, root mean squared error (RMSE), and mean absolute error (MAE) metrics. The neural network model showed the highest predictive accuracy, achieving an R-squared of 1 and an RMSE of 3 or less. This finding suggests that the energy output of PV systems can be optimized in response to changing climatic conditions. The research underscores the prospects for improving PV system design through predicted energy production, providing a pathway to more efficient renewable energy solutions. Finally, by understanding the relationship between climate variability and PV efficiency, engineers can tailor systems to promote sustainable energy production, reduce reliance on non-renewable energy sources, and reduce the environmental footprint.

**Keywords:** solar power prediction, PVGIS, supervised machine learning, MATLAB, predictive modeling, climate variables, renewable energy.

## TOPIC 03: Renewable energies and energy efficiency

### Electrodeposition of environment-friendly CZTS absorbing layer for photovoltaic applications

Omar Meglali<sup>1,2,\*</sup>, Belkheir Bensouaf<sup>2</sup>, Radia Boudaira<sup>3</sup>, Elguaizi Sabrine<sup>2</sup>

<sup>1</sup>Faculty of Sciences, University of M'sila, 28000, Algeria.

<sup>2</sup>Materials Science and Informatics Laboratory, University of Djelfa, 17000, Djelfa, Algeria.

<sup>3</sup>Department of Physics, Mentouri University, 25000, Constantine, Algeria.

\*Corresponding author E-mail address: omar.meglali@univ-msila.dz

#### Abstract

One of the factors that prevent the widespread use of solar energy is the price per watt of electricity produced by this system compared to the price per watt of electricity produced by conventional methods. Extending the lifetime of solar cells, reducing the amount of materials used in the manufacture of the thin films that make up solar cells and using element-rich materials are solutions proposed to lower the price per watt of electricity produced by photovoltaics.

The quaternary  $\text{Cu}_2\text{ZnSnS}_4$  thin films under its kesterite structure is one of the most promising materials for photovoltaic solar cells applications.

In this work, we deposited two  $\text{Cu}_2\text{ZnSnS}_4$  thin films on FTO substrates by the electrodeposition method using three-electrode system. The electrolyte solution consists of copper chloride  $\text{CuCl}_2$ , hydrated zinc sulfate  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ , tin chloride  $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ , sodium thiosulfate  $\text{Na}_2\text{S}_2\text{O}_3$ , sodium citrate  $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$  and tartaric acid  $\text{C}_4\text{H}_6\text{O}_6$ . The two samples are deposited at two different times (20 and 30 min) and are sulfurized at  $550^\circ\text{C}$  for 60 min. We investigated the effect of deposition time on the structural, morphological and optical properties respectively by X-ray diffraction, scanning electron spectroscopy and UV-Vis spectroscopy.

In both films, the X-ray diffraction showed the presence of the  $\text{Cu}_2\text{ZnSnS}_4$  phase in its kesterite structure. We have found that the lattice parameters are not affected by deposition time. The grain size as well as the gap energy of the two layers varies respectively from 66.50 to 87.61 nm and from 1.46 to 1.59 eV for deposition time changed from 20 to 30 min.

**Key words:** Photovoltaics,  $\text{Cu}_2\text{ZnSnS}_4$ , Deposition time, Sulfurisation temperature.

## TOPIC 03: Renewable energies and energy efficiency

---

Experimental study of horizontal and inclined solar radiation through empirical models applied in Photovoltaic power plants center , Ghardaïa state

### Abstract

Throughout the day, the solar panels intercepted luminous flux level usually depends on the position of the sun, where the solar panels are set in various positions, such as the horizontal position ( $0^\circ$ ) and the incline position ( $30^\circ$ ), which are related to the area's inclination angle and height. This work aims to propose a comparative study using semi-empirical approaches for determining the horizontal and incline solar radiation in OUED-NECHOU Ghardaïa region. Moreover, to confirm that the model we used is accurate and produces a strong result in the area. For this, we have adopted the model of PERRIN DE BRICHAMBAUT to estimate the illumination which is hardly ever used and we will compare it with inclined and horizontal experimental radiation data of the region. The model is identified and assessed using MATLAB environment. The recorded data have been obtained from a weather station installed on OUED-NECHOU photovoltaic panels center, to investigate the variation in solar radiation in the area throughout specific days on particular months of the year .

Through comparison between calculated and measured values, it turns out that the findings of this study indicate that PERRIN DE BRICHAMBAUT model gives more effectiveness for estimating the total solar radiation on inclined and horizontal surface of clear sky over the city of Ghardaïa, Additionally correlation coefficient (CC) reach max value 0.9720 which is good outcome, the statistical analysis evaluates the absolute error (AE), mean absolute error (MAE) and mean squared error (RMSE) , correlation coefficient (CC) .

## TOPIC 03: Renewable energies and energy efficiency

### Structural stability and electronic structure properties of half-heusler in 18-electrons transparent conductors: ab-initio study

HADBI Mohammed <sup>1</sup>, DEMMOUCHE Kamel <sup>2</sup>, BELKHIR Mohamed Lamine <sup>3</sup>, SARHANI Mohammed Elsaid <sup>4</sup> and FODEILI Mohammed Lamine <sup>5</sup>.

<sup>1,2</sup>Materials Science and Applications Laboratory. Faculty of Sciences and Technology. University of Ain Temouchent Belhadj Bouchaib, B.P. 284. 46000. Algeria

<sup>3,4,5</sup>dept. science of the matter, speciality Physics of materials University of Ammar Thelidji Laghouat, Algeria

<sup>\*</sup>(mohammed.hadbi@univ-temouchent.edu.dz) Email of the corresponding author

#### Abstract:

This research offers a comprehensive theoretical exploration of transparent conductors (TCs) in the realm of ternary intermetallic materials, specifically focusing on 18-electron Half-Heusler (HH) compounds, TaIrGe and ZrIrSb, based on iridium (Ir). The study leverages the Vienna ab-initio Simulation Package (VASP) [1] in conjunction with density functional theory (DFT) [2], specifically utilizing the GGA-PBE approximation [3] and meta-GGA SCAN for the computation of exchange and correlation energies.

Our investigation is grounded in a meticulous examination, with a keen eye on previous experimental and theoretical works for contextual comparison. These compounds feature a crystalline structure aligned with the cubic  $F\bar{4}3m$  space group notation ( $N^\circ:216$ ). In the domain of structural properties, our analysis encompasses the computation of cell parameters, resulting in outcomes that closely mirror experimental data. Additionally, we affirm the mechanical robustness of these compounds through the determination of elastic stiffness constants ( $C_{ij}$ ).

Turning to electronic characteristics, our study unveils the semiconductor attributes of these materials, marked by an indirect bandgap.

**Keywords:** Structural Stability, Electronic Structure, Elasticity Coefficients, Density Functional Theory (DFT), Vienna ab-initio Simulation Package (VASP), Half-Heusler Compounds, Semiconductor Materials.

## TOPIC 03: Renewable energies and energy efficiency

---

### References:

- (1) G. Kresse and J. Furthmüller, "Efficiency of ab-initio total energy calculations for metals and semiconductors using a plane-wave basis set," Computational materials science, vol. 6, pp. 15-50, 1996.
- (2) W. Kohn and L. Sham, "Physical review, 140," A1133, vol. 2, 1965.
- (3) J. P. Perdew, K. Burke, and M. Ernzerhof, "Generalized gradient approximation made simple," Physical review letters, vol. 77, p. 3865, 1996.

## TOPIC 03: Renewable energies and energy efficiency

### Hydrogen storage on 2D-carboneous single-layer : A DFT study

Ikram DJEBABLIA<sup>1,2,\*</sup>, HAMIDANI Ali<sup>2</sup>, Nor REBAH<sup>1</sup> and Kamel ZANAT<sup>2</sup>

<sup>1</sup> Laboratory of Physics of Matter and radiation (LPMR), Department of Material Science,  
University of souk-ahras, BP 1553, 41000 Souk-Ahras, Algeria.

<sup>2</sup> Physics Laboratory at Guelma, Faculty of Mathematics, Computing and Material Sciences,  
University 8 Mai 1945 Guelma, P.O. Box 401 Guelma 24000, Algeria.

\*Email of the corresponding author: [ik.djebablia@univ-soukahras.dz](mailto:ik.djebablia@univ-soukahras.dz)

#### Abstract:

Hydrogen gas ( $H_2$ ) is clean energy carrier which is friendly to the environment and emit water on combustion as by-products. However, efficient hydrogen storage is regarded as the key challenge in large-scale applications of hydrogen energy. Recently bidimensional structures have been proposed as hydrogen-storage materials owing to their large surface-to-volume ratios and light weight. In this work, based on the density functional theory (DFT) using a Plane-Wave basis set and pseudopotentials as they coded in the Vienna ab initio simulation package (VASP), we investigate the hydrogen storage ability on functionalized 2D-carboneous single-layer. Our results shows that 2D-carboneous structure can adsorb multiple  $H_2$  molecules with a promising average adsorption energy and high gravimetric density. This study indicates that carboneous single layer is a promising substrate for hydrogen storage applications.

**Keywords:** 2D-carboneous single-layer, density functional theory (DFT), hydrogen storage ability , average adsorption energy and gravimetric density.

## TOPIC 03: Renewable energies and energy efficiency

### Semiconducting and electrochemical properties of the perovskite $\text{KNbO}_3$ . Application to $\text{H}_2$ production Under Visible Light.

Romaissa MEKERSI<sup>1</sup>, Souhila BOUMAZA<sup>1</sup> and Mohamed TRARI<sup>2</sup>

<sup>1</sup>Laboratory of Chemistry of Natural Gas, Faculty of Chemistry (USTHB), BP 32, 16111 Algiers, Algeria.

<sup>2</sup>Laboratory of Storage and Valorization of Renewable Energies, Faculty of Chemistry (USTHB), BP 32, 16111 Algiers, Algeria.

\*Corresponding author e-mail: [mekersi.romaissa1997@gmail.com](mailto:mekersi.romaissa1997@gmail.com)

#### Abstract

Perovskites are crystalline materials known for their exceptional properties, especially in the realm of photocatalysis [1]. In this work, we synthesized a ternary oxide,  $\text{KNbO}_3$ , which adopts the perovskite structure, using the nitric combustion method which allowed to obtain a high-purity oxides catalyst, which is crucial for its effectiveness.

To characterize the synthesized material, we used various techniques. The X-ray diffraction analysis (XRD) confirmed the formation of a pure phase at  $700^\circ\text{C}$ , crystallizing in the orthorhombic structure. Raman spectroscopy further complemented this characterization by confirming the crystalline structure of  $\text{KNbO}_3$ . The optical gap of  $\text{KNbO}_3$  ( $E_g = 3.1 \text{ eV}$ ), determined by the diffuse reflectance spectroscopy, enables the photocatalytic exploitation under the solar light. The X-ray photoelectron spectroscopy (XPS) allowed the identification of the different oxidation states of the elements present in  $\text{KNbO}_3$  oxide.

The results of the characterization analyses of  $\text{KNbO}_3$  oxide are directly related to its potential in photovoltaic-driven hydrogen production. By harnessing these properties, we are paving the way for a cleaner and more efficient hydrogen production, contributing to the advancement of renewable energies [2].

**Keywords:** Perovskite oxides ; Hydrogen ; Photocatalysis ;  $\text{KNbO}_3$ .

#### References :

- [1] L. Boudjellal, A. Belhadi, R. Brahimi, S. Boumaza, [M. Trari](#) Semiconducting and photoelectrochemical properties of the ilmenite  $\text{CoTiO}_3$  prepared by wet method and its application for  $\text{O}_2$  evolution under visible light. *J. Solid State Electrochemistry* 2020;24:357-364.
- [2] S. Boumaza, R. Bouarab, [M. Trari](#), [A. Bouguelia](#). Hydrogen photo-evolution over the spinel  $\text{CuCr}_2\text{O}_4$ . *Energy Conversion and Management*, 2009, vol. 50, no 1, p. 62-68.



## TOPIC 03: Renewable energies and energy efficiency

### Superior Ferroelectric Properties Coupled with High Shift Current of Copper Sulfide Cu<sub>2</sub>S for Green Energy Conversion: Theoretical Study

Naouel. Chelil <sup>\*,1</sup>, Mohammed. Sahnoun <sup>1</sup>

<sup>1</sup>Laboratoire de Physique Quantique de la Modélisation Mathématique (LPQ3M), Mascara, Algeria.

<sup>\*</sup>(n.chelil@univ-masacare.dz) Email of the corresponding author

#### Abstract

Due to the polarization-induced efficient separation of charge carriers, ferroelectric semiconductors with narrow band gaps (approximately 1.3 eV) have been identified as an ideal choice for the active layer in photovoltaic systems. Recent research, exemplified by lead halide perovskite solar cells, has underscored the viability of this approach. This work proposes polar Copper sulfide (Cu<sub>2</sub>S) as a highly promising candidate for high-performance ferroelectric photovoltaics. Through density functional theory calculations, it is uncovered that Cu<sub>2</sub>S exhibits a moderate macroscopic polarization of 98.32  $\mu\text{C}\cdot\text{cm}^{-2}$ , which is sufficient for the separation of charge carriers. Furthermore, Cu<sub>2</sub>S is predicted to possess a direct band gap of approximately 1.19 eV. An examination of the optical absorption coefficient and the resultant nonlinear photocurrent, indicative of the bulk photovoltaic effect, demonstrates that even an ultra-thin layer of Cu<sub>2</sub>S has the capacity to produce significant photocurrents within the visible spectrum. Superior ferroelectric properties coupled with highly reported nonlinear optical behavior makes Cu<sub>2</sub>S as a potential candidate for solar harvesting.

**Keywords:** perovskite , photovoltaics, photocurrent, ferroelectric, density functional theory.

## TOPIC 03: Renewable energies and energy efficiency

### Eco-friendly and cleaner process for isolation of essential oils

Benabed Meriem<sup>1</sup>, Benmoussa Hasnia<sup>1</sup> and Benhammou Abdellah<sup>1</sup>

<sup>1</sup> Université des Sciences et de la Technologie d'Oran-Mohamed Boudiaf, USTO-MB, Laboratoire d'Ingénierie des Procédés de l'Environnement, Faculté de Chimie, BP1505, El M'naouer, 31000

Oran, Algeria

meriembenabedgpe@gmail.com

#### Abstract.

The study focused on optimizing the extraction of essential oils from *Ammoides verticillata*, a medicinal plant belonging to the Apiaceae family, in Algeria. The present study compared two extraction methods: hydro-distillation (HD) and Pressure Cooker Pre-treatment Hydrodistillation (PCPHD), and evaluated various parameters such as yield, composition, cost, time, energy consumption, and environmental impact. The study found that the PCPHD method produced a higher essential oil yield (4.22%) in 90 minutes compared to the HD method (2.88%) in 180 minutes. This indicates that PCPHD is more efficient in terms of essential oil extraction. PCPHD resulted in a higher content of oxygenated compounds in the essential oil compared to the conventional HD method. This difference in composition could be important for the quality and medicinal properties of the extracted oil. The PCPHD method was not only more efficient in terms of yield but also more cost-effective and energy-efficient. The energy required for PCPHD (1.05 kWh for 90 minutes) was significantly lower than that required for HD (2.1 kWh for 180 minutes). This suggests that PCPHD is a more economical extraction method. PCPHD had a lower environmental impact, as indicated by the reduced carbon dioxide emissions (0.84 kg CO<sub>2</sub>/g EOs) compared to HD (1.68 kg CO<sub>2</sub>/g EOs). Additionally, PCPHD generated less wastewater (0.177 L/g EOs) compared to HD (0.26 L/g EOs), further highlighting its eco-friendliness. In summary, the study concludes that the Pressure Cooker Pre-treatment Hydrodistillation (PCPHD) method is an efficient, cost-effective, and environmentally friendly alternative for extracting essential oils from *Ammoides verticillata*. This optimized method not only yields a higher quantity of essential oil but also reduces energy consumption, carbon emissions, and wastewater generation, making it a promising approach for essential oil extraction from this medicinal plant.

**Keywords:** *Ammoides verticillata*, Hydro-distillation, Essential oil, Optimization, Pressure Cooker Pre-treatment.

## TOPIC 03: Renewable energies and energy efficiency

### Cooling Performance Investigation of Pure Low-GWP Refrigerants as Substitutes for R134a (1,1,1,2-Tetrafluoroethane) in Standard Cooling System : Search for an Adequate Refrigerant

Youcef Maalem<sup>1</sup>, Hakim Madani<sup>2</sup>

<sup>1</sup>National Polytechnic School of Constantine, BP75 A, Nouvelle Ville RP, 25000 Constantine, Algeria.

<sup>2</sup>Laboratory of Studies of Industrial Energy Systems (LESEI), Department of Mechanical Engineering, Faculty of Technology, University of Batna 2, 05000 Batna, Algeria.

#### Abstract:

Knowing that from 2030 working fluids used in refrigerating engineering should have a global warming potential (GWP) of less than 150 and zero ozone depletion potential (ODP), searching for eco-friendly working fluids with good cooling performance and minimal environmental impact (Low-GWP and Zero ODP) to substitute the Phase-out R134a (GWP=1430) commonly used in cooling systems represents a great challenge for researchers. This study focuses on energy performance investigation and environmental impact analysis of four pure refrigerants (R1234yf (GWP=4), R1234ze (GWP=6), R161 (GWP=12) and R131I (GWP=0)) as possible alternatives to high GWP refrigerant R134a. To reach this objective, a numerical model is developed using MATLAB software to evaluate and compare the cycle performance parameters of the single-refrigerants considered in this work with R134a, like cooling capacity, coefficient of performance, volumetric refrigerating capacity and the pressure ratio. The comparison was made at evaporating temperatures ( $T_e$ ) ranging from (-10 to 10 °C) and the constant condensation temperature ( $T_c$ ) of 50 °C. The results proved that the application of the working fluid R161 exhibited a higher of COP, cooling capacity, volumetric refrigerating capacity, as well as lower pressure ratio compared with the traditional R134a, which confirms that it could be a good suitable substitute for the R134a in terms of cycle performances and environmental protection.

**Keywords:** Pure refrigerants, Low-GWP, Vapor compression system, Energy efficiency, Volumetric refrigerating capacity.

## TOPIC 03: Renewable energies and energy efficiency

### New mechanism of electrodeposited copper and its oxide onto planar aluminium electrode

N. ZAIDI<sup>(a)\*</sup>, L. MAKHLOUFI<sup>(a)</sup>, P. MANDIN<sup>(b)</sup>, S. TOUAZI<sup>(c)</sup>

(a) Laboratoire d'Electrochimie, Corrosion et de Valorisation Energétique (LECVE), Faculté de Technologie, Université de Bejaia, 06000 Bejaia, Alegria

(b) Institut de Recherche Dupuy de Lôme, IRDL UMR CNRS 6027, Université de Bretagne Sud, Centre de recherche rue de Saint-Mandé, 56100 Lorient, France

(c) Laboratoire de Valorisation des Energies Fossiles (LAVALEF), Ecole Nationale Polytechnique d'Alger, 16200 Alger, Alegria

(\*) zaidinadia06@gmail.com

#### Abstract :

The aim of this work was to elaborate deposits copper and its oxide on aluminium substrate using the electrodeposition method. The parameters limiting the deposition of the films were investigated by using cyclic voltamperometry. X-ray diffraction and scanning electron microscopy were used to study the morphoolgy, structure and composition of the resulted films. X-ray diffraction analysis demonstrated that the electrodeposited films are crystalline. We obtained deposit of three compounds such as  $\text{Cu}_2\text{O}$ , Cu and CuO, this last has not been reported previously with electrodeposition method. The value of diffusion coefficient was calculated by several laws with planer electrode. The neutral aqueous electrolyte based on copper acetate salt shows good electrochemical performances for supercapacitor applications.

**Key words:** copper oxides, aluminum substrate, electrodeposition, diffusion coefficient, impulsional technique

## TOPIC 03: Renewable energies and energy efficiency

### Etude ab-initio des constantes diélectriques d'un matériau binaire à base de bismuth

S. Benatmane<sup>1, 2\*</sup>

<sup>1</sup> Faculté des Sciences et technologies, Département des sciences et techniques, Université Abdelhamid Ibn Badis de Mostaganem, 27000 Mostaganem, Algérie

<sup>2</sup> Laboratoire de Modélisation et Simulation en Sciences des Matériaux, Université Djillali Liabes de Sidi Bel-Abbès, 22000 Sidi Bel-Abbes, Algérie

\*Corresponding author E-mail: [saadia.benotmane@univ-mosta.dz](mailto:saadia.benotmane@univ-mosta.dz)

#### Résumé :

La terre est aujourd'hui en situation de surexploitation ses capacités et cette situation va conduire inéluctablement à un épuisement prochain des ressources naturelles. En effet les ressources primaires fossiles, massivement exploitées depuis deux siècles sont non renouvelables, et sont sources d'émission gazeuses à effet de serre induisant des modifications chimiques potentiellement dommageables. Quant aux ressources fissiles, également équitables, elles génèrent des déchets bien difficiles à confiner ou à recycler. C'est dans ce contexte que l'électricité d'origine solaire photovoltaïque, est appelée à connaître un important essor qui devrait en faire l'une des sources majeures dans un bouquet énergétique nouveau au milieu du siècle, elle a fortement contribué au développement des systèmes spatiaux depuis 50 ans et joue un rôle déterminant dans les télécommunications et les télémesures.

Il est d'un grand intérêt de connaître les différentes manières dont la lumière interagit avec la matière dans la physique de l'état solide, tels que l'absorption, la transmission, la réflexion, la diffusion et l'émission. Le calcul direct des propriétés optiques basé sur les résultats de structure de bande est relié avec la compréhension plus profonde de la structure électronique. Toute fois, le calcul direct des propriétés optiques exige une grille dense de points  $k$ . Une information cruciale sur les valeurs propres et les fonctions propres est nécessaire pour calculer la fréquence (énergie) dépendante des propriétés optiques. Ces dernières sont automatiquement générées par le code de calcul ab-initio basé sur la méthode DFT et utilisés pour calculer les propriétés optiques des matériaux. Le code Wien2k permet de calculer les propriétés optiques des binaires qui sont dues aux transitions électroniques et en utilisant les approximations GGA-PBE et mBJ-GGA-PBE pour les deux structures zinc-blende et wurtzite.

**Mots clé:** DFT, GGA-PBE, FP-LAPW, propriétés optique.

# **Environment and Material Degradation**

## **TOPIC 04: Environment and material degradation**

---

### **Preparation and characterization of a biodegradable film based on potato starch.**

Name: Gouane

First name: Khadidja

Directed by: Bouarar Fahima

#### Abstract :

the objective of this work is to prepare biodegradable plastic films based on potato starch and waste (potato peelings) whose aim is to overcome the use of traditional polymers which are a source of pollution of the environment.

The various films obtained are transparent ductile. Different analyzes were carried out on the different samples for the evaluation of the quality of the product, such as analysis by FTIR, XRD, humidity rate and biodegradability test.

**Key words:** Bioplastic- Potato- Peelings- Starch- Biodegradable Films.

## **TOPIC 04: Environment and material degradation**

---

### **Ecodatabase electronic platform (ECO\_DATA)**

#### **Abstract :**

As desertification progresses, agriculture becomes more difficult, leading to low crop productivity and food scarcity. Algeria's arid climate, coupled with unsustainable land practices, has led to the expansion of desert areas and the degradation of fertile lands, and as a project proposal solution dedicated to a startup that aims to program and develop an environmental electronic platform for an environmental database, in order to unify the various environmental institutions in Algeria. Such a platform could facilitate collaboration, research and exchange of knowledge and resources between various stakeholders and researchers in the field, and could also serve as a hub for monitoring and analyzing the environment, collecting relevant data, and implementing strategies to improve the situation, with a special focus on combating desertification pests. To achieve this, the startup plans to use a drone equipped with environmental sensors. This drone will collect and monitor data and comprehensive analysis for specific areas. By gathering detailed information about the environment, we can ensure that any initiatives taken are informed and effective in combating desertification and other environmental issues. By periodically monitoring the progress of rehabilitation projects through the capabilities of the drone. This will allow them to assess the impact of these initiatives, make the necessary adjustments, and ensure continuous improvement in the environment.



## TOPIC 04: Environment and material degradation

### Mise en évidence des mycorhizes arbusculaire chez l'armoise blanche, plante endémique des écosystèmes arides et semi-arides et leur effet sur les stress abiotiques

Auteurs : GUENFOUD Fatima<sup>1</sup>, BENCHERIF Karima<sup>2</sup>, BENCHETTOUH Ahmed<sup>3</sup>.

<sup>1</sup>Laboratoire de recherche des sciences biologiques et sciences agronomiques, université Amar TELIDJI – Laghouat-.

<sup>2</sup>Enseignant chercheur, université ZIANE Achour -Djelfa.

<sup>3</sup>Enseignant chercheur, université Amar TELIDJI- Laghouat.

E-mail professionnel : fa.guenfoud@lagh-univ.dz

E-mail d'auteur principal :fatmagan50@gmail.com

#### Résumé :

Les plantes subissent une énorme pression pour survivre et produire de meilleurs résultats, même en présence de divers stress environnementaux tels que le stress dû au froid, à la sécheresse, au stress thermique, à la salinité, et aux polluants chimiques et métaux lourds etc.

nécessite une croissance végétale robuste, possible grâce à une association mycorhizienne.

Les mycorhizes améliorent la tolérance des plantes à plusieurs stress abiotiques par divers effets physiologiques, fonctionnels. et les changements biochimiques dans les plantes.

L'Armoise blanche *Artemisia herba-alba* Asso est une plante médicinale herbacée appartenant à la famille des Asteraceae. C'est une espèce des régions steppiques par excellence où elle est abondante sur les plateaux de la steppe. Elle se caractérise par sa richesse en huiles essentielles qui à lui accorde une valeur alimentaire importante. L'armoise blanche avec son rôle écologique est l'une des espèces emblématique de la steppe algérienne. Cependant elle est menacée d'extinction. Les relations symbiotiques arbusculaire jouent un rôle primordial à la nutrition hydrique et minérale particulièrement en phosphore sous les conditions de stress abiotique, en plus de la stimulation des hormones de croissance de la plante ce qui permet de les intégrer dans les programmes de réhabilitation et de fixation des sols en voie de dégradation. Dans ce contexte, notre présente étude, vise à mettre en évidence la symbiose arbusculaire chez l'armoise blanche par la méthode de Kormanick tout en réalisant une corrélation avec les paramètres édapho-climatiques. L'échantillonnage a été réalisé aléatoirement durant le mois d'avril(2014) au niveau de 3 sites de la région de Mankeb ben Hamed, l'analyse statistique

## TOPIC 04: Environment and material degradation

---

(test Tukey) a permis de constater qu'il y a une différence significative entre les 3 sites échantillonnés, un taux de mycorhization de 45,17% a été enregistré. Une corrélation positive a été enregistrée avec les précipitations indiquant un impact positif de la symbiose mycorrhizienne sur la phénologie de la plante dont la période de floraison est au printemps (la période d'échantillonnage). Les analyses pédologiques ont permis de constater une teneur assez considérable en phosphore au niveau des trois sites étudiés (182g/l).

Cette étude est une première dans son genre s'intéressant à l'armoise blanche, cependant il serait intéressant d'évaluer encore plus profondément les impacts de cette association symbiotique sur les paramètres biochimiques et physiologiques de la plante étudiée.

**Mots clé:** steppe, Asteraceae, *Artemisia herba-alba*, mycorhization arbusculaire, stress abiotiques, déchets.

## TOPIC 04: Environment and material degradation

### Processus d'adsorption pour éliminer les métaux lourds de l'eau contaminée

Faouzi. Lasmi,<sup>1</sup>, Hassiba.Laribi<sup>1</sup>, Houria.Hamitouche<sup>1</sup>, Sara. Rezzag<sup>2</sup>

<sup>1</sup> Laboratoire d'analyse fonctionnelle des procédés chimiques. Département de Génie des Procédés, Faculté de Technologie, Université Saad Dahlab Blida1, Blida 09000, Algérie.

<sup>2</sup> LI Laboratoire d'énergie, d'environnement et de systèmes d'information. Département des hydrocarbures et des énergies renouvelables, Faculté de Technologie, Université Ahmed Draia, Adrar 01001, Algérie.

\* L'adresse E-mail: [Lasmi.faouzi@etu.univ-blida.dz](mailto:Lasmi.faouzi@etu.univ-blida.dz)

#### Résumé. :

La contamination des sources d'eau par les métaux lourds pose de graves risques environnementaux et sanitaires, nécessitant des stratégies d'assainissement efficaces et durables. Les procédés d'adsorption sont apparus comme une technique prometteuse pour l'élimination des métaux lourds polluants de l'eau en raison de leur simplicité, de leur efficacité et de leur rapport coût-efficacité. Cette étude présente un examen complet des recherches récentes sur les méthodes basées sur l'adsorption utilisées pour atténuer la contamination par les métaux lourds dans les environnements aqueux. (Times New Roman 10).

**Mots-clés :** Environnementaux, Processus d'adsorption, Polluants métalliques.

## TOPIC 04: Environment and material degradation

### Physico-chemical characterization of raw clay for the elimination of phosphate by adsorption

Asma Behilil<sup>1</sup>, Ilham Sergma<sup>2</sup> and Karima Mezaouli<sup>2</sup>

<sup>1</sup> Laboratory of Chemistry and Environmental Sciences, University TAHRI Mohamed Bechar, Faculty of Sciences, Department of Technologies, BP 417 Kenadsa Road, Bechar 08000, Algeria

<sup>2</sup> Ahmed DRAIA University, Faculty of Sciences and Technologies, Hydrocarbon Department, Ahmed Daraya University, National Road No. 6, Adrar 01000, Algeria

\*Corresponding author e-mail: BEHILIL Asma [behilildz@yahoo.fr](mailto:behilildz@yahoo.fr)

#### Abstract :

Water is the most important natural resource for life on our planet, but it is usually contaminated with organic materials and pollutants. A shortage of clean water can lead to serious problems and illnesses [1]. Phosphate is an important component of organic matter, but when present in excessive proportions in the environment, it must be considered a contaminant. Clay is one of the most abundant constituents on the earth's surface. Because of its wide surface area, microporous structure, high adsorption capacity, chemical composition of its surface, and relatively rapid regeneration, clay is a promising adsorbent that is affordable and readily available in nature [2]. The goal of this research is to valorize local minerals such as clay mined from the Wilaya of Naama in "Ain Ouarka" and to decrease water pollution concerns. The results show that the raw clay contains three phases: quartz, clinocllore, and sericite 2M1. The excess of sulfate ( $\text{SO}_4^{2-}$ ) in Foggara de "Zaouiet Kounta" exceeds the standards of potability. The kinetic study indicates that the rate of sulfate fixation was of order 471.779 mg/g for raw clay (AB); furthermore, we found that the pseudo-second- order model indicates a good affinity, where the coefficient of correlation ( $R^2 = 0.994$ ) to the adsorbent AB.

**Keywords:** Enviroment, Material, pollution and Sulfate.

## TOPIC 04: Environment and material degradation

---

### References:

[1] Aazam, E.S. Photocatalytic oxidation of methylene blue dye under visible light by Ni doped Ag<sub>2</sub>S nanoparticles. Journal of Industrial and Engineering Chemistry 20(6) (2014) 4033-4038.

[1] Tsozué, D.; Nzeugang, A-N.; Mache, J-R.; Loweh, S.; Fagel, N. Mineralogical, physico- chemical and technological characterization of clays from Maroua (Far-North, Cameroon) for use in ceramic bricks production. Journal of Building Engineering 11 (2017) 17-24.

## TOPIC 04: Environment and material degradation

### Metallurgical Transitions Characterization of Heat-Treated X70 Steels using Magnetic Barkhausen Noise method

Hocine NEBAIR<sup>1,2</sup>, Sami ZIDELMEL<sup>3</sup>, Bachir HELIFA<sup>1</sup>, Samir BENSAID<sup>4</sup>, Ibn Khaldoun LEFKAIER<sup>1</sup>

<sup>1</sup>Laboratoire de Physique des Matériaux, Université de Laghouat, B.P. 37G route de Ghardaia 03000  
Laghouat, Algeria

[helifa@yahoo.fr](mailto:helifa@yahoo.fr); [lefkaierk@gmail.com](mailto:lefkaierk@gmail.com)

<sup>2</sup>Ecole Normale Supérieure de Laghouat, BP 4033, Laghouat, Algeria

[h.nebair@ens-lagh.dz](mailto:h.nebair@ens-lagh.dz)

<sup>3</sup>Laboratoire de Génie des Procédés, Laghouat, Algeria

[s.zidelmel@lagh-univ.dz](mailto:s.zidelmel@lagh-univ.dz)

<sup>4</sup>Laboratoire des Matériaux et du Développement Durable, Université de Bouira, Bouira, Algeria

[s.bensaid@univ-bouira.dz](mailto:s.bensaid@univ-bouira.dz)

#### ABSTRACT :

This research aims to characterize the metallurgical transitions during quenching of X70 steel by magnetic Barkhausen noise (MBN). In order to monitor the relationship between mechanical properties and micromagnetic parameters, a direct quench (DQ) treatment is used at the inter-critical annealing (IAT) temperature ranges applied to the samples from 740°C to 820°C. MBN were performed using the MikroMach instrument. Hardness measurements and microstructure examinations were carried out using a durometer and optical microscopy. The experimental results show that the DQ treatment revealed a hard martensite distributed in a ductile ferrite matrix. Martensite volume fraction (MVF) and hardness increase with increasing IAT. These treatments make it possible to obtain the highest hardness in DQ treatment at higher temperature. Indeed, the MBN method proved to be very sensitive to changes in microstructure and MVF morphologies.

## TOPIC 04: Environment and material degradation

### Synthesis of Graphitic Nitride modified Maghnite Clay Catalyst for Efficient Dye Degradation via Impregnation Calcination Method

MEKIDICHE Mounir<sup>1</sup>, MEKIDICHE Bouchra<sup>1</sup>, KHALDI Khadidja<sup>1,2</sup>

<sup>1</sup>Laboratory of Catalysis and Synthesis in Organic Chemistry, Faculty of Sciences, University of Tlemcen, Algeria.

<sup>2</sup>Scientific and Technical Research Center in Physico-Chemical Analyses CRAPC, BP 384, Bou-Ismaïl, RP 42004, Tipaza, Algeria

[mounirmekidiche02@gmail.com](mailto:mounirmekidiche02@gmail.com)

#### Abstract :

Graphitic nitride (gC<sub>3</sub>N<sub>4</sub>) is a promising catalyst due to its unique electronic and chemical properties. We synthesized a novel gC<sub>3</sub>N<sub>4</sub>-Maghnite catalyst through environmentally friendly impregnation and calcination techniques. Characterization via BET, FTIR, and XRD confirmed the successful synthesis yielding gC<sub>3</sub>N<sub>4</sub> with a high surface area and well-defined crystalline structure, UV-RD spectra confirmed the catalyst's ability to adsorb visible light irradiation. The efficacy of this catalyst was assessed in the degradation of Acetaminophen, a common dye used in the pharmaceutical industry. Under simulated solar irradiation, the catalyst achieved an impressive 97% degradation of the dye in just 40 minutes.

This study highlights the potential of impregnation and calcination-synthesized gC<sub>3</sub>N<sub>4</sub> catalysts for efficient dye degradation. These results hold promise for the development of sustainable and eco-friendly approaches to industrial wastewater treatment. The use of such catalysts could contribute positively to environmental preservation and pave the way for further research in this field.

**Keywords :** *Maghnite-gC<sub>3</sub>N<sub>4</sub>- Methylene blue-Photocatalysis.*

## TOPIC 04: Environment and material degradation

### Contribution of green Deep Eutectic Solvents in organic synthesis- Asymmetric Biginelli reaction as an example of application

F.Z. Saci<sup>1</sup>, A. Safer<sup>1,2</sup> and A. Morsli<sup>1</sup>

<sup>1</sup>Chemical engineering department, Chemistry faculty, University of Sciences and Technologies -MB-,  
Oran, Algeria

<sup>2</sup>Applied Organic Synthesis laboratory, Oran1-Ahmed BenBella university, Oran, Algeria

E-mail: [fz307473@gmail.com](mailto:fz307473@gmail.com), [asafer2001@yahoo.fr](mailto:asafer2001@yahoo.fr), [morsli\\_amine@yahoo.fr](mailto:morsli_amine@yahoo.fr)

#### Abstract :

Dihydropyrimidinones (DHPMs) are an important class of biologically active heterocycles. The present work reports the use of a simple deep eutectic solvents (DES) [choline chloride: urea 1:2] as a catalyst and environmentally benign reaction medium for the synthesis of 3,4-dihydropyrimidin-2(1H)-one, from benzaldehyde, methyl acetoacetate, and urea in good enantiomeric excess and good yields. DES, which is obtained by mixing two components (hydrogen Bond donors HBD and hydrogen bond acceptors HBA) combines many advantages like high biodegradability and low toxicity. The fact that a DES can act as a solvent and a catalyst in the same time allowed us to choose it as a reaction medium for the synthesis of DHPM.

In order to find out the most efficient method, reactions were carried out in solvent- free conditions with the presence of another type of catalyst such as Metal salts  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  and  $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$  in their available form or encapsulated in alginate beads. Results show that The Ni (II) metal catalyst supported on the alginate matrix favoured the almost complete formation of the R enantiomer then S, with excellent yields in short reaction time.

**Keywords:** DHPM, DES, alginate, green chemistry, enantiomeric excess.

#### Introduction

Recently, the interest in synthesis of functionalized 3,4-dihydropyrimidin-2(1H)-ones (denoted as Biginelli compounds or DHPMs) and their derivatives is increasing tremendously because of their therapeutic and pharmacological properties. The biological activity of drugs is generally attributed to a single enantiomer present in Drugs. Hence the importance of synthesizing products with enantiomeric



## TOPIC 04: Environment and material degradation

excess closes to or equal to 100%. Synthetic strategies for the DHPMs nucleus involves one-pot to multi-steps approaches. The classical Biginelli reaction has been first reported in 1893 as a cyclocondensation of dicarbonyl compounds with aldehydes (aromatic and aliphatic aldehydes) and urea or thiourea in protic solvents ( ethanol solution for example) containing catalytic amounts of acid [1].

This method, however, involves long reaction times, unsatisfactory yields and harsh reaction conditions because of the use of organic solvents as reaction media. In fact, common volatile organic compounds (VOC) used as solvents are regarded from an environmental point of view, they show many intrinsic drawbacks, such as accumulation in the atmosphere, flammability, high toxicity, and non-biodegradability [2].

In this context, and as a need for sustainable Chemistry, the asymmetric Biginelli reaction has received renewed interest in an environmentally thoughtful manner with improved yields. The use of ionic liquids as green catalyst [3], solvent free conditions [4], microwave [5] or ultrasound irradiation [6] has been reported.

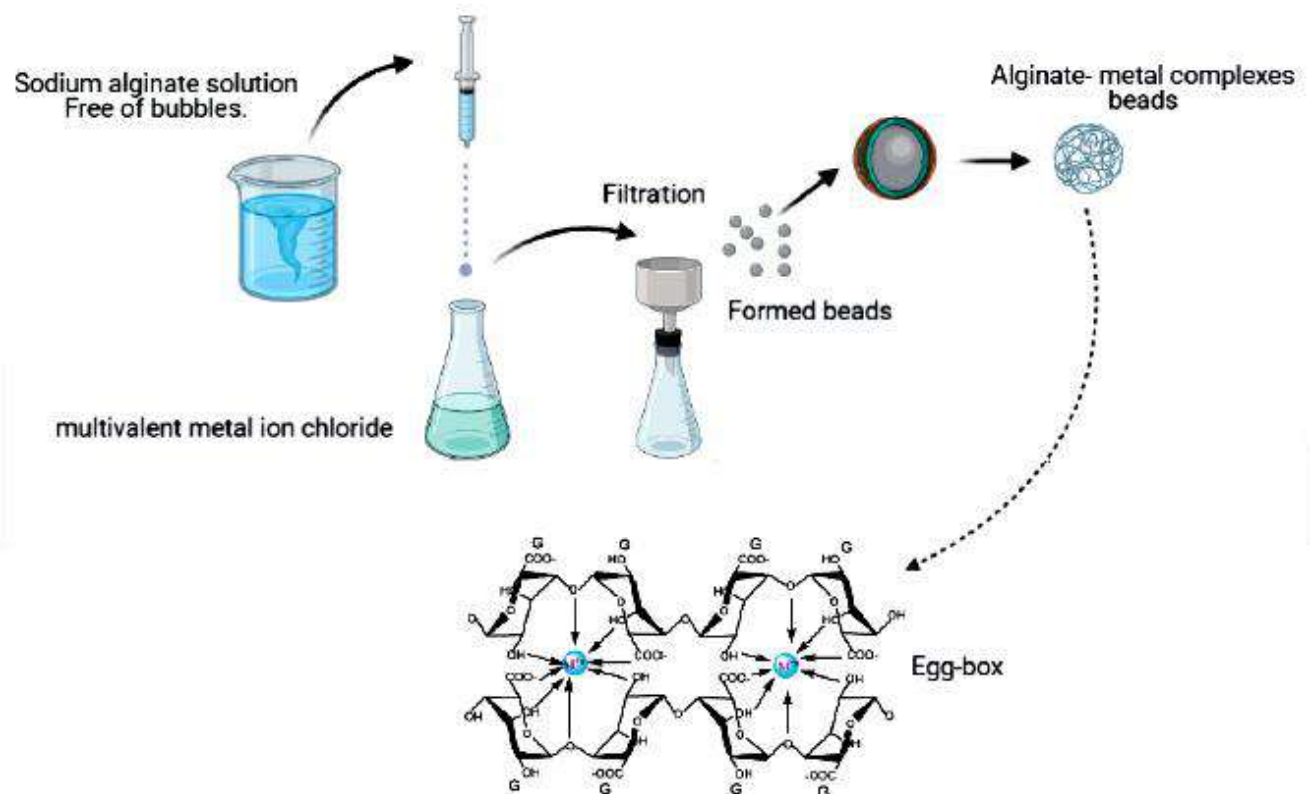
Thus, we focused in our work on the asymmetric Biginelli reaction, catalyzed by the Lewis acids  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  and  $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ . The use of Alginate, as a biosourced catalytic support, was also considered in this study. In addition, new solvents, qualified as green, appeared as an alternative to the usual organic solvents [2]. Deep eutectic solvents (DES) have attracted our attention to choose them as a reaction medium for the synthesis of DHPM.

DES include simple eutectics made from a combination of quaternary ammonium salts, like choline chloride ( $\text{ChCl}$ ), with either hydrogen bond donors like urea and glycerol, or with metal halides (complexing agent) like zinc chloride. This type of solvents combines the great advantages of other proposed environmentally benign alternative solvents, such as low toxicity, high availability, low inflammability, high recyclability, low volatility and low cost, avoiding many disadvantages of these neoteric media. The fact that many of the components of the mixture come directly from Nature assures their biodegradability and renewability.

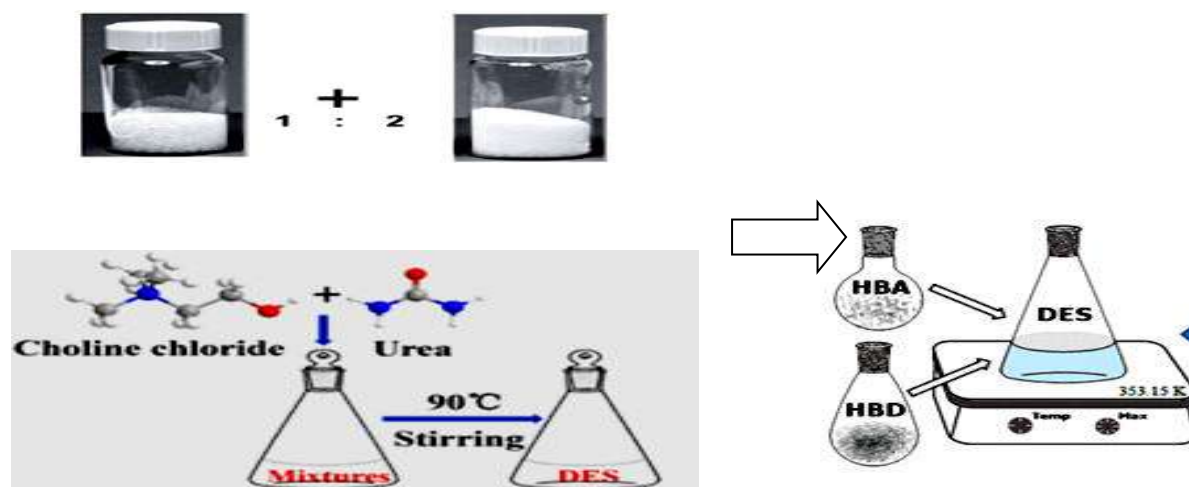
### Materials and Methods

- *Preparation of metal salts encapsulated in alginate beads*

## TOPIC 04: Environment and material degradation



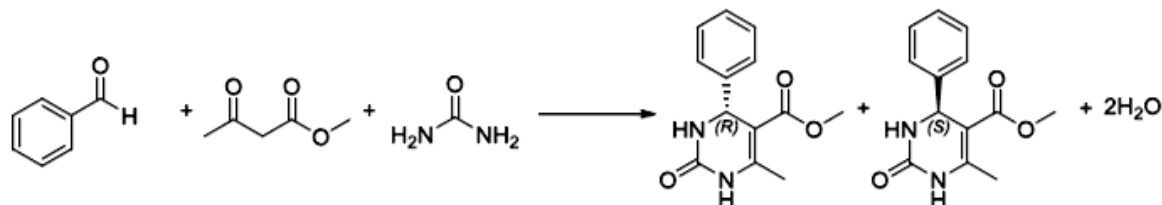
### ➤ Preparation of DES



### ➤ Biginelli Protocol

## TOPIC 04: Environment and material degradation

The cyclocondensation of 1 equivalent of methyl acetoacetate with 1 equivalent of benzaldehyde and 1.5 equivalent of urea (Scheme 1) was carried out in sufficient amount of solvent (DES [ChCl :urea 1:2] / acetic acid). The mixture was heated under constant stirring. The progress of the reaction was monitored by thin layer chromatography. The reaction mixture was quenched by adding distilled water while still hot. Precipitated products were filtered, dried and identified by  $^1\text{H}$  NMR,  $^{13}\text{C}$  NMR and melting point Measurements. The reactions were then catalyzed with metal salts  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  or  $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$  in their available form or encapsulated in alginate beads.



Scheme 1. The asymmetric Biginelli reaction

### Results and discussion

The analysis of the products obtained by chiral phase chromatography (HPLC) allowed to calculate the values of enantiomeric excess. Table 1 summarizes the most significant results in this work.

## TOPIC 04: Environment and material degradation

Table 1. Principal results

Entry	Catalyst / solvent	T (° C)	t	isolated yields (%)	ee (%)
1	H <sub>2</sub> SO <sub>4</sub> / EtOH (Folkers' conds.) [7]	Reflux	18 h	42	/
2	Catalyst-free / solvent- free	90	<15 mn	35 <sup>c</sup>	80
3	Catalyst- free/AcOH	Reflux	6 h	65	37
4	Catalyst- free/ DES	90	2 h	67	96
5	(10% mol.) CuSO <sub>4</sub> .5H <sub>2</sub> O/ solvent-free	90	<15	91	90
6	(10% mol.) Ni(NO <sub>3</sub> ) <sub>2</sub> .6H <sub>2</sub> O/ solvent-free	90	<15	95	92
7	(20% mol.) Cu-alg/ solvent-free	90	<15	72	95
8	(20% mol.) Ni-alg/ solvent-free	90	<15	82	99

c : conversion rate calculated by NMR equal to 88%.

Under solvent-free conditions, the totality of reagents have been consumed after 15 min of reaction. The addition of solvents slows down the reaction. However, it is three times faster in DES than in AcOH. A high stereoselectivity value is observed when DES is used (entry 4).

Theoretically, the reaction should lead to a racemic mixture (ee =0) since benzaldehyde is a planar molecule, but we observe a value for (ee) different from 0. These ee values suggests that the addition of

## TOPIC 04: Environment and material degradation

the rest of reagents is not made directly on plane benzaldehyde molecule, but on iminobenzene. In fact, the asymmetric carbon was formed on the imine formed between benzaldehyde and urea (the deviation from the plane is  $24.4^\circ$ , as shown in figure 1). On the other hand, Jaggi Lal et al [8] have confirmed that the formation of imine is an indispensable first step in the Biginelli reaction. Concerning the influence of the solvents used on the enantioselectivity, DES is more bulky than acetic acid as shown in figure 2. The *Re* face is the face released from the beginning. However, the *Se* face is less released when we use DES rather than AcOH because of its steric hindrance, which allows to explain the difference of the enantioselectivity observed between the two solvents (entry 4, entry 5).

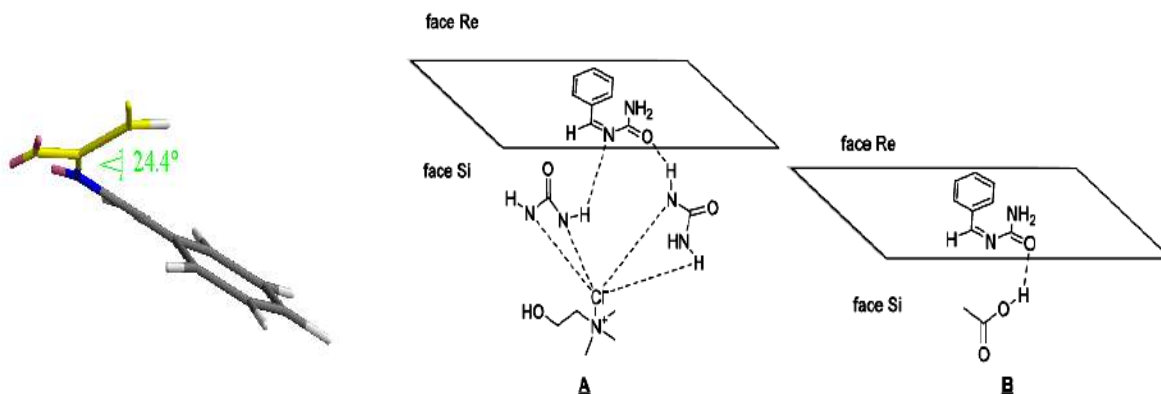


Figure 1. Addition on imino benzene molecule

Figure 2. Steric hindrance of DES/ AcOH

The use of a Lewis acid catalyst improved the yields and the enantiomeric excesses of the reaction compared to the first entry. The yields obtained by adding the metal salts in their available form (entry 5, entry 6) are higher than the encapsulated forms, this can be explained by the fact that the metal is complexed with the alginate. The use of alginate beads containing nickel or copper (entry 7, entry 8) favors better stereoselectivity of the reaction compared to the free metals. This is mainly related to the effect of the catalytic support. It is often considered a confined space for catalysts. Nickel gives the best results either in yield or enantioselectivity. In fact, the calculated energies of the nickel and copper complexes show that the complex with nickel is more reactive (the less stable) as shown in figure 3 and 4

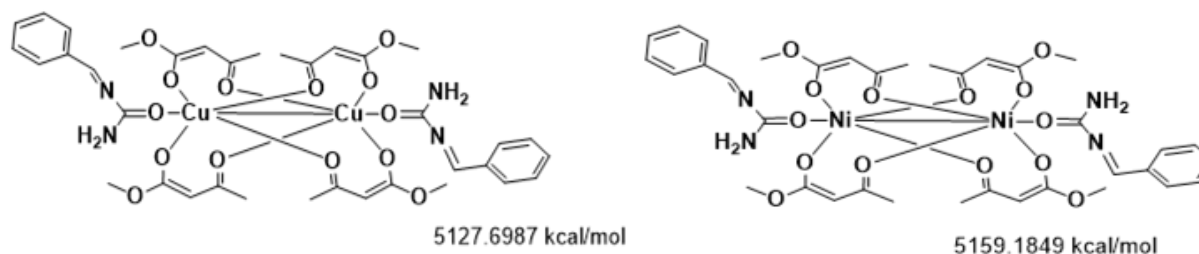


Figure 3 and 4. Structure of M-acetoacetate-iminobenzene complexes

### References

## TOPIC 04: Environment and material degradation

---

- [1] Kappe, C. O. *Tetrahedron*, 49, 6937 -6963 (1993).
- [2] Alonso, D. A., Baeza, A., Chinchilla, R., Guillena, G. *and all. Euro. J. Org. Chemistry*, 4, 612-632 (2016).
- [3] J.J. Peng and Y.Q. Deng. *Tetrahedron*, 42, 5917- 5919 (2001).
- [4] K. R. Reddy, Ch. V. Reddy, M. Mahesh *and all, Tetrahedron.*, 44, 8173-8175 (2003).
- [5] M. Mirza-Aghayan, M. Bolourtchian, M. Hosseini. *Syn. Comms.* 34, 3335-3341 (2004).
- [6] J. S. Yadav, B.V. S. Reddy, K. B. Reddy *and all. J. Chem. Soc. Perkin Trans. 1*, 1939-1941(2001).
- [7] Hu E. H., sidler D. R., & dolling U.H. *The Journal of Organic Chemistry*, 63(10), 3454-3457 (1998).
- [8] Lal, J., Sharma, M., Sahu, P.K. et al. *Proc. Natl. Acad. Sci., India, Sect. A Phys. Sci.* 83, 187-193 (2013).

### استخدام الاستشعار عن بعد في رصد تدهور الغطاء النباتي

HADDAD Hanane

Université Mohamed Khider de Biskra

hanane.haddad@univ-biskra.dz

#### المخلص

في ظل الازمات الحالية التي يشهدها العالم تعددت الرؤى والاستراتيجيات لمواجهتها و ايجاد حلول ناجعة للمخاطر البيئية سواء الناتجة عن النشاط البشري او الكوارث الطبيعية مثل تدهور الغطاء النباتي بسبب الحرائق و الذي يؤثر على الانسجام بين الانسان و البيئة، وللوقاية من هذه الاخطار البيئية و تسيير الكوارث في اطار التنمية المستدامة لا بد من اليات تمكن من التنبؤ بها. يعتبر الاستشعار عن بعد تكنولوجيا فعالة توفر بيانات ضخمة عن الظواهر البيئية بواسطة الاقمار الاصطناعية او الطائرات. ومن خلال هذه البيانات من صور ومرئيات فضائية وبعد تحليلها يمكن فهم ديناميكية تطور البيئة وكذا التحديد الدقيق للمؤشرات البيئية وتقدير مدى التدهور والتنبؤ بما ستكون عليه البيئة مستقبلا و التحقق من المخاطر المتوقعة وتأثيرها وتوفير الانذار المبكر و الاستجابة السريعة لحالات الطوارئ: في الملصق الذي 2 القمر الصناعي سانتنيل عن بعد واستخدام مرئيات سنعرضه سنوضح طريقة الحصول على بيانات الاستشعار لرصد وتتبع ظاهرة بيئية خطيرة وهي تدهور الغطاء النباتي من خلال SNAP ومعالجتها باستخدام برنامج (SentiNel2) دراسة وتوضيح العوامل المتدخلة واقتراح حلول فعالة للمحافظة على البيئة من اجل تنمية مستدامة .

## TOPIC 04: Environment and material degradation

---

### CARACTERISATION PARASITOLOGIQUE DES EAUX EPUREES DE LA STATION D'EPURATION DE LA COMMUNE DE TIGZIRT

Dyhia AISSAOUI, Mohammed Said METAHRI

Laboratoire des Ressources Naturelles, Faculté des Sciences Biologiques et des Sciences Agronomiques.  
Université Mouloud MAMMERI Tizi-Ouzou Algérie, UN 1501. [dyhia.aissaoui@ummtto.dz](mailto:dyhia.aissaoui@ummtto.dz)

#### Résumé :

Les eaux épurées de la commune urbaine de Tigzirt sont rejetées dans l'Oued Tamda qui alimente directement la plage Tassalast. Cette étude a été entreprise afin d'identifier la contamination parasitaire des eaux épurées par la station d'épuration installée en aval de la commune. L'analyse parasitologique a été effectuée par la méthode de filtration et en présence de lugol à 1 %. Les résultats observation au microscope à l'état frais indiquent une forte contamination pathogène ; une charge de protozoaire par l'*Entamoeba coli*, l'*Entamoeba histolytica* et le Kyste de *Giardia duodenalis* ; une charge d'helminthe par d'*Ascaris lumbricoide*, *Capillaria philippinensis*, *Trichuri strichuria*, l'œuf d'*Ankylostome*, le mal de *Ankylostoma duodenale*, larve rhabditoïde d'anguille, *Ténia saginata*, *Echinococcus granulosus*, l'œuf de *Schistosoma mansoni* et *Fasciola hepatica*. Les effluents constituent donc un risque pour l'environnement hydrique et pour la santé publique des utilisateurs de ladite plage.

**Mots-clés :** contamination, STEP, littoral, Tizi-Ouzou.



## TOPIC 04: Environment and material degradation

### Determination of optimal electrodeposition conditions of NiO thin films for environmental applications

Ouidad Baka<sup>1</sup>, Oussama Bacha<sup>1</sup>

<sup>1</sup>Univ. Ouargla, Fac. des Sciences Appliquées, Lab. Dynamique, Interactions et Réactivité des Systèmes,  
BP 511 Ouargla, Algeria.

<sup>\*</sup>(baka.widad@gmail.com) Email of the corresponding author

#### Abstract :

The objective of this study was to determine the optimal conditions for the electrodeposition of nickel oxide (NiO) nanostructures on an ITO glass substrate. An aqueous solution containing 0.05 M nickel sulfate, 0.1 M KCl, and 0.05 M EDTA was used to electrodeposite NiO nanostructures at various cathodic potentials. Solution's pH and temperature were adjusted to 12 and 70 °C, respectively. The XRD patterns show that the obtained NiO nanostructures are polycrystalline in cubic phase structure with preferred orientation along (220) direction, while the average crystallite size was varied between 50.91 and 64.91 nm. Moreover, the morphological characterization of NiO nanostructures using AFM showed that the films are rough and distributed totally over the ITO surface with a granular topography. Optical properties were determined using Uv-vis analysis, while the transmission spectra of NiO nanostructures were recorded in the wavelength range of 350–800 nm. The transmission values were decreased and the obtained optical band gap varied between 3.69 and 3.88 eV with increased cathodic potential. Furthermore, Mott-Schottky analysis confirmed the *p*-type semiconductor for all NiO samples. While the deposition potential was changed from -1.3 to -1.45 V, the charge carrier density was varied between  $1.21 \times 10^{18}$  and  $0.75 \times 10^{18} \text{ cm}^{-3}$ . Furthermore, the results of this study investigate that the obtained NiO is an excellent metallic oxide material for photocatalyst applications, low cost, efficient and has a large band gap of  $\leq 3.69 \text{ eV}$ . This last value has a critical role in the photocatalysis process, for the decomposition of organic pollutants.

**Keywords:** NiO, Electrodeposition, nanostructures, photocatalysis, organic pollutants

## TOPIC 04: Environment and material degradation

### Valorisation et traitement chimique des fibres végétales pour préparer des matériaux composites.

LAIB Nouri <sup>1</sup>, BENYAHIA Azzedine <sup>2</sup>, DEGHFEL Nadir <sup>1</sup>, Melouki Azzedine <sup>1</sup>, Chouki Farsi<sup>1</sup>

<sup>1</sup>Inorganics Materials Laboratory, University of M'sila, Algeria

<sup>2</sup>City, Society, Environment and Sustainable Development, University of M'sila, Algeria

E-mail: [nouri.laib@univ-msila.dz](mailto:nouri.laib@univ-msila.dz)

#### Résumé:

Les fibres naturelles sont connues depuis longtemps et sont utilisées comme renfort dans la fabrication de matériaux composites [1-3]. En particulier, dans le domaine de l'emballage, de la santé, de la pharmacie, de la construction automobile et dans le domaine aéronautique [4]. Les fibres naturelles présentent de nombreux avantages tels que; disponibilité, faible coût, faibles densités, rigidité, biodégradabilité et ont un comportement mécanique important [5]. De nombreux chercheurs ont observé que la préparation de matériaux composites renforcés de fibres naturelles peut améliorer l'efficacité mécanique de ces composites [6]. Laib et al. [7] ont préparé un matériau composite à partir d'une matrice de polyester insaturé avec des fibres de Luffa, qui a subi différents traitements chimiques (NaOH, permanganate, dichromate, silane et eau de Javel) afin d'améliorer l'adhérence interfaciale fibre-matrice. L'objectif de ce manuscrit est de étudier l'effet d'un traitement alcalin et du temps de traitement sur les propriétés mécaniques d'un matériau composite à base d'une matrice thermodurcissable (polyester insaturé) renforcé de fibres Alfa.

**mots clés:** Fibres naturelles, Composite, Traitement chimique ,polyester insaturé , Alfa.

## **TOPIC 04: Environment and material degradation**

---

### **Investigation of the impact of various chemical substances on the properties of palm fiber reinforced polyethylene composites.**

Nour Elhouda Nouioua<sup>1</sup>, Hamida Boussehel<sup>1, 2\*</sup>

*\* E-mail: nourelhouda.nouioua@univ-biskra.dz*

*<sup>1</sup> Laboratory of Mechanical Engineering LGM, University of Biskra, Algeria*

*<sup>2</sup> Department of Material Sciences, Faculty of Natural and Life Sciences, University of Biskra, Algeria*

*<sup>3</sup> Laboratory of Applied Chemistry LCA, University of Biskra, Algeria*

#### **Abstract**

In recent times, there has been a concerted effort to enhance the mechanical properties of synthetic polymeric materials by integrating a range of reinforcing fillers. Among these, lignocellulosic materials stand out due to their eco-friendly nature as agrowaste, offering a promising avenue for addressing upcoming environmental challenges. With their inherent ability to degrade naturally over time, these materials can be readily sourced from agrowaste without causing noteworthy harm to the environment. This study is focused on evaluating the impact of alkali treatments applied to palm fibers and the incorporation of silane coupling agents on the mechanical, thermal, and water absorption traits of polyethylene (PE) composites. The effects of these treatments on the fibers are assessed using infrared spectroscopy. The utilization of treated fibers in composite formulations results in elevated mechanical characteristics in comparison to untreated counterparts. Furthermore, detailed scanning electron microscopy (SEM) images underscore a robust interfacial adhesion between the treated fibers and the polyethylene composite matrices, thereby contributing to heightened water absorption capacity and reinforced thermal durability.

**Key Words:** Polyethylene, Palm fiber, Alkali treatment, Coupling agent, Adhesion

## TOPIC 04: Environment and material degradation

### Traitement du composé aromatique Para Xylène par encapsulation

Amina Benaïssa 1, Noura Naili 2, Faiza Chekkal 3 and Malika Khelfaoui<sup>4</sup>, Hamada Said,

Daifallah Farouk<sup>6</sup>, Mecheri Imad<sup>7</sup>

<sup>1,4</sup> Laboratory of Génie chimique et environnement de Skikda (LGCES), Department of Process Engineering, Faculty of Technology, 20 Août 1955 University, P.O. Box 26, Skikda 21000, Algeria

<sup>2,3</sup> Department of Chemistry, Faculty of Science, 20 Août 1955 University, P.O. Box 26, Skikda 21000, Algeria

<sup>5, 6, 7</sup> Department of Process Engineering, Faculty of Technology, 20 Août 1955 University, P.O. Box 26, Skikda 21000, Algeria

[a.benaïssa@univ-skikda.dz](mailto:a.benaïssa@univ-skikda.dz)

#### Abstract

Les produits aromatiques sont des composés toxiques présents dans de nombreux produits industriels, présentant ainsi des risques pour la santé humaine et l'environnement. Les produits aromatiques peuvent contaminer les sols et les eaux souterraines, entraînant la non-potabilité de l'eau et des problèmes à long terme. Ils ont également des effets néfastes sur les écosystèmes terrestres et aquatiques, perturbant ainsi l'équilibre écologique.

Cette étude porte sur le P-xylène, avec pour objectif d'éliminer durablement le xylène grâce à l'utilisation de supramolécules respectueuses de l'environnement. La cavité  $\beta$ -CD, a été examinée pour l'inclusion de la molécule du P-xylène. La méthode PM7 a permis d'optimiser les structures et de déterminer le complexe le plus stable. Cette étude suggère que la hôte peut être utilisée comme base pour concevoir des capteurs chimiques détectant et éliminant le P-xylène.

**Mot clés :** Complexation, B-Cyclodextrine, P-Xylène, risque, environnement

## TOPIC 04: Environment and material degradation

### Apport des méthodes indexées dans l'évaluation de la qualité de la nappe de la Mitidja (Nord-Algérie)

ZAMICHE S\*

\* Laboratoire Gestion et Valorisation des Écosystèmes Agricoles et Aquatiques, Institut des Sciences, Centre Universitaire Morsli Abdallah de Tipaza, Oued Merzoug, Tipaza 42022, Algérie

\* [zamichsamira22@gmail.com](mailto:zamichsamira22@gmail.com)

#### RESUME

Ces dernières années, l'essor économique, particulièrement agricole a entraîné, d'une part, l'accroissement des besoins en eaux et a provoqué, d'autre part, la dégradation de la qualité des eaux. L'objectif de ce travail est d'évaluer la qualité des eaux des forages de la plaine de Mitidja utilisés pour la consommation humaine, à travers le suivi de différents paramètres physico-chimiques. Trente forages ont été prélevés et analysés pendant les années 2015 et 2016.

Les résultats ont fait ressortir que les eaux des forages situés dans la partie Ouest et Centre de la nappe sont de bonne qualité chimique avec un indice de qualité de l'eau qui ne dépasse pas 93. Cette dernière se dégrade progressivement en partant vers l'Est de la plaine avec un Indice de Qualité de l'Eau (IQE) supérieure à 100, ce qui correspond à des eaux de mauvaise qualité pour la consommation humaine et avec une conductivité électrique (moyenne= 1656  $\mu\text{S}/\text{cm}$ ) qui dépasse la norme de l'OMS fixée à 1500  $\mu\text{S}/\text{cm}$ . De plus, les teneurs en Nitrates dans cette partie de la nappe sont importantes (moyenne  $\text{NO}_3^-$  =56.68 mg/l) dépassant les normes recommandées par l'OMS.

**Mots clés :** Nappe alluviale de la Mitidja, IQE, indice de contamination, pollution, vulnérabilité.

## TOPIC 04: Environment and material degradation

### Groundwater contamination in agricultural areas: case of the Hennaya plain, Tlemcen

LAOUFI Abdessalam <sup>\*1</sup>, BOUDJEMAA Abderrazak <sup>1</sup> and GUETTAIA Sabrine <sup>1</sup>

<sup>1</sup> Laboratory No. 25: "Promotion of Water, Pedology and Mining Resources, Environmental Legislation and Technological Choices", Department of Earth and Universe Sciences, Abu Bekr Belkaid University, PO Box 119 Tlemcen 13000, ALGERIA

\* E-mail: [abdessalamlaoufi42@gmail.com](mailto:abdessalamlaoufi42@gmail.com)

#### Abstract:

Groundwater is the main source of irrigation water supply in the Hennaya plain. However, it is currently facing serious deterioration due to pollution by organic pollutants. This study was carried out to estimate the level of contamination in groundwater. The preliminary results of the physico-chemical analysis of 19 samples show high concentrations of nitrates (from 97.99 to 217.26 mg.L<sup>-1</sup>). Nitrate pollution index (NPI) values vary between 3.90 and 9.86, suggesting very high pollution in all of the analysed groundwater samples, which is explained by the excessive use of agrochemicals (Nitrogen fertilizers, NPK ...). The values of the irrigation quality water index (IQWI) ranged between 56.85 and 69.04, which indicates that all of these groundwater samples are of medium quality for irrigation, and that they are only suitable for irrigation of certain plants with high salt tolerance with special salinity control practices. According to the Gibbs diagram, groundwater dominates between rocks and salty waters, which explains the high electrical conductivity (EC) values (1366 to 1630 S.cm1) and the need for treatment before it can be used for agricultural irrigation. The Geographic Information System (GIS) provides spatial distribution mapping of the various parameters, which will enable managers to make the best decisions for the rehabilitation of groundwater resources in this region.

**Keywords:** Hennaya plain, Irrigation water, NPI, IQWI, Gibbs diagram, GIS

## TOPIC 04: Environment and material degradation

---

### Synthesis of copper oxide/zinc oxide nanocomposites thin films and their photodegradation properties

Abdelhafid Mahroug

1

Laboratory of Materials Physics and Its Applications (MPAL), Mohamed Boudiaf University of M'sila,  
Algeria.

#### Abstract:

The photocatalytic process is used to remove organic contaminants. The present study investigates the photocatalytic degradation of methylene blue by sol-gel-synthesized CuO/ZnO nanocomposites thin films with different CuO content.

CuO/ZnO nanostructures thin films were characterized by X-ray diffraction (XRD), PL and UV-vis spectroscopies and photodegradation test. XRD results confirmed the presence of CuO and ZnO phases in the nanostructure thin films. By incorporation of the CuO compound, the gap energy of ZnO decreased, PL intensity reduced, and the absorption of films in the visible was enhanced. ZnO/CuO nanocomposites thin films exhibit an excellent performance of photocatalytic activity.

**Keywords:** ZnO/CuO nanocomposites; Optical properties; photodegradation

## TOPIC 04: Environment and material degradation

### SYNTHESIS AND CHARACTERIZATION OF A PHOTOCATALYTIC SEMICONDUCTOR MATERIAL

Ksouri Ahlem<sup>1,\*</sup>, Meklid Abdelhek<sup>1</sup>

1. Applied Chemistry Laboratory, Mohamed Kheider University of Biskra BP145 (07000), Algeria

Corresponding author: [ahlem.ksouri@univ-biskra.dz](mailto:ahlem.ksouri@univ-biskra.dz)

#### Abstract :

The main objective of this work relates to the synthesis, the characterization of a semiconductor material of perovskite structure  $ABO_3$  by different techniques and to study the photocatalytic properties for the degradation of organic pollutants and the treatment of water. The material selected for this study was prepared by the sol gel method, and calcined at  $T = 800^\circ \text{C}$  for 5 hours, to form the perovskite oxide phase. Different characterization techniques were used such as scanning electron microscopy (SEM), X-ray diffraction analysis (XRD), and we performed Rietveld refinement using the FullProf software program on the obtained XRD, IR...

**Keywords:** Perovskite, Semiconductor,  $\text{BaBiO}_3$ , Degradation, Photocatalysis.



## TOPIC 04: Environment and material degradation

### Photodegradation of Rhodamine B by nanocomposite Co-Doped BTO/ZW synthesized by molten salt method

Ounis Amina<sup>1</sup>, Ksouri Ahlem<sup>2</sup>

<sup>1</sup>Applied chemistry laboratory Mohamed kheider university, biskra, Algeria

<sup>2</sup>Applied chemistry laboratory, Mohamed kheider university, biskra, Algeria

E mail : ounisamina27@univ-biskra.dz

#### Abstract:

$\text{Bi}_4\text{Ti}_3\text{O}_{12}$ 's (BTO) Aurivillius phase has drawn a lot of attention for its degradation of organic pollutants and treatment water. In this work the synthesis of 8%(In/Ta)-BTO/ZW nanocomposite was carried out by the molten salt method. X-ray diffraction analysis was performed on the prepared samples using a BRUCKER-AXS D8 ADVANCE instrument with CuK radiation ( $\lambda = 1.5406 \text{ \AA}$ ). Lattice parameters were determined from the XRD data using the cellref program. The Bragg angle ( $2\theta$ ) was scanned from  $10^\circ$  to  $80^\circ$  at a scanning rate of  $0.04^\circ/\text{sec}$  at room temperature. Surface morphology and the elemental composition of the sintered pellets were analyzed using a Scanning Electron Microscopy (SEM/EDX), specifically the model TS5136XM, VEGA. To confirm the presence of phases in the prepared samples, Fourier Transform Infrared Spectroscopy (FTIR) was conducted using a PerkinElmer instrument. UV-Vis absorbance measurements were performed using a UV-Vis spectrophotometer (UV-759CRT, Shanghai, China) to assess the UV absorbance. The band gap of the samples was determined using the Tauc plot formula. To assess the photocatalytic capability of the BTO/ZW nanomaterial its efficiency in breaking down Rhodamine-B (Rh-B) pollutants was evaluated. Rhodamine-B, with a peak absorption wavelength of 554 nm in aqueous environments, was chosen as the model pollutant. The finely powdered BTO/ZW compound was allowed to reach desorption/adsorption equilibrium during a 30-minute period of darkness before commencing the photocatalytic experiment under UV light irradiation (354 nm, 6W). Remarkably, BTO/ZW emerges as an effective catalyst, leading to a substantial 94% reduction in the concentration of Rhodamine-B after a 180-minute irradiation period, indicating that the degradation follows pseudo first-order.

**Keywords:** Aurivillius, nanocomposite, Photocatalytic, photodegradation, catalyst.

## TOPIC 04: Environment and material degradation

### ETUDE SUR LES REPONSES METABOLIQUES DES RATS MALES WISTAR DANS UN ENVIRONNEMENT NOCICEPTIF

Chahira RETEM<sup>1,\*</sup>, Fella CHEBBAH<sup>1</sup>, Chaima SMILI<sup>1</sup>, Amina DJOUINI<sup>1</sup> et Abd el Madjid BAIRI<sup>1</sup>

<sup>1</sup>Laboratoire de NeuroEndocrinologie Appliqué, Département de Biologie, Faculté des Sciences, Université Badji Mokhtar, ANNABA, ALGERIE.

\* E-mail: [retem\\_chahira@yahoo.fr](mailto:retem_chahira@yahoo.fr)

#### Résumé :

Les composés organophosphorés (COP) sont une classe importante de substances chimiques organiques, ils ont en commun une certaine liposolubilité et leur mode d'action sur le système nerveux en tant qu'inhibiteurs irréversibles de l'acétylcholinestérase, ce qui les rend très toxiques. Malgré les interdictions ou restrictions d'utilisation et la faible persistance de ces COP, ils sont détectés dans les sols, les eaux de surface et les organismes vivants dans tous les pays du monde. Parmi les organophosphorés, nous nous sommes intéressés au méthyl parathion « insecticide organophosphoré » qui est largement étudié pour ses propriétés neurotoxiques chez les mammifères et les poissons.

Ce travail consiste à mettre en évidence d'une part, l'effet inhibiteur des organophosphates (méthyl parathion) sur les taux de glucose, cholestérol et les triglycérides. D'autre part, étudier l'effet de la taurine antioxydante associée au MPT sur les paramètres biochimiques chez des rats mâles Wistar.

L'expérimentation consiste à administrés aux 18 rats males répartis en 3 lots à raison de 6 rats par lots, il s'agit : le lot T (témoin), le lot gavé au MPT (4mg/Kg) et le lot gavé au MPT + TA (2%) pendant 10 jours.

Les résultats obtenus montrent que l'insecticide organophosphoré appliqué par gavage induit des modifications des taux de glucose, cholestérol et les triglycérides. Le traitement de rats gavés (MPT) avec de la taurine a restauré les valeurs basales.

Le traitement MPT induit une augmentation significative de la concentration en glucose, triglycérides et cholestérol dans le sang. Le traitement des rats gavés au (MPT) par la taurine rétablie les valeurs basales des paramètres métaboliques.

**Mots clé :** MPT, La taurine, Glucose, Cholestérol, Triglycérides, Rat.

## TOPIC 04: Environment and material degradation

### Removal of Cationic Dye in Aqueous Solution by Photocatalytic Degradation Using Natural and Modified Clays by Vanadium(V) Oxide Under Sunlight Irradiation.

Messaoudi Zakarya Ayoub <sup>1</sup>, Messaoudi Mohammed <sup>2</sup>.

<sup>1</sup>Laboratory of Chemistry and Environmental Sciences. University of Tahri Mohamed, Bechar, Algeria.

<sup>2</sup>Department of Life and Natural Sciences, University of Adrar - Ahmed Draia, Algeria.

\*Corresponding author E-mail: [zakarya.messaoudi91@gmail.com](mailto:zakarya.messaoudi91@gmail.com)

#### Abstract:

A  $V_2O_5$ -supported natural volcanic Algerian clay ( $V_2O_5/CCA$ ) was synthesized through an impregnation method to prepare a photocatalytic adsorbent integrated. The discoloration of crystal violet dye (CV) from an aqueous solution using natural and modified clays via Vanadium (V) oxide by photocatalytic degradation. The materials were characterized by different analysis techniques. The  $V_2O_5/CCA$  material is considered to be an effective adsorbent and photocatalyst in the decolorization of the CV dye solution. The photocatalysis process of CV was executed by the  $V_2O_5/CCA$  material under sunlight irradiation. The characterization results of the  $V_2O_5/CCA$  material indicate the existence of the  $V_2O_5$  phase. The experimental results show that the pseudo-second and pseudo-1st order models describe the kinetics of adsorption and degradation, respectively. The discoloration efficiency with the  $V_2O_5/CCA$  (~ 92%) is higher compared to the CCA (64%), clearly indicating to promoting effect of  $V_2O_5$ .

**Keywords:** Clay;  $V_2O_5$ ; Crystal violet dye; Impregnation; Photocatalysis; Sunlight irradiation

# **PARTICIPANT STATISTICS**

## **SRWWE 2023**

# PARTICIPANT STATISTICS

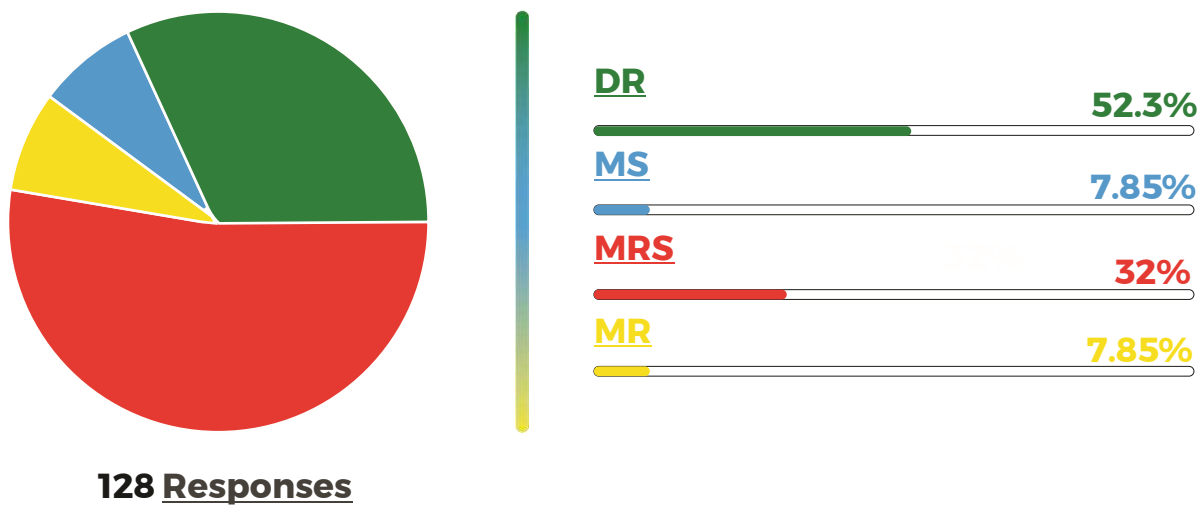
## INTRODUCTION

The First National Conference on Sustainable Resources: Waste, Water, and Energy (SRWWE 2023) brought together a diverse group of participants, including researchers, academicians, and students. This section offers a detailed statistical analysis of their contributions, categorized by scientific qualification, thematic focus, participation mode (in-person or virtual), and type of presentation (oral or poster). These insights highlight the inclusivity and multidimensional approach of the event.

## TEXTS FOR CIRCLES

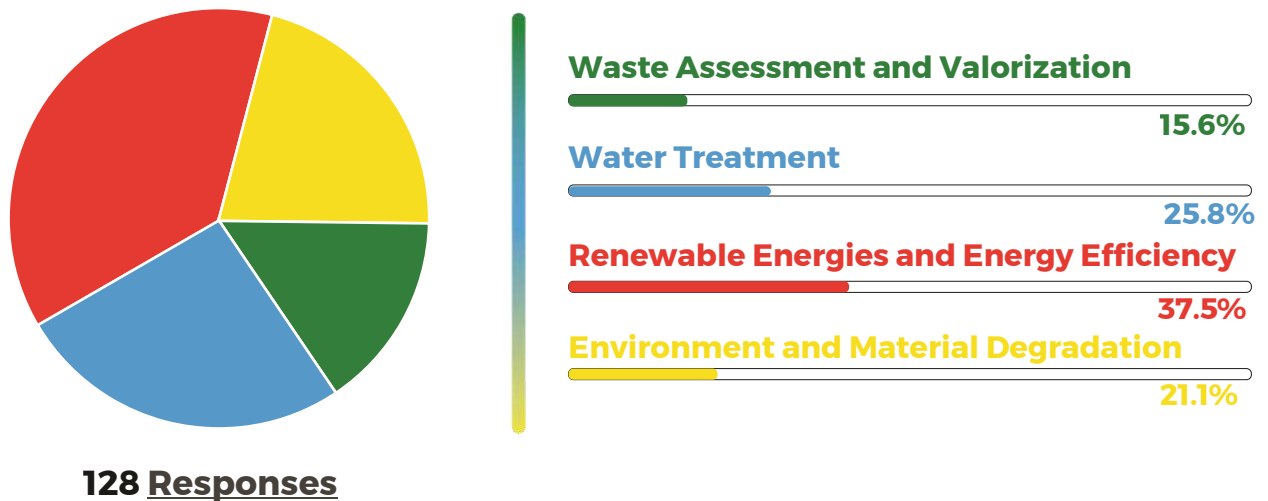
### 1. Scientific Degree of Participants

This chart depicts the distribution of participants based on their academic qualifications, including professors, doctors, researchers, and students. Each level of expertise brought valuable insights, fostering a vibrant exchange of ideas and knowledge.



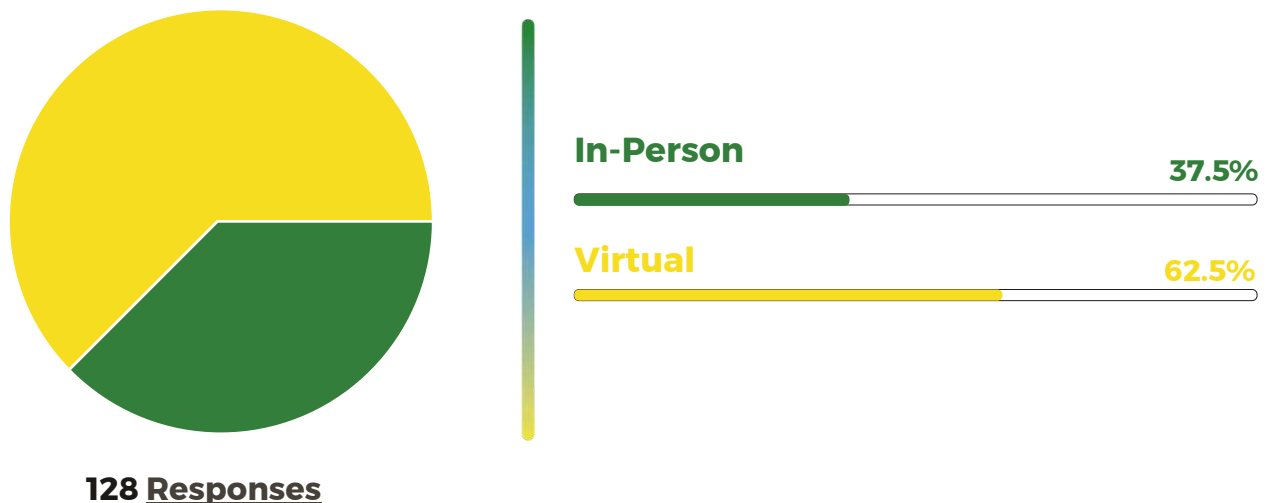
## 2. Participation by Topic

This chart presents the distribution of contributions across the four main themes of the conference: Waste Assessment and Valorization, Water Treatment, Renewable Energies and Energy Efficiency, and Environment and Material Degradation. It showcases the breadth of research areas addressed during the event.



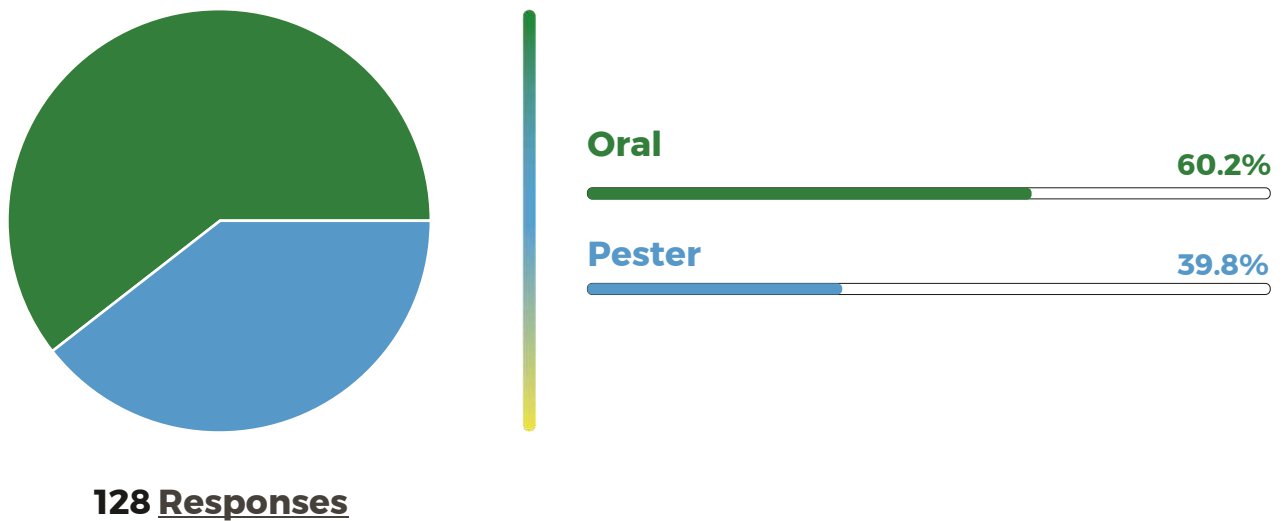
## 3. Participation Modes

This chart illustrates the balance between in-person and virtual participants, reflecting the hybrid nature of SRWWE 2023. The dual format ensured accessibility and enabled a wider audience to engage in meaningful discussions.



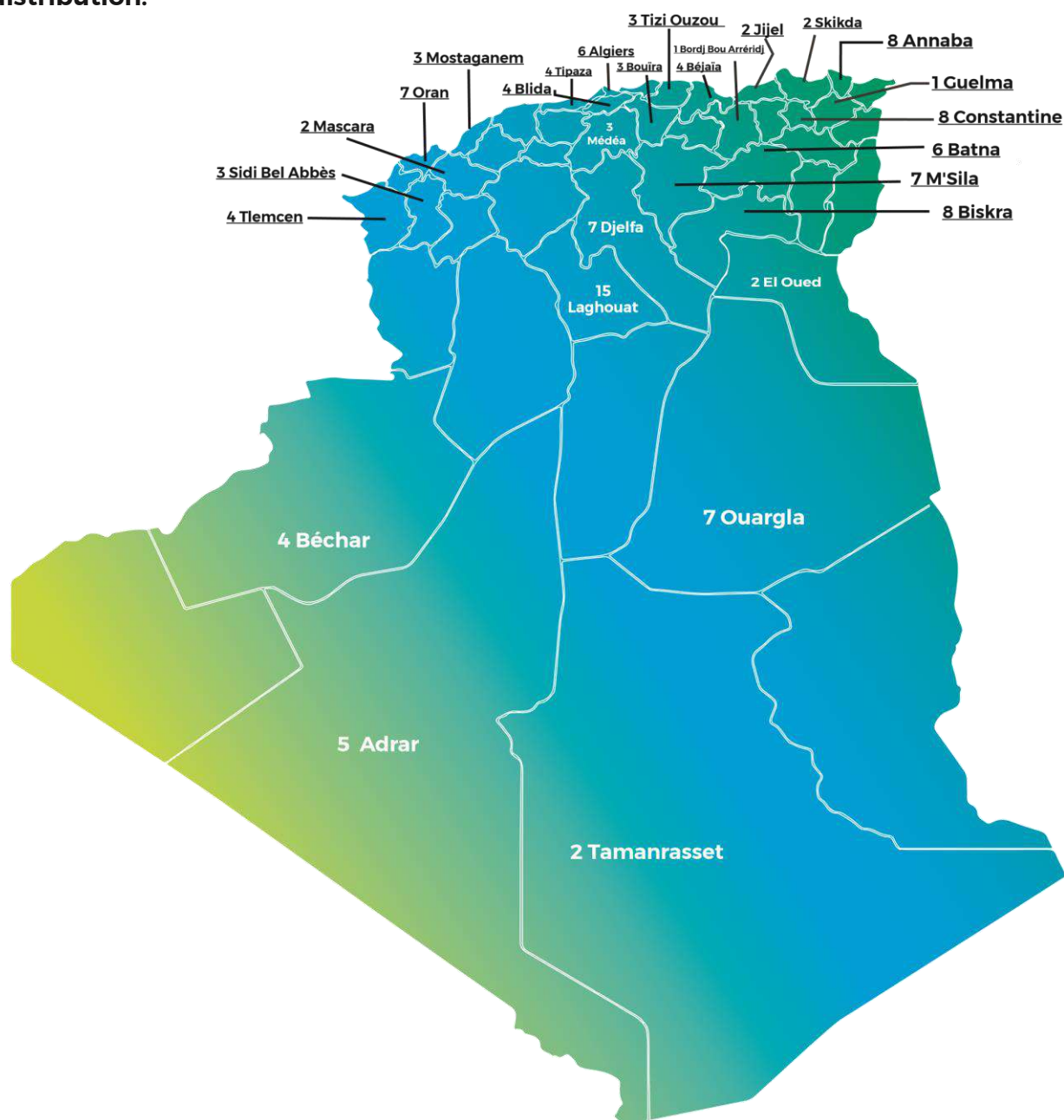
#### 4. Types of Presentations

This chart highlights the types of presentations—oral and poster—that participants delivered during the conference. The diverse presentation styles facilitated dynamic interactions, offering various ways to share and discuss innovative research.



## 5. Geographic Distribution of Participants

SRWWE 2023 brought together 128 participants from across Algeria, with contributions from 28 states, as well as international attendees from France and Tunisia. This map illustrates their distribution.



**128 Responses**

**126 Responses from Algeria**

**1 Replies from Tunisia**

**1 Replies from France**



## Conclusion

---

As we conclude the First National Conference on Sustainable Resources: Waste, Water, and Energy (SRWWE 2023), we reflect on the invaluable contributions of researchers, academics, and industry professionals who participated in this groundbreaking event. The discussions, presentations, and innovative ideas shared during this conference underscore the critical importance of sustainable practices in shaping a better future.

The conference served as a platform for fostering collaboration, exchanging knowledge, and addressing some of the most pressing challenges in environmental sustainability. From waste valorization and water treatment to renewable energies and combating material degradation, the contributions made here will resonate far beyond this gathering, inspiring continued efforts in research, policymaking, and real-world applications.

We extend our heartfelt gratitude to all participants, sponsors, and organizers whose dedication and commitment made this event a success. Your engagement and passion for sustainability remind us of the power of collective action.

As we look to the future, let us continue to innovate, collaborate, and lead the way toward a more sustainable world. Together, we can achieve the balance necessary for our planet's prosperity and for future generations.

## Acknowledgments

---

The SRWWE 2023 Organizing Committee extends sincere thanks to all contributors who enriched this event. A special acknowledgment is due to our sponsors and institutional partners, whose support was instrumental in the conference's success.

## Looking Ahead

---

We eagerly anticipate welcoming you to future editions of the SRWWE conference, where we will continue to explore new horizons in sustainable development. Let this event serve as a reminder of our shared responsibility to protect and preserve the planet.

**Thank you for being part of SRWWE 2023.**

## About the Conference:

**SRWWE 2023** brings together leading experts, researchers, and policymakers to discuss and develop innovative solutions for sustainable resource management, focusing on waste assessment, water treatment, renewable energies, and environmental preservation.

## Themes:

### Waste

Unwanted materials generated by human activity that require sustainable management to minimize environmental impact.

### Water

A critical resource essential for life, managed to ensure sustainable and clean use for all.

### Energy

The power needed for various activities, emphasizing renewable and efficient solutions to protect the environment.

## Acknowledgments:

We extend our gratitude to our sponsors, partners, and all contributors who have made **SRWWE 2023** possible. Your support drives progress in environmental sustainability.



[www.srwwe.com](http://www.srwwe.com)



[conf-001@ens-lagh.dz](mailto:conf-001@ens-lagh.dz)



[www.facebook.com/SRWWE/](https://www.facebook.com/SRWWE/)

