MADICA 2024

NOVEMBER 14-16th, 2024 Monastir Tunisia

Association Tunisienne pour l'Information Scientifique, ATIS, Tunisie

APES

Association pour la Promotion des Echanges Scientifiques, APES, Lyon-France

Madica.atis@gmail.com www.atis-tn.com https://madica-tn2024.sciencesconf.org/

Plenary Conferences

Latifa Fakri-Bouchet

Senior Associate Professor ; Institute of Analytical Sciences (ISA), CNRS, and Claude Bernard Lyon 1 University, France

Innovations in Breast Cancer Imaging: The Contribution of Microwaves and Artificial Intelligence

Date: November 14th, 2024 **Time: 9:30:00 AM** **Room:** A

Le cancer du sein demeure un défi majeur en santé publique, nécessitant des méthodes de dépistage plus efficaces et moins invasives. Malgré les progrès réalisés, les techniques actuelles (mammographie, échographie et IRM) présentent des limitations, notamment en termes de confort pour les patientes et d'efficacité pour certains types de seins.

Les tendances émergentes dans la littérature scientifique incluent le développement de systèmes d'imagerie portables, l'utilisation de réseaux d'antennes innovants, et l'intégration de techniques d'imagerie multimodales combinant différente modalités pour une détection plus précise.

L'imagerie micro-ondes émerge comme une alternative prometteuse, offrant une approche non ionisante et potentiellement plus confortable. Les avancées récentes en imagerie micro-ondes et en intelligence artificielle (IA) pour améliorer la détection précoce et le suivi du cancer du sein.

L'intégration de l'IA en général et dans cette technologie en particulier ouvre de nouvelles perspectives pour l'interprétation des données, la réduction des erreurs de diagnostic et la personnalisation du dépistage. Ces innovations pourraient conduire à des dispositifs de dépistage plus accessibles et à une amélioration significative de la prise en charge des patientes.

Le projet E-Daisy, combinant capteurs hyperfréquences miniaturisés et algorithmes d'IA, illustre le potentiel de ces technologies pour démocratiser l'accès au dépistage du cancer du sein, indépendamment des contraintes géographiques ou socio-économiques.

Cette synergie entre imagerie micro-ondes et IA promet d'améliorer la détection précoce du cancer du sein, offrant ainsi de nouvelles perspectives pour la santé des femmes à l'échelle mondiale.

Olfa Kanoun

Professor; University -Chemnits, Germany

Potential of flexible polymer-carbon-nanomaterials composites enhanced sensors for the next generation sensing technologies

---

Date: November 14th, 2024 **Time: 10:00:00 AM** **Room:** A

Salmon Laurent

Professor ; Université-Paris-saclay, France

Carbohydrate-based electrochemical biosensors for detection of a cancer biomarker in human plasma

Salmon laurent (1), Guo jia (1), Korri-Youssoufi hafsa (1)

1 - Institut de Chimie Moléculaire et des Matériaux d'Orsay (France)1 - Institut de Chimie Moléculaire et des Matériaux d'Orsay (France)

Date: November 14th, 2024 **Time: 11:00:00 AM Room:** A

The glycolytic enzyme phosphoglucose isomerase (PGI) is a multifunctional protein with a number of extracellular activities. Once secreted outside the cell, PGI is known as a cytokine named ‘autocrine motility factor' (AMF), which has been detected in the serum or urine of cancer patients with a poor prognosis, and is therefore considered a putative metastasic biomarker. PGI secreted in human serum is therefore emerging as a new biomarker for the early, non-invasive diagnosis of cancer. Currently available analytical methods for determining PGI concentration in human fluids are difficult to adapt for rapid, systematic diagnosis. As time is a critical parameter in cancer therapy, the design of an analytical tool that would enable convenient, rapid, sensitive and specific quantification of this pathological biomarker in human fluids could be of great interest for the positive prognosis of cancer patients. Such a device could thus contribute to early detection of an ongoing metastatic process, as well as easy monitoring of the efficacy of drug agents used in therapy. Numerous studies have shown that biosensor technology has the potential to provide fast and accurate detection of several pathological biomarkers. In recent years, we have designed different types of sensitive and specific carbohydrate-based electrochemical biosensors for the detection and quantification of both a protein model of human AMF/PGI, namely rabbit muscle phosphoglucose isomerase, as well as over-expressed human AMF/PGI [1,2]. Biosensors were constructed by covalent binding of a carbohydrate bioreceptor molecule, either a substrate or an inhibitor [3] of the PGI enzyme, using different types of transducers and electrodes. Protein interactions were quantified by electrochemical impedance spectroscopy and square-wave voltammetry, demonstrating detection limits in the fM range and high selectivity against non-specific carbohydrate proteins such as D-glucose-6-phosphate dehydrogenase. Detection of AMF/PGI protein in enriched human plasma was carried out to demonstrate the effectiveness of these systems in a real sample. Such devices would most likely enable easy, rapid and efficient detection of the cancer biomarker AMF/PGI in human serum. It could also provide a valuable analytical tool for cancer screening and patient monitoring. [1] M. Devillers, L. Ahmad, H. Korri-Youssoufi, L. Salmon, Carbohydrate-based electrochemical biosensor for detection of a cancer biomarker in human plasma, Biosens. Bioelectron. 96 (2017) 178–185.

https://doi.org/10.1016/j.bios.2017.04.031. [2] L. Ahmad, L. Salmon, H. Korri-Youssoufi, Electrochemical detection of the human cancer biomarker ‘autocrine motility factor-phosphoglucose isomerase' based on a biosensor formed with a monosaccharidic inhibitor, Sens. Actuators B Chem. (2019) 126933. https://doi.org/10.1016/j.snb.2019.126933. [3] L. Ahmad, S. Plancqueel, N. Lazar, H. Korri-Youssoufi, I. Li de la Sierra-Gallay, H. van Tilbeurgh, L. Salmon, Novel N-substituted 5-phosphate-d-arabinonamide derivatives as strong inhibitors of phosphoglucose isomerases: synthesis, structure-activity relationship and crystallographic studies, Bioorg. Chem. (2020) 104048. https://doi.org/10.1016/j.bioorg.2020.104048.

Aziz Amine

Professor ; Laboratory of Process Engineering and Environment, Faculty of Sciences and Techniques, Hassan II University of Casablanca, Morocco

Recent Advances in Biosensors based on Nanozymes

Date: November 14th, 2024 **Time: 2:00:00 PM** **Room:** A

Recent Advances in Biosensors based on Nanozymes

Aziz AMINE

Laboratory of Process Engineering and Environment, Faculty of Sciences and Techniques, Hassan II University of Casablanca, P. A. 146., Mohammedia, Morocco

Abstract

Nanozymes are synthetic nanomaterials with enzyme-like catalytic properties, showing promise in fields such as medicine, environmental science, and sensing technologies. Their growing importance stems from their enhanced activity, stability, tunability, and cost-effectiveness. These properties make nanozymes ideal alternatives to natural enzymes, particularly in biosensors used for environmental monitoring and biomedical diagnostics.

In recent years, the development of nanozyme-based biosensors has advanced rapidly. This conference aims to highlight these achievements by first discussing key representative nanozymes, such as peroxidase mimics, oxidase mimics, and hydrolase mimics, which have been employed in biosensor technologies. Additionally, it examines the integration of molecularly imprinted polymers (MIPs) with nanozymes, effectively replicating the functionality of natural enzymes, where the enzyme and MIP function as coenzyme and apoenzyme, respectively [1]. Finally, the conference will review bioanalytical applications for the detection of various analytes and address current challenges and future research directions.

Keywords: nanozyme, biosensors, coenzyme, molecularly imprinted polymers, nanomaterials

Reference:

[1] Bioinspired Synergy Strategy Based on the Integration of Nanozyme into a Molecularly Imprinted Polymer for Improved Enzyme Catalytic Mimicry and Selective Biosensing

Abdelhafid Karrat, Aziz Amine

Biosensors and Bioelectronics, 2024, Volume 266, 116723

Baouab Mohamed Hassen V

Professor ; University of Monastir, Tunisie

Dispersion of Magnetite Nanoparticles in a Biopolymer Matrix: Catalytic and Microbiological Application

---

Date: November 14th, 2024 **Time: 2:00:00 PM** **Room:** B

As the field of nanotechnology continues to develop, the evaluation of the catalytic and biological activity of magnetite (Fe3O4) nanoparticles is important for their continued application in the field of fine and applied chemistry and biomedicine. In this work, we have focused on evaluating the results of research into the synthesis and characterisation of cellulose complexes of the type [Tetraaza 2,3 microcrystalline aldehyde cellulose@Fe3O4] and classical complexes of the type [M (C32H28N4) X2], where M = Ni (II), Cu (II) and Fe (II), X = Cl- and a new complex of magnetic magnetite nanoparticles in a Schiff-based ligand: [Fe3O4MNP-INS-(C32H28N4)], which was prepared using a novel process of Co-precipitation of coordinated ferric ion in a [Fe(C32H28N4) Cl2] complex under mild conditions. All the complexes were characterised using various physico-chemical techniques such as Fourier transform infrared (FT-IR), ultraviolet and visible spectroscopic techniques (UV-Vis), one-dimensional (1D), 1H and 13C NMR, powder X-ray diffraction (PXRD), vibrating sample magnetometer (VSM), scanning electron microscopy (SEM), elemental analysis and molar conductance measurements. In addition, the highest saturation magnetisation was 26.56 emu.g-1, obtained for [Fe3O4MNP-INS- (C32H28N4)], allowing easy separation by an external magnetic field. In addition to the highly advanced catalytic activity of [Tetraaza 2,3 dialdehyde microcrystalline cellulose@ Fe3O4] complexes for the degradation of textile industry dyes, in vitro screening of all [M (C32H28N4) X2]-type compounds against different species of bacteria and fungi showed that [Fe3O4MNP-INS- (C32H28N4)] was an effective antidote against the strains tested compared with the macrocyclic ligand and the selected complexes. The anti-tumour activity of all compounds was also examined in 3 human tumour cell lines such as U87, MDA-MB-231 and LS-174. The [Fe3O4MNP-INS- (C32H28N4)] complex exhibited moderate and strong anti-tumour activity against brain cancer, colon cancer and breast cancer (U87, MDA-MB-231 and LS-174 respectively). All our results suggest that this complex can be guided to the target site, producing local toxic effects on tumour cells, and could thus minimise secondary effects on normal tissues.

Boris LAKARD

Professeur ; Université de Franche-Comté, France

Chemical Sensors based on Conducting Polymers

Date: November 14th, 2024 **Time: 2:30:00 PM** **Room:** B

Conducting polymers are an important class of functional materials that has been widely applied to fabricate chemical sensors, because of their interesting and tunable chemical, electrical, and structural properties (1). Conducting polymers can also be designed through chemical grafting of functional groups, nanostructured, or associated with other functional materials such as nanoparticles to provide tremendous improvements in sensitivity, selectivity, stability and reproducibility of the sensor's response to a variety of analytes.

Conducting polymers have demonstrated great potential for chemical gas detection at room temperature since their electrical conductivity can be varied when they are exposed to oxidative or reducing gas molecules at room temperature. Consequently, our team has for several years been developing chemiresistive gas sensors using electrodeposited polypyrrole or polyaniline films as the sensitive layers. To improve the sensitivity of these films and lower their detection limit, they have been successively combined with macrocycles (2), surfactants (2), ionic liquids (3) or other organic molecules (4). The electrodeposition parameters (electrodeposition time and potential, concentrations of electrolyte constituents) were also varied to modify the physico-chemical properties of the films and optimize the response of the sensors.

Similarly, conducting polymer-based biosensors are playing a significant and growing role in delivering the diagnostic information and therapy monitoring, as they offer advantages such as low cost and low detection limits. For these reasons, a number of electrochemical biosensors, including enzymatic biosensors, immunosensors, DNA biosensors or whole-cell biosensors, have been developed in recent years that use conductive polymers to recognize biological substances. In this field, our team has developed flexible electrochemical biosensors using electrodeposited polyaniline films combined with enzymes (5), surfactants (6) or nanoparticles (7) to detect and quantify bioanalytes of interest such as urea (5) or dopamine (7).

Najla Fourati

Professor ; CNAM Paris, France

Biosensors for prostate cancer biomarkers detection: Recent advances and challenges

N. Blel1, M. Mokni2,3, Z. Mazouz1, C. Zerrouki2, A. Omezzine3,

N. Yaakoubi4, A. Othmane1, N. Fourati2

1. Faculté de Médecine de Monastir, LIMA Laboratory, Av. Avicenne, 5019, Monastir, Tunisia

2. Cnam, SATIE Laboratory, UMR CNRS 8029, 292 rue Saint Martin, 75003, Paris, France.

3. Hôpital Universitaire Sahloul, Service de Biochimie, 4011, Sousse, Tunisia.

4. Le Mans University, LAUM Laboratory, UMR CNRS 6613, Av. Olivier Messiaen, 72085 Le Mans, France

1. Faculté de Médecine de Monastir, LIMA Laboratory, Av. Avicenne, 5019, Monastir, Tunisia

2. Cnam, SATIE Laboratory, UMR CNRS 8029, 292 rue Saint Martin, 75003, Paris, France.

3. Hôpital Universitaire Sahloul, Service de Biochimie, 4011, Sousse, Tunisia.

4. Le Mans University, LAUM Laboratory, UMR CNRS 6613, Av. Olivier Messiaen, 72085 Le Mans, France

---

Date: November 15th, 2024 **Time: 8:30:00 AM** **Room:** A

Prostate cancer (PCa) is one of the most prevalent and fatal cancers among men, necessitating early detection for effective management and improved patient outcomes. Electrochemical biosensors are probably the most promising tools for enhancing the precision and reliability of prostate cancer diagnosis. These devices offer significant advantages in terms of sensitivity, selectivity, and miniaturization, which allow for the development of portable devices, enabling decentralized testing and continuous monitoring in clinical settings.

Electrochemical biosensors have been successfully used to detect several PCa biomarkers, including the main common one, prostate-specific antigen [1-4], the prostate cancer antigen 3

gene [5-6], and the emergent engrailed 2 [7-8]. The reported devices exhibit remarkable metrological performances, offering the potential for early-stage cancer detection.

Electrochemical biosensors, beyond PCa, are relevant across various malignancies, such as breast, lung, and colorectal cancer. Their versatility in detecting various cancer biomarkers underscores their potential impact on oncology. However, widespread commercialization faces difficulties related to reproducibility, functionalization accuracy, long-term stability, and cost-effective production. Challenges in simplifying sample preparation, achieving regulatory approval, and developing multiplex platforms for synergistic biomarkers detection to address their sensitivity and specificity limitations. Increasing clinical awareness and overcoming market barriers are also essential for broader adoption.

In conclusion, electrochemical biosensors play a crucial role in improving the detection and diagnosis of prostate cancer and have the potential to be generalized across different cancer types. It is undeniable that various challenges still need to be overcome before these devices become routine analytical tools, but recent technological advances associated with the rational use of artificial intelligence position them as key tools in the future of personalized oncology and tailored therapies.

References

[1] H. Shao, et al., An epitope imprinted electrochemical sensor for highly sensitive and selective determination of prostate-specific antigen. Microchim Acta, 2024, 191, 660.

[2] H. Nasimi, et al., Protein biomarker detection in prostate cancer: A comprehensive review of electrochemical biosensors, Sensors and Actuators Reports, 2023, 6, 100168.

[3] N. Blel et al., Ultrasensitive Electrochemical Sensors for PSA Detection: Related Surface Functionalization Strategies. Curr Top Med Chem, 2017, 17, 2913-2925.

[4] Z. Mazouz et al., Computational approach and electrochemical measurements for protein detection with MIP-based sensor., Biosens. Bioelectron., 2020, 151, 111978.

[5] M Mokni, et al., Designing a Simple Electrochemical Genosensor for the Detection of Urinary PCA3, a Prostate Cancer Biomarker, Micromachines, 2024, 15 (5), 602.

[6] S.Takita, et al., Ultrasensitive prostate cancer marker PCA3 detection with impedimetric biosensor based on specific label-free aptamers, Biosens. Bioelectron.,: X, 2024, 18, 100462.

[7] M. Mokni, et al., Novel sensitive immunosensor for the selective detection of Engrailed 2 urinary prostate cancer biomarker, Biosens. Bioelectron., 2022, 217, 2022.

[8] S. Lee, et al., Ultrasensitive electrochemical detection of engrailed-2 based on homeodomain-specific DNA probe recognition for the diagnosis of prostate cancer, Biosens. Bioelectron, 2015, 66, 32-38.

Maxence Rube

Maitre des conférences ; Université de Guyane, France

Acoustic wave sensors in liquids : A new paradigm in their use

RUBE Maxence[1], SEBELOUE Martine[1], LACHAUD Jean-Luc[2], REBIERE Dominique[2], TAMARIN Ollivier[1], DEJOUS Corinne[2]

1. Univ. Guyane, Espace-Dev, UMR 228, Cayenne, F-97300

2. Univ. Bordeaux, Bordeaux INP, CNRS, IMS, UMR 5218, Talence, F-33400

maxence.rube@univ-guyane.fr

Date: November 15th, 2024 **Time: 9:00:00 AM** **Room:** A

Surface Acoustic Wave (SAW) sensors have gained widespread attention for their ability to detect changes in physical, chemical, and biological environments by using elastic waves propagating across a piezoelectric substrate [1]. These sensors are prized for their sensitivity, versatility, and low power consumption, making them applicable in fields such as environmental monitoring, medical diagnostics, and industrial process control. At the core of a typical SAW sensor lies the interdigitated transducer (IDT), a crucial component that enables the conversion of electrical signals into acoustic waves. The IDT consists of two sets of parallel metal electrodes arranged in a comb-like structure, patterned onto the surface of a piezoelectric material such as quartz or lithium niobate [1]. An alternating voltage applied across the electrodes induces mechanical stress in the piezoelectric substrate, which in turn produces surface acoustic waves that propagate along the surface of the material.

A closer examination of the IDT reveals its functional similarity to a planar capacitor. In both cases, the structure involves parallel electrodes separated by a dielectric medium. The electric field generated by the interdigitated electrodes on the piezoelectric material resembles that of a planar capacitor, and the induced charge distribution across the IDTs creates an electric potential that couples to the acoustic wave. The first research works using SAW sensors tried to reduce as much as possible any perturbating effect of this capacitor. Indeed, the associated electric field can be influenced by the materials, affecting the overall response. As such, in liquid medium, in most cases, a PDMS cell was used for biosensing detection to localize the liquid exclusively onto the acoustic path, between the IDTs. However, recent works [2, 3] put to evidence that the capacitance, rather than being parasitic, could be used and coupled with the acoustic wave sensing mechanism to further enrich the response and performance of SAW sensors, similarly to Interdigitated Capacitive Sensors (ICS) commonly used in biosensing or dielectric spectroscopy [4]. Our team even showed than the energy flow of most SAW sensors could be divided into three responses which made the device sensitive to changes in dielectric

parameters (electrical conductivity and permittivity) and mechanical parameters (density, viscosity & mass-effect).

In conclusion, SAW sensors, with their core component being the IDT, can be also regarded through a planar capacitor. This analogy not only offers a broader understanding of the transduction mechanism but also provides a foundation for improving the design and functionality of SAW-based sensing systems. Along with progress in material science and sensor technology, the planar capacitance model of IDTs will remain a valuable framework for future innovations in acoustic wave-based devices.

References:

1. Rocha-Gaso, M.-I., March-Iborra, C., Montoya-Baides, A., & Arnau-Vives, A. (2009). Surface Generated Acoustic Wave Biosensors for the Detection of Pathogens: A Review. Sensors.
2. A.Choudhari, M.Rube, O.Tamarin, & C.Dejous. (2023). Love Wave acoustic sensors behavior in complex liquids. Multiparameter sensing using acoustic and electrical signals
3. Rube, M., Tamarin. O., Sebeloue, M., Sadli. I., Hallil. H., Linguet. L., Rebiere, D., Dejous, C., « Unconventional protocol for SAW sensor: multi-physic response enrichment in liquid medium ». IEEE Sensors Journal, 02 July 2021, DOI: 10.1109/JSEN.2021.3094299.
4. Hu, X., & Yang, W. (2010). Planar capacitive sensors - Designs and applications. Sensor Review.

Ahmed Khalil Saad

Professor ; 1 - Fayoum University, Egypt

The Role of Multiphase MoS2 Nanosheets within PES Membranes in Oily Wastewater Treatment

Date: November 15th, 2024 **Time: 9:30:00 AM** **Room:** A

With global human population on the rise, there is an emerging threat of water shortage and therefore measures must be put in place to solve this problem. One of the most efficient and reliable solution is wastewater treatment using membrane technology. However, a persisting challenge in wastewater treatment using membranes is fouling from organic and inorganic foulants found in wastewater. In this work, a comparative study has been conducted regarding the role of various phases of molybdenum disulphide (MoS2) nanosheets on removal of oil from wastewater using symmetric and asymmetric polyethersulfone (PES) membranes. Multiphase MoS2 nanosheets synthesized with a high percentage of 1T phase via hydrothermal technique, rendered the resultant composite membranes hydrophilic. This was confirmed by a lower water contact angle for both symmetric and asymmetric PES in comparison with unmodified PES membrane samples. Single phase 2H MoS2 rendered PES membranes hydrophobic by increasing the water contact angle. Hydrophilic membrane composites possessed improved pure water permeability and enhanced oil rejection. Pure water permeability was higher in symmetric PES than asymmetric PES at a tune of 6,911 kg.m-2h-1bar-1 and 778 kg.m-2h-1bar-1 respectively. Using an oil concentration of 1 g/L for heavy-duty crude oil in water emulsion, both MoS2 modified asymmetric and symmetric membranes showed a rejection efficiency of 99%. In both cases, the optimal concentration of MoS2 was found to be 0.2 wt% as this would not negatively affect the mechanical properties and porous structure of the resultant nanocomposite membranes. Antifouling properties were equally enhanced in hydrophilic than hydrophobic membranes. The dominant rejection mechanism was found to be size exclusion. This study revealed a promising potential of effectively utilizing MoS2 in modifying different PES membrane types for application in oily wastewater treatment.

Chouki Zerrouki

Professor ; CNAM Paris, France

Sensors & biosensors multi-transductions: redundancy or complementarity?

N. Fourati*, C. Zerrouki*

** Cnam, SATIE Laboratory, UMR CNRS 8029, 292 rue Saint Martin, 75003, Paris, France.* Cnam, SATIE Laboratory, UMR CNRS 8029, 292 rue Saint Martin, 75003, Paris, France.*

Date: November 15th, 2024 **Time: 2:00:00 PM** **Room:** A

The development of chem/bio-sensors for medical, environmental, and analytical applications has steadily risen over the past two decades [1-3]. This growth has been significantly accelerated by the emergence of multi-transduction as a pivotal technology [4-8]. Multi-transduction, with its potential to substantially enhance the functionality and reliability of sensing devices compared to a single transduction mode, has become a game-changer. Its importance is particularly evident in detecting various types of analytes in complex or dynamic environments where a single transduction mode could be limiting. Consider the scenario where many substances in the environment or biological fluids share similar chemical properties. The multimodal transduction approach is crucial in improving sensor selectivity in such cases. Providing multiple ways to measure the same target analyte enhances the sensors' ability to distinguish between different substances. For instance, an electrochemical/piezoelectric signal indicating the presence of a specific molecule can be cross-validated by an optical change (fluorescence, absorbance, etc.) and vice versa. This cross-check significantly reduces the likelihood of false positives/negatives, thanks to the synergy of the different mechanisms involved. As a result, multi-transduction sensors, regardless of complementarity or redundancy considerations, are better suited to applications where accuracy and selectivity are paramount, such as in medical diagnostics. Furthermore, the potential of a multi-transduction approach extends beyond medical diagnostics. It can also be harnessed for environmental monitoring, such as monitoring photosynthetic activity induced by herbicides [9]. Here, the fluorescence yield and oxygen production rate are measured using complementary-coupled optical and electrochemical devices. The diversity of applications for multimodal transduction underlines the versatility of this approach and its potential in a wide range of fields where both complementarity and redundancy are sought.

References

[1] Sakhraoui, H.E.E.Y., et al., Design of L-Cysteine and Acrylic Acid Imprinted Polypyrrole Sensors for Picomolar Detection of Lead Ions in Simple and Real Media, IEEE Sensors Journal, vol. 20, no. 8, 4147-4155 (2019), doi: 10.1109/JSEN.2019.2961984.

[2] Çimen, D., Denizli, A. Development of Rapid, Sensitive, and Effective Plasmonic Nanosensor for the Detection of Vitamins in Infant Formula and Milk Samples. Photonic Sens 10, 316–332 (2020). Doi: 10.1007/s13320-020-0578-1

[3] Ghazizadeh E, et al., Approaches of wearable and implantable biosensor towards of developing in precision medicine. Front. Med. 11:1390634 (2024), doi: 10.3389/fmed.2024.1390634

[4] Lattach, Y., et al., Molecularly imprinted surface acoustic wave sensors: The synergy of electrochemical and gravimetric transductions in chemical recognition processes, Electrochimica Acta, Volume 73, 2012, 36-44, https://doi.org/10.1016/j.electacta.2011.11.119.

[5] Elnemr, Y.E., et al., Multi-Transduction-Mechanism Technology, an Emerging Approach to Enhance Sensor Performance, Sensors, 2023. 23, 4457. DOI: 10.3390/s23094457.

[6] Chu, S.S., et al., Towards Multiplexed and Multimodal Biosensor Platforms in Real-Time Monitoring of Metabolic Disorders, Sensors, 2022. 22, 5200. DOI: 10.3390/s22145200.

[7] Gugliandolo, G., et al., Development of a multi-transduction system for breath analysis in neurodegenerative diseases, 2021 IEEE International Symposium on Medical Measurements and Applications (MeMeA), Lausanne, Switzerland, pp. 1-6, doi: 10.1109/MeMeA52024.2021.9478730.

[8] Śmietana, M., et al., Simultaneous optical and electrochemical label-free biosensing with ITO-coated lossy-mode resonance sensor, Biosens. Bioelectron, 2020. 154: p. 112050. doi: 10.1016/j.bios.2020.112050.

[9] Poorahong, S., et al., Integration of optical and electrochemical sensors on a microfluidic platform using organic optoelectronic components and silver nanowires, 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Orlando, FL, USA, 2016, pp. 3002-3005, doi: 10.1109/EMBC.2016.7591361.

Aymen Mahjoub

R&D Scientist ; THALES RESEARCH & TECHNOLOGY, France

Technologie Électrocalorique : Fondamentaux, Avancées et Perspectives

---

Date: November 15th, 2024 **Time: 2:30:00 PM** **Room:** A

The energy transition and digitalization are two transformative trends shaping the future of society. Energy consumption related to refrigeration and cooling alone accounts for approximately 20% of global energy usage, highlighting the critical need for innovation in these areas. At the same time, digitalization is accelerating the development of increasingly intelligent systems, which require complex processing and therefore consume significant energy. These systems also face heat dissipation challenges, further complicating energy efficiency efforts. Presently, vapor-compression-based refrigeration is the predominant technology for managing cooling demands. However, after a century of development, this technology has reached its thermodynamic limits, emits greenhouse gases, generates noise, and is unsuitable for miniaturization, such as in chip-scale cooling applications.

The discovery of the Giant Electrocaloric Effect (ECE) in PZT thin films [1] has identified electrocaloric (EC) materials as promising candidates for replacing conventional cooling systems. EC materials exhibit reversible changes in entropy and temperature under varying electric fields, offering unique advantages over current technologies: (1) they can directly utilize electrical energy, (2) they have low application costs, and (3) they are highly scalable, even for small devices. Furthermore, EC materials have been shown to enhance overall device efficiency, with experimental results demonstrating up to 70% recovery of electrical charge [2].

This presentation will show the potential of electrocaloric technology, its applications, and the specific characteristics of EC materials. Additionally, it will discuss future perspectives and anticipated advancements in this promising field

References:

[1] : A. S. MISCHENKO et al, , SCIENCE, 2006, Vol 311, Issue 5765 (DOI: 10.1126/science.1123811)

[2] : E. Defay et al, NATURE COMMUNICATIONS | (2018) 9:1827, (DOI:10.1038/s41467-018-04027-9)

Giovanni Neri

Professor ; University of Messina. Department of Engineering, Gas sensor Lab, Italy

New directions in semiconductor materials for gas sensing

Date: November 16th, 2024 **Time: 8:30:00 AM** **Room:** A

Chemoresistive gas sensors are steadily attracting increasing attention for the detection of gaseous species because of their outstanding performances, such as high sensitivity, small size, easy integration with microelectronic circuits and low cost. Metal oxide semiconductors (MOX), such as SnO2, ZnO and so on, have been the first sensing materials proposed for developing chemoresistive gas sensors. Conductive polymers and carbon materials in various structure and shapes (i.e. CNTs, graphene) have also been largely investigated in the past decades. The development of strategies for obtaining novel nanomaterials with high sensitivity, fast response and good selectivity has been ultimately pursued as the major scientific ongoing challenges in the gas sensing field.

Here, the attention is focused on novel materials/architectures which are considered the most promising for replacing the conventional MOX semiconductors as sensing materials for advanced applications, such as, core-shell heterostructures, transition metal disulfide (TMDS), metal organic frameworks (MOF) and carbon quantum dots.

The preparation and sensing mechanism of these novel nanomaterials will be presented along with the description of the related chemoresistive gas sensors successfully developed in our laboratory for environmental monitoring, automotive applications, air quality control and breath analysis.

Slaheddine Khlifi

Prof ; Université de Jendouba, UR-GDRES, Tunisie

Apports de la science du citoyen et des capteurs dans le monitoring des hydrosystèmes : cas de la Medjerda (Nord de la Tunisie)

Date: November 16th, 2024 **Time: 9:00:00 AM** **Room:** B

Les techniques conventionnelles des observations quantitatives comme les enregistrements pluviométriques, les débits, le volume des barrages, les niveaux des nappes, … et la caractérisation de la qualité de l'eau comme le suivi des nitrates, du pH, de la salinité de l'eau … permettent de définir et d'ajuster les règles de gestion des ressources en eau de surface et/ou souterraines. Leur coût relativement élevé, leur collecte à un certain nombre d'endroit des entités hydrologiques, l'accès à ce genre de données parfois tardifs constituent des inconvénients majeurs de ces procédés. Les pas de temps journalier de certaines observations pour les eaux de surface et bisannuel pour les ressources souterraines, peuvent être satisfaisantes, mais ne permet pas encore d'incorporer correctement la dynamique des processus hydrologiques à des pas de temps plus fins (p.ex. processus liés aux pluies torrentielles) dans la gestion opérationnelle. Ces dernières années, une révolution technologique et méthodologique a lieu dans le domaine de la métrologie environnementale qui permet de remédier à ces problèmes permettant de booster les capacités d'observation et la surveillance des ressources en eau. La technologie de la télédétection continue à augmenter la résolution spatio-temporelle de l'observation de la terre comme le Sentinel-2 qui fonctionne à une résolution spatiale de 10 à 60 m et avec un temps de revisite de 5 jours et d'autres capteurs sont devenus accessibles gratuitement. Le déploiement massif de capteurs, à travers le concept de « l'Internet of Things, IoT », permet d'augmenter massivement la résolution spatio-temporelle de la surveillance de terrain in-situ. Finalement, la participation des parties prenantes, « citizen science », est un élément clef dans le concept de la gestion durable et intégrée des ressources en eau. Des applications de ces outils ont été essayées dans le bassin versant de la Medjerda, où se localise l'essentiel de l'infrastructure hydraulique du pays. C'est l'entité hydrologique stratégique de la Tunisie, avec environ 40% des ressources en eau de surface et 50% de la production de céréales. Il assure également l'alimentation en eau potable de près de la moitié de la population tunisienne, directement et indirectement à travers le transfert de l'eau.

Oral Communications

Sensors and Application in Health

One health: A paradigm shift to better understand health problems. The case of infectious diseases caused by bacteria multi-resistant to antibiotics

Mansour Wejdene

Faculty of Medicine of Sousse/ University of Sousse

Date: November 14th, 2024 **Time:** 11:30:00 AM **Room:** A **Ref**: Heal-O19

The "One Health" paradigm represents a transformative approach to comprehending and addressing complex health challenges by recognizing the interdependence of human, animal, and environmental health. This integrated framework offers a unique lens through which to examine issues like zoonotic diseases, antimicrobial resistance, and climate-related health impacts. By bridging diverse fields—such as medicine, veterinary science, ecology, and public health—One Health promotes a holistic understanding that supports more effective prevention, diagnosis, and response strategies for emerging health threats. It's important to explore how the One Health approach can advance scientific knowledge, shape policy, and create more resilient health systems. Through collaborative research, knowledge exchange, and innovative practices, each contributor from the different sectors will contribute to reshaping the future of global health.

Real-time selectivity by zinc oxide nanoparticle pellets, based on the virtual electronic nose concept, of various VOCs, holds promise for identifying potential biomarkers of VOCs in human breath.

Bouricha brahim (1), Souissi riadh (1), El Mir lassaad (2), Abderrabba manef (1)

1 - Carthage University, Laboratory of Materials, Molecules and Applications, Preparatory Institute for Scientific and Technical Studies (Tunisia), 2 - University of Gabes, Laboratory of Physics of Materials and Nanomaterials Applied at Environment (LaPhyMNE), Faculty of Sciences in Gabes, 6072, Gabes (Tunisia)

Date: November 14th, 2024 **Time:** 11:45:00 AM **Room:** A **Ref**: Heal-O1

This work uses a single compacted nanoparticle ZnO chemical sensor to exercise a novel procedure with virtual e-nose systems. The pellets are formed by nano-powders synthesized via a simple sol-gel method. Furthermore, in this paper task, we show the transient differences in the dynamic response curves for ZnO pellet when exposed to volatile organic compounds (VOCs) namely ethanol, methanol, isopropanol, acetone, and toluene. VOCs are categorized using the transient response of a single sensor at four different operating temperatures, offering diverse features that depend on the reaction mechanism of the target molecule. The relevant attributes of responses were run through Hierarchical Ascending Classification (HAC) integrated with Principal Component Analysis (PCA). Three clusters classified for three specific feature subsets were distinguished. A new mathematical iteration of this hybrid process led to good HAC output stability. After thorough implementation, the result is delivered automatically with three-digit sorts in a specified order. While the LOD is much lower than standard concentrations of VOCs emitted by humans, this selectivity offers the possibility of performing a real clinical case study of cancer diseases due to the eventual presence of VOCs, which can be considered biomarkers.

Nanofibers Based on Biopolymers and Conducting polymers for Cancer Detection

Noha Elnagar1,2 Nada Elgiddawy 3 Waleed M. A. El Rouby 2 Ahmed A. Farghali 2 and Hafsa Korri-Youssoufi 1

1-Université Paris-Saclay, CNRS, Institut de Chimie Moléculaire et des Matériaux d'Orsay (ICMMO), ECBB, 91400 Orsay, France, 2-Materials Science and Nanotechnology Department, Faculty of Postgraduate Studies for Advanced

Sciences (PSAS), Beni-Suef University, Beni-Suef 62 511, Egypt

, 3-Department of Biotechnology and Life Sciences, Faculty of Postgraduate Studies for Advanced

Sciences (PSAS), Beni-Suef University, Beni-Suef 62 511, Egypt

Date: November 14th, 2024 **Time:** 12:00:00 AM **Room:** A **Ref**: Heal-O3

The detection of cancer biomarkers in the early stages could prevent cancer-related deaths significantly. Folate receptors are a class of cell surface proteins that play a critical role in the uptake and transport of folate into cells, in various physiological processes, including cell proliferation, tissue growth, and vitamin transport, also known as vitamin B9. Folate receptors are overexpressed on the cell surface of various cancer types and is present in plasma sample [1]. Conventional methods for detecting folate receptors often involve complex and time-consuming procedures, such as enzyme-linked immunosorbent assays (ELISAs) fluorescence-based techniques, and PET imaging with folate-targeted radiotracers. These techniques may lack the desired sensitivity, selectivity, and portability required for rapid point-of-care electrochemical biosensors have been utilized to detect FRs with promising performances, but most were complicated, non-reproducible, non-biocompatible, and time and cost consuming.

In this study, we developed an environmentally friendly and electrochemical impedimetric biosensor for FR detection based on nanofibers polymers as transducers and folic acid as bioreceptor. Nanofibers are formed by composite of polymers formed with bio-friendly polymers: sodium alginate and polyethylene oxide used as an antifouling polymer, with folic acid as biorecognition element [2]. The bio-composite is prepared by electrospinning method which has the advantage of forming the transducers in one step with nanofibers structure providing high surface area. We explore also biosensors formed with conducting nanofibers by the association of conducting polymer poly(3-hexyl thiophene) to form conducting nanofiber [3].

We evaluated the performance of the nanofibers and conducting nanofibers biosensors towards folate receptors detection with EIS and demonstrated the sensitive and selective folate receptor detection in human plasma. The biocompatibity of nanofibers regarding the toward MCF-7 breast cancer cells are evaluated demonstrating also their potentials application as drug carrier.

References: [1] Shulpekova Y., V. Nechaev, S. Kardasheva, A. Sedova, A. Kurbatova, E. Bueverova, A. Kopylov, K. Malsagova, J. C. Dlamini, and V. Ivashkin. 2021. The concept of folic acid in health and disease. Molecules 26(12):3731. doi: 10.3390/molecules26123731

[2] Elnagar N., N. Elgiddawy, W. M. El Rouby, A. A. Farghali, and H. Korri-Youssoufi. 2024. Impedimetric Detection of Cancer Markers Based on Nanofiber Copolymers. Biosensors 14(2):77. doi: 10.3390/bios14020077.

[3] Elnagar N., N. Elgiddawy, W. M. El Rouby, A. A. Farghali, and H. Korri-Youssoufi. Poly(3-Hexylthiophene) based bioelectronic interface using conducting nanofibers (CNFs) for the sensitive determination of folate receptor cancer biomarkers in human plasma 2024, Analyticals Letters doi.org/10.1080/00032719.2024.2406445

Reduced graphene oxide combined with derived tetraphenylporphyrin

nanomaterial as platform for electrochemical DNA sensors application

Yaqiong Wang, Helene Sauriat-Dorizon and Hafsa Korri-Youssoufi

Institut de Chimie Moléculaire et des Matériaux d'Orsay (ICMMO), Université Paris-Saclay, CNRS

Avenue des Sciences 91405 Orsay, France

Date: November 14th, 2024 **Time:** 12:15:00 PM **Room:** A **Ref**: Heal-O4

The design and development of biosensors for direct detection of biomarkers in biological fluid sample is real challenge in research for their application in point of care system in diagnostic. Since few years, we are interesting in the fabrication of a new nanomaterial based on reductive graphene oxide (rGO) and porphyrins to follow electrochemically biological recognition process. Graphene exhibits high conductivity and specific surface suitable for grafting numerous biomolecules. Besides, the surface and structure of graphene is independent of pH, salt concentration and biocompatibility that make it an excellent substrate for DNA detection [1]. Porphyrin is an aromatic macrocycle which strongly interacts with carbon structure through □-stacking interactions; it can be easily functionalized with various groups that allows different biomolecules attachment on it and can incorporate numerous redox metals affording interesting redox properties of porphyrin. To validate the concept, different types of porphyrins were synthetized and associated with rGO for the detection of Hepatitis C gene. The manganese (III) tetraphenylporphyrin, functionalized with carboxylic acid group, was covalently grafted with single DNA strand to detect complementary DNA strand in solution [2]. We demonstrated that the lower detection limit was estimated to be 6.1 × 10-14 M by EIS, with a good selectivity in presence of non-complementary and one-mismatch DNA sequence. In parallel, a study of the relationship between the chemical properties of free-metal porphyrins functionalized with one carboxylic group (H2TPP-1C) and four (H2TPP-4C) was investigated on the performance of the biosensors. The proposed DNA sensors showed high sensitivity for detecting complementary DNA in a wide linear range of [10-18-10-12 M] and [10-18 M-10-11 M] for DNA sensor based on H2TPP-1CP/CRGO and H2TPP-4CP/CRGO, respectively with a detection limit as low as 2×10-18 and 7×10-19 M (S/N = 3). Most importantly, we demonstrated that the selectivity was enhanced by introducing numerous negative charged functional groups on the porphyrins. Indeed, only 15% of variation for the relative change of peak current were observed during the detection of non-complementary DNA sequence at low concentration compared to 30% for the sensor based on H2TPP-1CP/CRGO.

Microwave-assisted green synthesis of silver nanoparticles using tunisan plant extracts leaves and application

Belhadj Mbarek Mkacher najoua (1)

1 - NANOMISENE RD Laboratory [Sousse] (Tunisia)

Date: November 14th, 2024 **Time:** 14:30:00 PM **Room:** A **Ref**: Heal-O5

Najoua BELHADJ MBAREK MKACHER 1,2, Fatma BELKHIRIA1, Rihem EL GHOUL1, Rihem HAMMOUDA1, Nader SEBAI3, Ridha TOUATI1,2, Chérif DRIDI1 1 NANOMISENE Laboratory, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology (CRMN), Sousse Technopole, B.P. 334, 4054 Sahloul Sousse, Tunisia 2 University of Sousse, High School of Sciences and Technology of Hammam Sousse, Rue Lamine Abbassi, 4011 hammam sousse, Tunisia 3 Mahdia Hospital Tahar Sfar, 5100 Madia, Tunisia Abstract: Recently, we focused in our Group on the biosynthesis of metal and metal oxide nanoparticles by Green Nanotechnology and their applications in agriculture, water quality monitoring and remediation as well as emerging diseases biomarkers detection using thermal and sonication approaches [1,2]. In this work, we report Green synthesis of silver nanoparticles (AgNPs) by the bio-reduction of silver nitrate using leaves aqueous extracts of two growing wild Tunisian plants namely Thymelaea hirsuta and Rhus tripartita. The energy required for this extraction and synthesis was supplied by microwave radiation. This green synthesis method is characterized by its simplicity, speed and environmental friendliness. The biosynthesis of the silver nanoparticles (AgNPs) in solution using the aqueous leaves plant extracts as a reducing and stabilizing agents, under optimized experimental conditions namely the concentration of the silver nitrate solution and the aqueous extract of the plant leaves as well as the reaction time and microwave power exposure, were validated by change in color from yellow to brown. Bio-reduction was monitored using UV–Visible spectroscopy which revealed absorption peaks around 400 nm. The average particle size of AgNPs were found, based on DLS measurements, to be about 40 and 30 nm using Thymelaea hirsuta and Rhus tripartita leaves aqueous extracts, respectively. Fourier transform infrared (FTIR) spectra confirmed the possible interaction between silver nanoparticles and capping agents. The antifungal potential of the two types of AgNPs have been tested against fungicide to remediate infections (mycoses) due to Candida albicans. We have demonstrated high antifungal activities against candida and better inhibition of the infection growth than those reported in the literature opening new opportunities of Green synthesized AgNPs applications in pharmacology and medicine. References: 1. M. B. Jaballah, X. Cetó, C. Dridi, B. P.-Simón, “Voltammetric electronic tongue for the discrimination of antibiotic mixtures in tap water”, J. of Envi. Chem. Eng., 12 (2024) 113831 2. A. ElGolli, S. Contreras-Iglesias, C. Dridi, « Bio-synthesized ZnO NPs & sunlight-driven photocatalysis for Environmentally friendly and sustainable route of Synthetic Petroleum Refinery Wastewater treatment”, Scientific Reports, 13 (2023) 20809 3. A. Fdhila, S. Jebril and C. Dridi, "Development Cost-effective Sensor for Simultaneous Determination of Nanoplastics Using Artificial Neural Network," IEEE Sensors J. 23 (2023) 27038-27-45 4. S. Jebril, M. V. García-Moreno, J. M. Palacios-Santander, C. Dridi & L. Cubillana-Aguilera, “Development of a cost-effective and sustainable nanoplatform based on a green AuSNPs/CB nanocomposite for high performance simultaneous determination of nanoplastics”, Envi. Science: Nano, 9, (2022), 3126

Investigating the role of Surface Plasmon Resonance Sensor in Breast Cancer Early Detection : A Comprehensive Analysis

Zekriti mohssin (1), Zaz ghita (2), Fakri-Bouchet latifa (3) (4)

1 - Euromed University of Fès (Morocco), 2 - Ensam, Hassan II University, 150 Avenue Nile Sidi Othman, Casablanca, 20670, Morocco (Morocco), 3 - Institut des Sciences Analytiques de Lyon (5 rue de la Doua, 69100, Villeurbanne France), 4 - INSA de Lyon (20 Av. Albert Einstein, 69100 Villeurbanne France)

Date: November 14th, 2024 **Time:** 3:00:00 PM **Room:** A **Ref**: Heal-O6

In the recent years, several research works have been conducted in understanding and diagnosis of breast cancer, one of the greatest public health concerns worldwide. Various commercial kits are available in the market and most of them utilize enzyme and fluorescent substrates in the clinical diagnosis. However, biosensors based of fluorescent substrates have inherent limitations, necessitating the development of new label free detection technologies. Surface Plasmon Resonance (SPR) sensors can play a crucial role in this regard when their sensitivity and limit of detection are improved to meet the early diagnosis conditions. In this paper, we present a comprehensive study on the role of surface plasmon resonance sensors in the early diagnosis of breast cancer. We examine various sensor configurations that utilize metal oxide as top layer to address the main limitations with regards to SPR sensors, such as poor stability, non-specific adsorption and limit of detection. The benefits and drawbacks of each design strategy will be discussed together with some of the recent achievements.

Advancements in DNA Biosensors for Monitoring within the Framework of the One Health Concept

Mohammadi hasna (1), Amine aziz (2)

1 - Laboratory of Process Engineering & Environment, Faculty of Sciences and Techniques, Hassan II University of Casablanca, B.P.146, Mohammedia, Morocco; hasna.mohammadi@fstm.ac.ma (Morocco), 2 - Laboratory of Process Engineering & Environment, Faculty of Sciences and Techniques, Hassan II University of Casablanca, B.P.146, Mohammedia, Morocco; (Morocco)

Date: November 14th, 2024 **Time:** 3:15:00 PM **Room:** A **Ref**: Heal-O7

The One Health Approach acknowledges the deep interconnection between human, animal, and environmental health, encouraging interdisciplinary cooperation to address complex health challenges. Biosensors, analytical devices that convert biological responses into measurable signals, are becoming critical tools within this framework. They offer rapid, sensitive, and specific detection of diseases, biomarkers, pathogens, toxins, and environmental pollutants across diverse settings. This presentation explores the pivotal role of biosensors in advancing the One Health Approach, particularly by enabling real-time monitoring and early detection of cancer biomarkers, agri-food pathogens, and environmental infectious agents. We focus on amplification strategies that integrate nucleic acid amplification techniques with enzymatic or nanozymic catalysis, enhancing detection sensitivity to attomolar levels. In our strategies, the final biosensor step results in a signal that, following the appropriate substrate reaction, can be measured using a portable smartphone device for on-site detection, providing either optical or electrochemical readouts of the enzymatic product. Developing portable, affordable, and user-friendly biosensors broadens their accessibility in resource-limited areas and promotes global health equity.

A Conductometric Sensor Based on Electropolymerized Pyrrole-Tailed Ionic Liquids for Acetone Detection

Ben Halima hamdi (1), Madaci anis, Contal emmanuel, Errachid abdelhamid, Lakard boris, Jaffrezic Renault nicole, Viau lydie

1 - Institut UTINAM (France)

Date: November 14th, 2024 **Time:** 3:30:00 PM **Room:** A **Ref**: Heal-O8

In chemical industry and research institutes, acetone serves routinely as solvent, reactant and extractant. However, due to its high volatility and toxicity, monitoring its vapor concentration is of great necessity for health and industrial safety. Besides that, simple and easy-to-use portable sensors are still lacking. In this work, a conductometric transducer was developed for the detection of acetone vapor. For this, interdigitated electrodes were functionalized by electropolymerization of a series of N-(1-methyl-3-octylimidazolium)pyrrole [PyC8MIm]X monomers that contains different counter-anions X-, namely hexafluorophosphate (PF6-), tetrafluoroborate (BF4-) and bis(trifluoromethylsulfonyl)imide (TFSI-). The functionalized interdigitated electrodes were widely characterized. The analytical performances of the microsensors were determined in the presence of gaseous ethanol, acetone, toluene, chloroform, and methanol, collected from the headspace above aqueous solutions of known concentration. The gas-sensing responses of the films were measured at room temperature, through differential conductometric measurements conducted at 10 kHz. Among the different sensors, the one bearing BF4- anions presented the best analytical performance and was able to selectively detect acetone vapors. The response time (tRes) of the sensor varied from 6 to 13s from lower to higher concentrations. The detection limit was 0.76 v/v % (7600 ppm) in the gas phase. The relative standard deviation for the same sensor was 6% for lower concentrations, and 2% for higher concentrations. The acetone sensor presented 2 times lower sensitivity for ethanol, and 4 times lower sensitivity for methanol. A detection of acetone in the headspace of a nail varnish remover sample led to an acetone content being in good agreement with the value given by the producer.

Green Synthesis of Zif-8 Combined with Ruthenium Nanoparticules for Enhanced Electrochemical detection of Dopamine.

Moumen youssra (1), Wannassi jassem (1), Sondes bourigua (1), A. Castilla-Martinez carlos (2), Barhoumi houcine (1), Demirci umit B. (2), Kahri hamza (1)

1 - Laboratory of Interfaces and Advanced Materials, Faculty of Sciences, University of Monastir, 5019 Monastir, Tunisia. (Tunisia), 2 - Institut Européen des membranes (France)

Date: November 14th, 2024 **Time:** 3:45:00 PM **Room:** A **Ref**: Heal-O9

Green synthesis of zeolitic imidazolate framework-8 (ZIF-8) combined with ruthenium nanoparticles (Ru@ZIF-8) was conducted and utilized as an enzyme-free sensor for dopamine detection. Various characterizations such as XRD, SEM and BET were employed to investigate the structure and morphology of Ru@ZIF-8 nanocomposites. The electrochemical performance of the Ru@ZIF-8 nanocomposite modified glassy carbon electrode (Ru@ZIF- 8/GCE) was examined in 0.1 M phosphate-buffered with different concentrations of dopamine. Cyclic voltammetry (CV), differential pulse voltammetry (DPV), and electrochemical impedance spectroscopy (EIS) were utilized to evaluate the electrochemical activity. Consequently, Ru@ZIF-8/GCE exhibited excellent electrochemical catalytic performance towards dopamine, with a wider linear range from 0.05 to 20 μM and a lower detection limit of 0.05 μM. The proposed sensor demonstrated acceptable stability and repeatability due to the synergistic effect of Ru nanoparticles and ZIF-8. All the evidence suggests a potential application of Ru@ZIF-8 nanocomposites in non-enzymatic dopamine sensors.

Electrochemical Biosensors Based on Fructose-6-Phosphate for the Quantification of AMF in Human Fluids

Guo jia (1)

1 - Institut de Chimie Moléculaire et des Matériaux d'Orsay (France)

Date: November 14th, 2024 **Time:** 4:30:00 PM **Room:** A **Ref**: Heal-O10

The glycolytic enzyme phosphoglucose isomerase (PGI) is a multifunctional protein with several extracellular activities. Once secreted outside the cell, PGI is known as a cytokine called "autocrine motility factor" (AMF), which is detected in the serum or urine of cancer patients with poor prognoses and is thus considered a suspected metastatic biomarker. Recently, elevated serum enzymatic activity of PGI has also been detected in patients with non-alcoholic fatty liver disease (NAFLD). Hence, PGI secreted in human serum emerges as a novel biomarker for the early and non-invasive diagnosis of cancer and/or NAFLD. Biosensor technology has the potential to provide rapid and accurate detection of various pathological biomarkers. This study aims to develop new electrochemical biosensors of clinical interest for diagnosing this cancer biomarker in real human fluids. Previous works in our groups demomstrated the proof-of-concept for detecting AMF in human plasma using carbohydrates bioreceptors. This presentation will focus on ongoing works concerning the design of electrochemical biosensors based on graphene-pyrene modified affordable and practical "screen-printed electrodes" (SPE). The biosensors will include a spacer with "anti-fouling" properties and a sugar motif specifically designed to recognize the biomarker. Contact angle measurements, Fourier-transform infrared spectroscopy (FT-IR), and X-ray photoelectron spectroscopy (XPS) were utilized to analyze the modified electrode surfaces. The properties of the surfaces following modification were characterized using cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) at various stages of layer formation. Both CV and EIS successfully demonstrated the specificity and sensitivity required for the biosensor. This biosensors promises fast, accurate, and non-invasive diagnostic tools, thereby improving early diagnosis and prognosis for patients.

Modeling of an innovative surface acoustic wave (SAW) sensor for non-invasive detection of liver diseases through breath analysis.

Ben Abdelkader makrem (1) (2), Gharbi insaf (1) (3), Dridi chérif (1)

1 - NANOMISENE Laboratory, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology (CRMN), Tunisia. (Tunisia), 2 - National Engineering School of Sousse, University of Sousse, 4000 Sousse, Tunisia (Tunisia), 3 - Higher Institute of Computer Science and Mathematics of Monastir, 5000,Monastir, Tunisia (Tunisia)

Date: November 14th, 2024 **Time:** 4:45:00 PM **Room:** A **Ref**: Heal-O11

Chronic diseases are a leading global health concern, responsible for most deaths. While early detection is crucial for effective treatment, current methods are often invasive, time-consuming, and expensive. Human breath analysis has recently emerged as a promising, non-invasive, and cost-effective alternative for detecting disease-related biomarkers. Micro Electro-Mechanical Systems (MEMS) gas sensors, known for their high sensitivity and low cost, are particularly useful for detecting these biomarkers in breath. Among the sensor technologies, resistive and acoustic sensors stand out for their ability to identify specific gaseous substances linked to diseases. This study aims to utilize finite element method (FEM) simulation with COMSOL Multiphysics software to develop advanced gas sensors leveraging surface acoustic wave propagation. These sensors are designed to detect ethanol biomarkers in breath, potentially enhancing the diagnosis of chronic diseases.

DIAGNOSIS OF CANINE CUTANEOUS LEISHMANIASIS BASED ON ELECTRONIC NOSE TECHNOLOGY COMBINED WITH PATTERN RECOGNITION METHOD

War makhtar (1), Diouf alassane (1), Diouani mohamed Fethi (2), Jaimes-MogollÓn aylen Lisset (3), Ionescu radu (4), Kerdcharoen teerakiat (5), Bouchikhi benachir (1)

1 - Biosensors and Nanotechnology Group, Department of Biology, Faculty of Sciences, Moulay Ismaïl University, B.P. 11201, Zitoune, Meknes, (Morocco), 2 - Laboratory of Molecular Microbiology, Vaccinology and Biotechnology Development, LR11IPT01, Institute Pasteur of Tunis, 1002 Tunis-Belvédère, (Tunisia), 3 - GISM Group, Faculty of Engineering and Architecture, University of Pamplona, 543050 Pamplona, (Colombia), 4 - Institute of Veterinary Medicine and Animal Sciences, Estonian University of Life Sciences, 51006 Tartu, (Estonia), 5 - Electronic Nose Company Ltd., 11000 Nonthaburi, (Thailand)

Date: November 14th, 2024 **Time:** 5:00:00 PM **Room:** A **Ref**: Heal-O12

Leishmaniasis, caused by protozoan parasites of the Leishmania genus, is a significant global health concern, particularly in impoverished regions with limited access to healthcare [1]. Cutaneous leishmaniasis is the most common form characterized by skin lesions at the site of infection [2]. The composition of exhaled breath has been recognized to undergo changes during the early stages of disease, indicating its potential as a non-invasive diagnostic method. Additionally, various body parts emit distinctive odors, prompting growing scientific and clinical interest in studying volatile organic compounds released by living organisms. These disease-specific volatile organic compounds hold promise as precise, reproducible, and rapid biomarkers, providing a non-invasive alternative to conventional diagnostic techniques. In this study, we investigated cutaneous leishmaniasis in dogs using a simple-to use, non-invasive approach to analyse volatile organic compounds from exhaled breath [3], and other biological materials, such as hair. Samples were collected from Tunisia and analyzed using an electronic nose system equipped with gas sensors based on single-walled carbon nanotubes [4]. The e-nose was designed to analyse volatile organic compounds emitted from breath and hair of dogs. Data sets collected from the sensor arrays were processed by using pattern recognition techniques, allowing for the assignment of a unique signature to each sample, and enabling discrimination between infected and non-infected dogs. Principal component analysis yielded an accuracy score of 98.05% for breath samples, and 84.93% for hair samples. These results highlight the capability of the electronic nose in identifying and classifying infection status, with breath analysis showing greater accuracy in distinguishing infected from non-infected canines compared to hair analysis. Acknowledgement Authors gratefully acknowledge Moulay Ismaïl University of Meknes for financial support of the project “Research support, UMI-2018" and H2020-MSCA-RISE-2020 project, grant agreement ID: 101007653: “Non-invasive volatiles test for canine leishmaniasis diagnosis”. References: J. D. S. Catarino, R. F. D. Oliveira, M. V. Silva, H. Sales-Campos, F. B. de Vito, D. A. A. D. Silva, & Jr, V. Rodrigues.Genetic variation of FcγRIIa induces higher uptake of Leishmania infantum and modulates cytokine production by adherent mononuclear cells in vitro, Frontiers in Immunology, 15, 1343602 (2024). N. T. T. Nguyen, L. M. Nguyen, T. T. T. Nguyen, U. P. Tran, D. T. C. Nguyen, & T. Van Tran, A critical review on the bio-mediated green synthesis and multiple applications of magnesium oxide nanoparticles, Chemosphere, 312, 137301 (2023). T. G. Welearegay, M. F. Diouani, L. Österlund, F. Ionescu, K.

Belgacem, H. Smadhi, & R. Ionescu, Ligand-capped ultrapure metal nanoparticle sensors for the detection of cutaneous leishmaniasis disease in exhaled breath, ACS sensors, 3(12), 2532-2540 (2018).
C. M. Durán-Acevedo, & J. M. Cáceres-Tarazona, Low-cost desorption unit coupled with a gold nanoparticles gas sensors array for the analysis of volatile organic compounds emitted from the exhaled breath (gastric cancer and control samples). Microelectronic Engineering, 237, 111483 (2021).

Smartphone-operated dual colorimetric and fluorescent platform based on microalgae's phycocyanin for the detection of biomolecules

Chelly meryam (1) (2), Chelly sabrine (1) (2), Giacobbe alberto (1), Frikha fakher (3), Fazio enza (4), Bouazizketata hanen (2), Neri giovanni (1)

1 - Department of Engineering, University of Messina, C.da Di Dio, I-98166 Messina, Italy (Italy), 2 - Laboratory of Toxicology-Microbiology Environmental and Health, LR17ES0, Faculty of Sciences, University of Sfax, Tunisia (Tunisia), 3 - Laboratory of Molecular and Cellular Screening Processes, Centre of Biotechnology of Sfax, University of Sfax, P O Box 1177, Sidi Mansour Road, 3018, Sfax, Tunisia (Tunisia), 4 - CNR-DSFTM, URT LabSens Beyond Nano Messina, Viale F. Stagno d'Alcontres, 31 I-98166, Messina, Italy (Italy)

Date: November 15th, 2024 **Time:** 10:30:00 AM **Room:** A **Ref**: Heal-O13

Smartphone-operated sensing platforms are revolutionizing the field of diagnostics and environmental monitoring by offering a highly accessible, portable, and user-friendly solution. These sensing platforms leverage the advanced capabilities of modern smartphones, such as high-resolution cameras, powerful processors, and connectivity features, to perform complex analyses that were once confined to laboratory settings. In the field of optical sensors, the integration of colorimetric and fluorescent sensors with smartphones enables real-time, on-site detection of various biomolecules and environmental contaminants. This not only allows access to sophisticated diagnostic tools but also facilitates rapid decision-making in critical situations. In this communication, we report for the first time the development of an accessible and friendly smartphone-operated optical sensor based on dyes (e.g. phycocyanin) derived from spirulina, a natural algae plant. Phycocyanin dye exhibits high fluorescence intensity and is suitable to monitor riboflavin (Vitamin B2) through its change of fluorescent intensity which is visible to the naked eye and easily captured and quantified from the fluorescent sensors. In conclusion, using such eco-friendly material and the smartphone-operated sensing platform represents a significant advancement in making high-quality and precise sensing devices for many advanced applications in the biomedical field, which aligns with the growing emphasis on sustainable and green technologies.

An Electrolyte-Gated Transistor combined with CRISPR/Cas13a for RNA detection

Piro benoît (1), Guermonprez pierre (2), Le thu Anh (3), Renaud louis (4), Nioche pierre (5), Krejci eric (6), Alleaume-Buteaux aurélie (5), Battaglini nicolas (7), Vu thi Thu (3), Sanaur sébastien (8)

1 - Laboratoire ITODYS (France), 2 - Laboratoire ITODYS (France), 3 - Université des Sciences et Technologies de Hanoi (Vietnam), 4 - Univ Lyon, UCBL, INSA Lyon, ECL, CNRS, CPE Lyon, INL, UMR5270, 69622 Villeurbanne, France (France), 5 - Structural and Molecular Analysis Platform, INSERM US 36 (France), 6 - Centre Borelli UMR 9010 (France), 7 - Université Paris Diderot, laboratoire ITODYS (France), 8 - Department of Flexible Electronics (France)

Date: November 15th, 2024 **Time:** 10:45:00 AM **Room:** A **Ref**: Heal-O2

Ribonucleic acids (RNA) detection is a crucial step in the identification of viral or bacterial infections in humans and animals. To date, reverse transcriptase-polymerase chain reaction (RT-PCR) remains the gold standard, but it is based on an amplification step which takes time and can induce transcription errors. However, clustered regularly interspaced short palindromic repeats linked to a Cas endoribonuclease particle (CRISPR/Cas) have recently revolutionized the recognition step of two types of RNA, i.e. the CRISPR-RNA and the target, providing a much better selectivity compared to the naked hybridization on which RT-PCR is based. In this study, we combine the high sensitivity of the CRISPR/Cas13a system with the transduction and amplification capabilities of an electrolyte-gated graphene field-effect transistor (EGGFET) for the detection of specific RNA sequences, which promise selective and sensitive detection, without PCR amplification. In these devices, fabricated on flexible plastic substrates, the active material of the transistors (reduced graphene oxide - rGO) is deposited by additive printing techniques. The rGO is then functionalized using Au nanoparticles decorated with polyU RNA strands immobilized by a thiol-gold bond. In the presence of a specific RNA sequence, the enzymatic function of the CRISPR/Cas13a complex is activated and the polyU RNA strands are cleaved from the Au nanoparticles, inducing a loss of negative charges on the rGO layer. This phenomenon leads to significant shift of the charge neutrality point (CNP) of the rGO, converted into a shift of the transistor's transfer curves. This sensing device was tested for the detection of a SARS-CoV-2 RNA sequence and showed a linear response in the range of 10-7 - 102 ng.µL-1. With the optimized device, the LOD was found to be 75´10-9 ng.mL-1, which was estimated to be around 10 fM, as expected for an amplification-free CRISPR/Cas-mediated nucleic acid sensor. The sequence of the target RNA to be detected can be adjusted by modifying the corresponding crRNA, making this sensor highly versatile and multipurpose. This work is an important cornerstone for the complete development of a point-of-care RNA sensor. Such an RNA sensor could not only detect the presence of viruses, but could also be used to track bacterial growth in food, after infection in humans or animals, or in diseases where miRNAs are produced

New spectrophotometric and electrochemical enzyme biosystem based on laccase and ionic liquid for the detection of intracellular Glyphosate in different biological samples

Said Galai1, Amine Aladnani1,5, Sihem HajKacem1, Andreia Rosatella4, Antonia Pérez de Los Rios2, Fransisco José Hernandez Fernandez2, Olfa Masmoudi5, Carlos Afonso3, Med Fethi Diouani6

1-Laboratory of Biochemistry, National Institute of Neurology at Tunis, University Tunis El Manar, Tunisia, 2-Department of Chemical Engineering, University of Murcia, Spain, 3-Faculty of Pharmacy, University of Lisbon, Portugal, 4-Faculty of Science, University of Lusufona, Portugal, 5-Laboratory of Neurosciences, University Tunis El Manar, Tunisia, 6-Laboratory of Epidemiology and Veterinary Microbiology (LEMV), Institute Pasteur of Tunis, Tunisia

Date: November 15th, 2024 **Time:** 12:00 **Room:** A **Ref:** Heal-O20

Glyphosate (N- (phosphonomethyl) glycine), one of the most widely used pesticides in the world. The detection methods are difficult to implement, time consuming and expensive due to its chemical properties and its low prevalence; there is a strong need to develop sensitive analytical methods for glyphosate (GLP) monitoring. For this purpose, a new biosystem based on enzyme reaction was implemented by laccase, redox mediator (Acetosyringone: ASGN), and ionic liquid (IL, as conservator and activator) to catalyze GLP. The laccase-catalytic system has been investigated by two analytical methods: spectrophotometric and electrochemical one. In terms of efficiency, the detection limits for spectrophotometric method was 25 µM GLP while electrochemical method was even lowest around 5 µM GLP. The developing biosensor based on this enzymatic system has been carried out using gold-plated screen-printed electrode and Nafion polymer for laccase, redox mediator and ionic liquid complexes immobilization. GLP samples were successfully analyzed using cyclic voltammetry (CV) measurement at scan rate of 100 mV/s. The concentration of GLP was accurately determined in the range of 5 µM to 15 µM GLP, and high correlation rate (98%) between current density and GLP concentration was determined using the laccase-based-biosensor, which shown good reproducibility and repeatability, high selectivity and therefore it has been used for GLP assays in biological samples (cell lysate and culture medium)

Understanding binary racemic adsorption of sucrose and caffeine on the β-CDMe surface using the statistical physics modeling and molecular docking.

Bouzid mohamed (1)

1 - Faculté des Sciences de Monastir (Tunisia)

Date: November 16th, 2024 **Time:** 10:30:00 AM **Room:** A **Ref**: Heal-O14

In this study, statistical physics and molecular docking are utilized to interpret the interactions between caffeine and sucrose molecules on a β-cyclodextrin surface. Initially, the Hill model is applied to investigate the interaction mechanisms between caffeine and sucrose in the adsorption mixture on β-cyclodextrin. Subsequently, stereochemical and energetic parameters are considered to achieve a comprehensive understanding of the binary mixture of caffeine and sucrose molecules in both quantitative and qualitative aspects of their adsorption on β-cyclodextrin. This analysis shows that the caffeine molecule is oriented parallel to the β-cyclodextrin, while the sucrose molecule adopts a planar orientation relative to the β-cyclodextrin. Finally, a molecular docking study involving caffeine, sucrose, and β-cyclodextrin is conducted, revealing significant similarities in how receptors detect ligands. The docking results confirm that the calculated binding affinities fall within the range of the observed adsorption energies.

Redox-Capacitance Detection of Kanamycin and Aflatoxin B1 using Polyaniline: A Novel Biosensing Approach

Rabti amal (1), Ghodbane ouassim (1), Raouafi noureddine (2)

1 - National Institute for Research and Physico-Chemical Analysis (INRAP) (Tunisia), 2 - University of Tunis El Manar (Tunisia)

Date: November 16th, 2024 **Time:** 10:45:00 AM **Room:** A **Ref**: Heal-O15

The accurate and rapid detection of antibiotics and mycotoxins in food products is crucial for ensuring food safety and public health [1-2]. This study presents the development and application of two innovative biosensors utilizing polyaniline (PANI) for the redox-capacitance detection of kanamycin and aflatoxin B1. Polyaniline, a conductive polymer, is employed for its excellent electrochemical properties, enhancing the sensitivity and selectivity of the biosensors. For the detection of kanamycin, we designed a biosensor based on a screen-printed carbon electrode (SPCE) modified with reduced graphene oxide (rGO), polyaniline (PANI), and a kanamycin-specific aptamer (K-Apt). The SPCE/rGO/PANI/K-Apt biosensor exploits rGO's high surface area and conductivity, coupled with PANI's redox activity, to create a robust detection platform. The aptamer's selective binding to kanamycin induces a measurable redox-capacitance signal change. Similarly, for the detection of aflatoxin B1, we developed a biosensor using SPCE modified with gold nanoparticles (AuNPs), polyaniline, and an aptamer (A-Apt) specific to aflatoxin B1. The SPCE/AuNPs/PANI/A-Apt aptasensor benefits from the unique properties of AuNPs, such as their high conductivity and biocompatibility, which, in conjunction with PANI, significantly enhances the electrochemical response. The aptamer's selective binding to aflatoxin B1 results in a distinct PANI redox-capacitance change, allowing for precise quantification. Both biosensors demonstrate excellent sensitivity and selectivity in detecting their respective analytes. The integration of polyaniline in these biosensing platforms not only provides the redox-capacitance response but also offers a cost-effective and scalable approach for developing label-free advanced biosensors. These findings highlight the potential of PANI-based redox-capacitance biosensors in ensuring food safety by providing efficient detection methods for hazardous contaminants. References: [1] B. Singh, A. Bhat, L. Dutta, K.R. Pati, Y. Korpan, I. Dahiya, Biosensors 2023, 13(9), 867. [2] F. Jubeen, A. Batool, I. Naz, S. Sehar, H. Sadia, A. Hayat, M. Kazi, Mycotoxins detection in food using advanced, sensitive and robust electrochemical platform of sensors: A review, Sensors and Actuators A: Physical 2024, 367, 115045.

Development of a non-enzymatic glucose Sensor based on biogenic synthesis of CuO NPs

Echabaane mosaab (1), Mliki haifa (2), Atri afrah (2), Dridi cherif (1)

1 - NANOMISENE Lab, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology CRMN of Technopark of Sousse, B.P. 334, Sahloul, 4034 Sousse, Tunisia (Tunisia), 2 - Laboratory of Advanced Materials and Interfaces (LIMA), Faculty of Sciences of Monastir, University of Monastir, Avenue of the Environment, 5000 Monastir, Tunisia (Tunisia)

Date: November 16th, 2024 **Time:** 11:00:00 AM **Room:** A **Ref**: Heal-O16

Non-enzymatic electrochemical glucose sensors have garnered significant interest due to their potential to offer improved sensitivity, stability, and cost-effectiveness compared to traditional enzyme-based glucose sensors. In this study, we developed a non-enzymatic glucose sensor based on copper oxide (CuO) nanomaterials as the active sensing element. CuO nanomaterials were synthesized via a green chemistry approach and characterized by various techniques, including, transmission electron microscopy (TEM), X-ray diffraction (XRD), UV-visible spectroscopy, and Fourier-transform infrared (FTIR) spectroscopy. To fabricate the sensing electrodes, indium-doped tin oxide (ITO) substrates were modified with biosynthesized CuO nanoparticles. The modified electrodes were characterized using scanning electron microscopy (SEM) to assess their surface morphology and cyclic voltammetry (CV) to evaluate their electrochemical performance. The CuO-modified ITO exhibits good electrocatalytic activity for glucose oxidation, responding effectively to glucose concentrations from 0.1 µM to 4 mM, with a detection limit of 0.08 µM. Additionally, the developed nonenzymatic sensor shows high reproducibility, stability, and selectivity, highlighting its potential for sensitive monitoring applications.

Electrochemical Detection of Dopamine Using a Nanocomposite Based on Gold Nanoparticles Decorated on Dopamine-Functionalized Graphene

Belkhiria fatma (1), Asma blel (1), Cherif dridi (1)

1 - NANOMISENE RD Laboratory [Sousse] (Tunisia)

Date: November 16th, 2024 **Time:** 11:15:00 AM **Room:** A **Ref**: Heal-O17

Dopamine is a neurotransmitter essential for regulating numerous behavioral and physiological functions, such as mood, sleep, and appetite. A deficiency in dopamine can lead to feelings of depression and anxiety. Additionally, dopamine is a significant clinical target, especially as a biomarker for breast cancer. In this study, we developed an innovative electrochemical sensor for dopamine detection, based on a nanocomposite of gold nanoparticles (AuNPs) decorated on dopamine-functionalized graphene oxide (GODA) and used with a modified glassy carbon electrode (GCE). The AuNPs were synthesized via a green, cost-effective method using Juniperus extract. The sensor exhibited a linear detection range from 2.5 µM to 70 µM, with a detection limit of 4 µM, and excellent selectivity in the presence of a 1000-fold excess of interferents. It was also successfully applied to detect dopamine in serum samples. Our biosynthesized nanocomposite enabled effective dopamine (DA) detection using a GCE. This approach offers several advantages, including portability, compact size, low cost, and ease of mass production. Square wave voltammetry (SWV) revealed a single peak at 0.19 V for dopamine, confirming the sensor's performance in complex mixtures. This sensor demonstrated high sensitivity and selectivity for dopamine detection, with potential applications in medical diagnostics and healthcare monitoring

Development of an electrochemical aptasensor based on Polypyrrole-Chitosan Nanospheres for the detection of aflatoxin M1

Besbes fatma (1) (2), Mlika rym (2), Korri-Youssoufi hafsa (1)

1 - Laboratoire Chimie Bioorganique et Bioinorganique (France), 2 - Laboratoire Interfaces et Matériaux Avancés (Tunisia)

Date: November 16th, 2024 **Time:** 11:45:00 AM **Room:** A **Ref**: Heal-O18

Aflatoxin M1 (AFM1) is a highly toxic mycotoxin that poses serious health hazards. It was previously classified as a group 2B carcinogen but has since been reclassified as a group 1 carcinogen by the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) and the maximum level applies in the milk is 0. 05 µg/kg. Given its potential impact on food safety, detecting AFM1 is paramount. This study presents a novel electrochemical aptasensor for detecting AFM1 based on polypyrrole-chitosan nanospheres (PPy-CS NSs). The developed biosensor benefits of high conductivity derived from polypyrrole, and chemical properties of chitosan. Chitosan, a natural polysaccharide, facilitates the formation of core/shell nanospheres where the polypyrrole is in the core assuring the conductivity and chitosan is in the shell, leading to a robust matrix for the immobilization of AFM1-specific aptamers. The conductive nanosphere ensures effective electron transfer, improving the electrochemical signal transduction. The sensor's analytical performance was characterized using cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). Sensitivity is measured in a wide range of concentrations from 1 ng /L to 1000 ng/L and LOD is determined at 0.42 ng/L. The selectivity tests confirmed the sensor's specificity for AFM1, even in the presence of other compounds such as OTA and OTB. The fabricated aptasensor was successfully used to measure AFM1 in milk samples with excellent results. This study demonstrates the potential of PPy-CS nanospheres as a versatile platform for aptasensor development, offering a promising tool for food safety monitoring and public health protection against mycotoxin contamination.

Material Devices for Sensors

Investigating Temperature and Bias Voltage Effects on Electrical and Dielectric Properties in New MIS Nanotechnology Structures

Hlali slah (1), Hizem neila (1), Militaru liviu (2), Kalboussi adel (1), Souifi abdelkader (2)

1 - University of Science of Monastir (Tunisia), 2 - Institut des Nanotechnologies de Lyon (France)

Date: November 14th, 2024 **Time:** 3:00:00 PM **Room:** B **Ref:** Mat-O1

The electrical and dielectric properties of TiN/Al2O3/p-Si MIS structure were studied in the temperature range of 380-450 K at 1MHz. These properties were calculated from experimental and measurements. Experimental results show that the forward bias plots exhibit a distinct peak at high temperatures, this Kind of behavior is mostly attributed to the series resistance and interface states between Al2O3/p-Si. The temperature and bias voltage dependence of dielectric constant, dielectric loss, dielectric loss tangent and the ac electrical conductivity are studied for TiN/Al2O3/p-Si MIS structure. Experimental results show that the values of and depend on the variation of both bias voltage and temperature. Theandcharacteristics prove that the and of the diode are important parameters that strongly influence the electric parameters in MIS device. The density of, depending on the temperature, was determined from theand data using the Hill-Coleman Method. The Arrhenius plot of the ac conductivity at 1 MHz is illustrated and the activation energy is found to be. Moreover, the electric modulus formalisms were employed to understand the relaxation mechanism of the TiN/Al2O3/p-Si structure.

Study of the inhibitory effect of an expired drug against corrosion of mild steel in 1M H2SO4 by the weight loss method

Youbi asma (1), Abderrahmane sihem (1), Athmani sameh (2)

1 - Surface Engineering Laboratory (L.I.S), Faculty of Sciences; Badji Mokhtar-Annaba University, P.o.Box 12, Annaba. (Algeria), 2 - Surface Engineering Laboratory (L.I.S), Faculty of Sciences; Badji Mokhtar-Annaba University, P.o.Box 12, Annaba. 2-Scientific and Technical Research Center in Physico-chemical Analysis CRAPC, BP 384, Bou-Ismail Industrial Zone, RP 42004, Tipaza, Algeria. (Algeria)

Date: November 14th, 2024 **Time:** 3:15:00 PM **Room:** B **Ref:** Mat-O2

This work explores the innovative use of an expired drug as a corrosion inhibitor - a potentially cost-effective and environmentally friendly approach to valorizing pharmaceutical waste. The inhibitory effect of Domperidone against corrosion of A9M mild steel in 1M H2SO4 was studied using the weight loss (WL) method at different times (2, 4, 6, 8,10, 24, 48 and 72 h) and concentrations. Inhibitory efficacy was tested at temperatures of 25, 35, 45 and 55°C. Results showed that inhibitory efficacy (I.E) increased with increasing Domperidone concentration, reaching 91% at 1.15.10-4M. The latter was characterized by FTIR and UV-Visible spectroscopy. Surface characterization was carried out by scanning electron microscopy coupled to energy dispersive spectroscopy (SEM-EDS), optical microscopy (OM) and profilometry. Domperidone is a good corrosion inhibitor for mild steel in 1M H2SO4

Nanostructured ITO Growth for Biosensor Fabrication: Pros and Cons

Manel lopez (1) (2), Martínez López mònica (3), Pruna Morales raquel (3)

1 - Manel Lopez (Spain), 2 - Department of Electronics and Biomedical Engineering / Departament d'Enginyeria Electrònica i Biomèdica [Spain] (Spain), 3 - Departament of Electronics and Biomedical Engineering (Spain)

Date: November 14th, 2024 **Time:** 3:30:00 PM **Room:** B **Ref:** Mat-O3

ITO, an acronym for ”Indium Tin Oxide,” is a mixed oxide of indium and tin widely known and used in electronics and optoelectronics applications due to its excellent electrical conductivity and transparency in the visible spectrum and part of the near-infrared spectrum[1]. Because of its characteristics, this metallic oxide has significant applications in touch screens, optoelectronic devices, solar panels, and smart windows[2],[3]. In recent years, this material has also gained relevance as a functionalizable surface in biosensor design, known in the biosensor world as the working electrode[1]. This is due to its dual characteristics: it is transparent, allowing for fluorescence analysis of materials bound to the surface, and it is electrically conductive, making it a very good material for performing electrochemical measurements. This type of measurement requires a functionalizable surface where an antigenantibody reaction occurs, allowing the element to be studied to bind, varying the characteristics of the surface. The larger the functionalizable area, the greater the detection capacity, and thus a higher measurement resolution can be achieved.

In this work, we present the study of functionalizable surfaces based on nanostructured ITO and demonstrate how nanostructured growth of ITO, depending on the temperature and time, can increase the functionalizable active area by more than 200% for the same physical area, as we demonstrate in [4]. We also study the fact that one of the materials used, indium, is relatively scarce, so reducing the proportion of this material results in lower production costs[5]. Finally, an environmental analysis is presented, studying the pros and cons of this type of material.

References

[1] Raquel Pruna Morales, Transparent nonostructured metal oxideds for chemical biosensors: Towards point-of-care environments. Tesis doctoral, 2019,

[2] David S. Ginley and H. Hosono, ”Handbook of Transparent Conductors”, Ed. Springer, 2011

[3] Stadler, A. Transparent Conducting Oxides—An Up-To-Date Overview. Materials 2012, 5, 661-683. https://doi.org/10.3390/ma5040661

[4] Raquel Pruna, Francisco Palacio, Manel L´opez, Judit Perez, Monica Mir, Oriol Blazquez, Sergi Hernandez and Blas Garrido, Applied Physics Letters, 109(6) (2016), 063109 doi: 10.1063/1.4960734

[5] L´opez, M.; Frieiro, J.L.; Nuez-Mart´ınez, M.; Pedemonte, M.; Palacio, F.; Teixidor, F. Nanostructure ITO and Get More of It. Better Performance at Lower Cost. Nanomaterials 2020, 10, 1974. https://doi.org/10.3390/nano10101974

Synthesis of Ag2S nanoparticles and their use for fluorescence imaging in living cells

Ibrahim mayssa (1), Haouari mohamed (2)

1 - Faculty of Science of Monastir,Laboratory of Interfaces and Advanced Materials (LIMA) (Tunisia), 2 - Faculty of Science of Monastir,Laboratory of Interfaces and Advanced Materials (LIMA) (Tunisia)

Date: November 14th, 2024 **Time:** 3:45:00 PM **Room:** B **Ref:** Mat-O4

Our work describe a simple chemical route for preparing silver sulfide nanoparticles (Ag2S) stabilized with thioglicolic acid (TGA). The structural and the optical propreties of the obtained product were caracterised by using different spectroscopic techniques.The obtained Ag2S nanoparticles are highly luminescent in the NIR-I biological window.These NIR NPs present excellent cytocompatibility even at 100 ug/mL with U87 cells. These results have opened up the possibilities of using our nanoparticles for cell imaging , luminescence thermometry and sensing.

Growth, Structural and Optical Characterization of Mixed Halide (I/Br) Perovskite Microcrystals

Abiedh khouloud (1), Nairi safa (2), Zaaboub zouhour (2), Bazzurro virginia (3), Manfrinetti sergio (3), Salerno marco (4), Hassen fredj (1)

1 - UNIVERSITY OF MONASTIR (Tunisia), 2 - Faculty of Science (Tunisia), 3 - University of Genoa (Italy), 4 - Univesity of Genoa (Italy)

Date: November 14th, 2024 **Time:** 4:30:00 PM **Room:** B **Ref:** Mat-O5

In this study, mixed bromide iodide lead perovskite microcrystals were successfully prepared by using low cost solution process. We investigated the structural and optical properties in perovskite single microcrystals using X-ray diffraction of mixed halide (I/Br) perovskite, UV-visible absorption, steady state and time resolved photoluminescence spectroscopies. The surface morphology of mixed halide microcrystals was analysed by optical microscope. We observed that crystalline phase changed from orthorhombic to cubic structure as iodide content increase. The perovskite crystals show bandgap decreasing with increasint I content. The results of this work opens the possibility to turn the emission of mixed halide single crystals, which is promising for sensing devices.

Modeling and optimizing the structure of poly-silicon optical sensor with incorporation the quantum dots

Abdelkayoum o. (1), Aissat abdelkader (2) (3) (4), Dupont s. (4), Benammar m.a., Vilcot j. P. (4)

1 - Laboratory MERL Faculty of Technology University of Tamanghasset. (Algeria), 2 - Université Ahmed Draya Adrar (Algeria), 3 - Laboratory LATSI Faculty of Technology University of Blida.1, 09000 Blida. (Algeria), 4 - Institute of Electronics, Microelectronics and Nanotechnology (IEMN), UMR CNRS 8520 (France)

Date: November 14th, 2024 **Time:** 4:45:00 PM **Room:** B **Ref:** Mat-O6

In the initial phase of our study, we analyzed two types of optical sensors a simple junction PN and a PIN singlejunction made of Poly-silicon. These structures facilitate the conversion of light energy into electrical energy by separating electron-hole pairs and generating a photocurrent, and the thickness of each layer: dn-polySi=150nm, dp-polySi=500nm and di-polySi=100nm. In the second step, we injected InGaAs quantum dots into the intrinsic region (i-PolySi) of the PIN single junction with dimensions of quantum dots (length, l=10nm and width, h=5nm) and compared the results from the three structures. We observed a significant improvement in the efficiency of the PIN single junction with InGaAs QDs compared to the PIN without QDs and a simple PN junction. The efficiency was 5.52% for PN, 6.17% for PIN without QDs, and 8.67% for PIN with QDs at 30 layers. This improvement is attributed to the increased absorption coefficient of the PIN solar sensor structure. All this modeling was done using SILVACO software. This structure allows us to produce optical sensors for detection or solar cell applications.

Synthesis and Characterization of hybrid Membranes Based on Biochitosan and Perovskites.

Achour Khedhiri arwa (1), Zidani jacem (1) (2), Zannen moneim (1), Hriz khaled (1), Majdoub mustapha (1), Lahmar abdelilah (2)

1 - Laboratory of Interfaces and Advanced Materials (LIMA), Faculty of Sciences of Monastir, University of Monastir, Bd. of the Environment, Monastir 5019 , Tunisia (Tunisia), 2 - Laboratoire de Physique de la Matière Condensée (LPMC), Université de Picardie Jules Verne, 33 rue Saint-Leu, 80039 Amiens, CEDEX 1, (France)

Date: November 15th, 2024 **Time:** 10:30:00 AM **Room:** B **Ref:** Mat-O7

The combination of inorganic and organic components in the fabrication of membranes promotes an interesting cooperation between their physical and chemical properties. Certainly, this research explores the incorporation of perovskite-type particles such as BiFeO3, synthesized using the sol-gel technique, into polymer matrices of biological origin, such as chitosan extracted from crustacean shells. The analyses of synthesized bismuth ferrite emphasize its structural and morphological analysis-ray diffraction analysis (XRD) shows that the BFO exhibits a pure perovskite phase, with no evidence of secondary phases detected in the studied region. Furthermore, it is attributed to a rhombohedral symmetry with space group R3c.Scanning electron microscopy (SEM) of the powder revealed variability in particle size as well as the presence of grain agglomerates. Various types of analyses, including morphological, optical, and dielectric analyses, characterize the membranes. The scanning electron microscopy analysis of the film shows an even distribution of BFO throughout the polymer matrix, suggesting a strong interaction between the nanoparticles and the polymer matrix. The optical properties results indicate the emergence of a new band in the visible spectrum following the addition of 6% BFO, attributed to the characteristics of the nano-powder. Additionally, the obtained membranes show a low variation in the bandgap. Research conducted over a wide range of frequencies suggests that increasing the quantity of BFO particles within the polymer matrix enhances both the dielectric permittivity and losses of CS/BFO membranes, thereby improving the dielectric properties of chitosan.

Thermal Sensing Characteristics of Neodymium-Substituted Bismuth Ferrite Nanoparticles for Thermistor Applications

Chiba ilhem (1), Zannen moneim (2), Hassen fredj (1), Autret-Lambert cécile (3)

1 - Laboratory of Microptoelectronics and Nanostructure LMON (LR99/ES29), Faculty of Sciences, Monastir University (Tunisia), 2 - Laboratory Interfaces and Advanced Materials LIMA, Monastir University (Tunisia), 3 - Materials Research Group, Microelectronics, Acoustics and Nanotechnologies, GREMAN,University of Tours France (France)

Date: November 15th, 2024 **Time:** 10:45:00 AM **Room:** B **Ref:** Mat-O8

In this study, we synthesized bismuth ferrite nanoparticles doped with 6% neodymium using the sol-gel method. X-ray diffraction analysis indicated a rhombohedral perovskite structure with an R3c space group. The crystallite size of the sample was determined using Scherrer's equation and the Williamson-Hall method. Furthermore, morphological characterization was performed through FESEM and TEM analyses, revealing the formation of well-defined grain nanoparticles with an average size of 195 nm. Semi-quantitative EDX analysis confirmed the presence of the anticipated elements, with EDX patterns showing Bi, Fe, Nd, and O in the synthesized nanoparticles, while no secondary elements were detected. Raman analysis identified 13 Raman modes, comprising nine E modes and four A1 modes, which further confirmed the structural stability of the Nd-modified $BiFeO_3$ nanoparticles. The analysis of dielectric properties validated the exclusive negative temperature coefficient of resistance (NTCR) behavior exhibited by our synthesized sample across various temperatures, as indicated by the variation in resistance. Calculations of the thermistor constant (β), sensitivity factor (α), and stability factor for the sample confirmed its suitability as an NTC thermistor.

Innovative Chemiresistive Sensor Networks: Selective Detection of Acetone, Ethanol, and Water Using Machine Learning

Haj Ammar wiem (1), Boujnah aicha (1), Boubaker aïmen (1), Pecqueur sébastien (2), Lmimouni kamal (2), Kalboussi adel (1)

1 - University of Monastir, Faculty of Sciences (Tunisia), 2 - Institute of Electronics, Microelectronics and Nanotechnology (France)

Date: November 15th, 2024 **Time:** 11:00:00 AM **Room:** B **Ref:** Mat-O9

Chemiresistive sensors, widely used in various fields, modify their conductivity in response to specific analytes. Organic semiconductors, such as P3HT, stand out for their molecular versatility, allowing them to detect a wide range of chemical substituents through different intermolecular bonding modes. This chemospecific sensitivity makes organic semiconductors promising materials for gas detectionIn this study, we demonstrated that doped P3HT, combined with hybrid descriptors (static and dynamic) and the k-means clustering algorithm, can effectively distinguish water, ethanol, and acetone vapors. Furthermore, this study reveals that an efficient sensing network does not only rely on the intrinsic quality of individual sensors, but on their ability to work in synergy. Therefore, new performance measures, other than traditional metrology approaches, are proposed for sensing systems using machine learning pattern recognition.

Simultaneous detection of Cd2 + and Pb2 + by an electrochemical sensor based on PANI@Tio2@CNT nanocomposites

Ali emna (1) (2), Barhoumi houcine

1 - Faculty of Science of Monastir (Tunisia), 2 - Laboratory of Interfaces and Advanced Materials (Tunisia)

Date: November 15th, 2024 **Time:** 11:15:00 AM **Room:** B **Ref:** Mat-O10

---

this article covers a study that developed and applied a novel electrochemical setup to detect cadmium ion s(Cd2+) and Pb2+). The system used a glassy carbon electrode functionalized with (PANI@TiO2@CNT/GCE). We dope Pani with TiO2 a metal oxide then the CNTs interact by hydrogen and wander waals combination in order to enhance its characteristics. The generated PANI@TiO2@CNT/GCE electrode was tested using differential pulse voltammetry (DPV) technique in 0.1 M acetate buffer for lead and cadmium detection. Following optimization, the electrode exhibited a linear response across the concentration range of Cd2+ from 7.5x10-9 M to 7.5x10-8 M and Pb2+ from 5x10-9 M to 5.10-8 M, with a minimal detection limit respectively 7.5x10-9 M and 5x10-9 M. This sensor demonstrates its effectiveness across various environmental conditions owing to its adaptability and resilience. It is capable of functioning reliably amidst temperature fluctuations, varying humidity levels, and a wide range of pH values. With its exceptional sensitivity and ability to detect even minute concentrations of heavy metal pollutants like Pb2+ or Cd2+ in water sources, it proves invaluable in environments where water quality monitoring is crucial. Moreover, its robust construction ensures long-term stability and durability, making it suitable for continuous monitoring applications in diverse settings, including industrial facilities, agricultural areas, and natural ecosystems.

Synthesis and Characterization of a Novel Trinuclear Copper MOF for Micro-Supercapacitor Applications

Toumia hiba (1), Zerida habiba (1), Martinez javier (2), Haj Said ayoub (3)

1 - Laboratoire des Interfaces et des Matériaux Avancés (Tunisia), 2 - Instituto de sistemas optoelectronicos y microtecnologia, Universidad Politécnica de Madrid (Spain), 3 - Centre de Recherche en Microélectronique et Nanotechnologie, Technopole de Sousse (Tunisia)

Date: November 15th, 2024 **Time:** 11:30:00 AM **Room:** B **Ref:** Mat-O11

Metal-organic frameworks (MOFs) are a promising class of porous materials with broad applications, including energy storage. This study presents a novel trinuclear copper-based MOF with a highly porous structure and a large specific surface area. The MOF was synthesized solvothermally using copper nitrate and dimethylpyrazol-naphthalene diimide (H_2NDI-H) [1]. Its crystal structure and morphology were characterized by powder X-Ray Diffraction (XRD) and scanning electron microscopy (SEM). Additionally, thermogravimetric analysis (TGA) and low-temperature nitrogen adsorption were used to determine the specific surface area and pore size distribution. As a proof-of-concept, we fabricated MOF-based electrodes for micro-supercapacitors using laser-assisted printing [2]. These electrodes demonstrated excellent electrochemical performances, including high specific capacitance, good rate capability, and sgood cycling stability. The obtained results suggest that laser-printed MOF electrodes hold great promise for future miniaturized energy storage devices.

SUB-PPM NO2 GAS SENSOR BASED ON OPTIMIZED ZNO :GA THIN FILM

Paret benjamin (1) (2), Presmanes lionel (2), Barnabe antoine (2), Camps thierry (1), Mazenq laurent (1), Charlot samuel (1), Menini philippe (1)

1 - LAAS-CNRS, Toulouse, France (France), 2 - CIRIMAT UMR 5085 UPS-CNRS-INP, Institut Carnot, Université Toulouse III Paul SABATIER, 118 route de Narbonne, 31062 Toulouse Cedex 9, France (France)

Date: November 15th, 2024 **Time:** 11:45:00 AM **Room:** B **Ref:** Mat-O12

The detection of very low concentrations of NO2 is crucial for monitoring outdoor air pollution and requires highly sensitive sensors capable of detecting a few tens of ppb. In our recent work, we developed a ZnO-based sensing layer doped with Gallium dedicated to the technology of resistive metal oxide sensors. This material was obtained through the sintering of a target of Zinc oxide doped with 4% Gallium, for deposition by RF magnetron sputtering under high pressure (2 Pa), allowing for good control of the deposition with maximum porosity. The performance under gas conditions proved to be extremely promising (high sensitivity to NO2: Rg/R0=12 and very low sensitivity to other reducing gases) but unstable. To achieve these performance levels in terms of sensitivity and response time, we considered the film thickness from 12 to 100 nm and substrate roughness by comparing flat thermal SiO2 and rough PECVD SiO2. To address these instability issues, we studied the probable causes and focused on the annealing of the ZnO:Ga thin film at different temperatures. The optimum at 600°C could be explained through measurements of our various samples under photoluminescence.

Green synthesis of silver nanoparticles prepared using aqueous root extract of Salvadora persica L. growing wild in the region of Najran in Saudi Arabia: Synthesis optimization, characterization and antibacterial activities

Hadj Lajimi ramzi (1, 2), Alsahli sultan (1), Snoussi mejdi (3)

1 - Department of Chemistry, College of Science, University of Ha'il, P.O. Box 2440, Ha'il 2440 (Saudi Arabia), 2- Laboratory of Water, Membranes and Environmental Biotechnologies, Center of Research and Water Technologies,

P. B 273, Soliman 8020, Tunisia, 3 - Department of Biology, College of Science, University of Ha'il, P.O. Box 2440, Hail 2440 (Saudi Arabia)

Date: November 15th, 2024 **Time:** 3:45:00 PM **Room:** A **Ref:** Mat-O15

The green synthesis of silver nanoparticles (AgNPs) using aqueous extracts of plant materials is a sustainable ecofriendly approach for the synthesis of metal nanoparticles. This approach contributes to the environment preservation by using less chemicals and thus producing less chemical waste as well as the use of renewable natural resources which makes it sustainable. In this work, we report the synthesis optimization of silver nanoparticles (R-AgNPs) using the aqueous root extract (ARE) of Salvadora persica L. growing wild in the region of Najran in Saudi Arabia. The phytochemical composition of the ARE was screened using HR-LCMS in both positive and negative modes. The effect of reaction time, concentration of the dried aqueous root extract of Salvadora persica L. (DARE) and temperature were studied. The kinetic study of R-AgNPs formation was followed by UV-Vis spectroscopy for 48 h reaction time. Different DARE concentrations ranging from 0.004% to 0.200% (w/w) were studied to find the optimal concentration giving the smallest size and size distribution of R-AgNPs. The effect of temperature will be studied for the concentration which gave the best results. The presence of the surface plasmon resonance (SPR) peak, within the range 400-450 nm, confirmed the formation of R-AgNPs which was detected for all concentrations at 80 °C. Changing the reaction time and concentration of DARE affected the intensity and wavelength of the SPR peak. The prepared AgNPs with a DARE concentration of 0.120% (w/w), 1 mM Ag+, at 80 °C and after 24 h reaction time gave the smallest size and size distribution. Reducing the temperature to 60 °C gave fewer R-AgNPs and at 40 °C, AgNPs did not form. The prepared R-AgNPs with a DARE concentration of 0.120% (w/w), 1 mM Ag+, at 80 °C and after 24 h reaction time have an average size: r (nm) = 15.944 ± 4.321 as determined by TEM, r (nm) = 26.589 ± 3.117 as determined by SEM and r (nm) = 56.4 ± 18.6 as determined by DLS. The R-AgNPs were characterized also by PXRD, and the diffractogram showed intense discrete diffraction peaks, confirming a crystalline structure formed by cubic AgCl. The thermogravimetric analysis showed that R-AgNPs were stable until 238 °C which is higher than that of DARE which started to decompose at 63 °C. Moreover, we evaluated the antibacterial activity of the DARE and R-AgNPs against clinical bacterial strains responsible for several bacterial infections by using both well diffusion and microdilution assays. The obtained results revealed that R-AgNPs were more active against all tested microorganisms as compared to the DARE with mGIZ ranging from 11.67±0.57 mm (E. feacalis 268) to 15±0 mm (S. aureus MRSA 217), and low MICs (ranged from 0.019 to 0.781 mg/mL) and MBCs values (MBCs values ranging from 0.781 to 6.25 mg/mL).

Sensors and apllications for Agriculture

A novel low-cost and practical solution for wine quality assessment

Moncada sofía (1), Caravaca oriol (1), Moreno sergio (1), Benito-Altamirano ismael (1), Canals joan (1), Roca-Domenech gemma (2), Puig-Pujol anna (2), Vilà anna (1), López manel (1), Prades daniel (1), Dieguez angel (1)

1 - University of Barcelona (Spain), 2 - INCAVI-Catalan Institute of Vine and Wine (Spain)

Date: November 14th, 2024 **Time:** 2:45:00 PM **Room:** A **Ref: Agr-O1**

The wine industry has a significant economic impact, especially in Europe. Wine elaboration requires precise yeast cell counts at specific production stages to ensure quality. We introduce in this paper a microscope-on-a-chip solution for in situ sample analysis, offering a more cost-effective alternative to traditional, often expensive, laboratory equipment. The setup uses a lensless holographic microscope constructed from off-the-shelf components such as a lensless camera and an LED micro-display, supplemented with custom 3D-printed parts and standard laboratory disposables. An application developed in Python with the QT framework captures real-time images from wine samples. Users can then process these images through a sophisticated computer vision pipeline, consisting of normalization, image composition to enhance resolution and scanning area, holographic reconstruction, and particle counting stages. This approach ensures high accuracy in cell counting and image resolution, comparable to traditional optical microscopy. Experiments were conducted to validate the setup by measuring Saccharomyces cerevisiae cells in white wine samples. The system successfully recovered cell images from holographic reconstructions and provided accurate cell counts, demonstrating a resolution of around 2-3 μm, half the size of a typical yeast cell. Comparative analysis with optical microscopy confirmed the reliability of the microscope-on-a-chip measurements. Our system combines readily available components with advanced computer vision techniques to create effective and accessible microscope-on-a-chip solutions for critical industry applications like wine production. It offers a practical, efficient, and cost-effective solution for the wine industry, matching the performance of traditional optical microscopy while providing greater convenience and automation. This work has received funding from FEADER and DACC of the GenCat. with grant 56-30123 2021-2A. This work has also received funding from Grants PID2019-105714RB-I00 and PID2022-136833OB-C21 funded by MICIU/AEI/10.13039/501100011033 and the European Regional Development Fund.

Integrated strategy using synbiotics in crop biocontrol and postharvest biopreservation of citrus

Mounir majid (1), Farih kawtar (1), Arhlam khaoula (1), Smaili moulay Chrif (2)

1 - Biotechnology and Biotransformations Laboratory, Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, Morocco (Morocco), 2 - UR - Protection des Plantes, Institut National de la Recherche Agronomique INRA - Centre Régional de Kénitra, Kénitra 14000 – Morocco (Morocco)

Date: November 16th, 2024 **Time:** 11:30:00 AM **Room:** A **Ref: Agr-O2**

The present work reports the potential of using of synbiotics as bio-supplements, biopesticides and post harvest biocontrol agents for citrus crops. Initially, two sample collection companies were carried out in the two regions of EL GHARB and FES-MEKNES with a view to isolating probiotic and/or antagonistic strains. Samples of fresh fruit and sorting deviations were also collected. 32 yeast strains were isolated from the peel of these fruits and other substrates. They were then operated according to two main performance criteria: biomass and ethanol production. Furthermore, a study focused on fruit samples taken in Morocco, including organic oranges, conventional oranges and organic lemons. A total of 45 bacterial strains were isolated from these matrices, and their identification was carried out by PCR of the 16S gene. The results revealed the presence of several species of bacteria, including Pseudomonas sp., Bacillus sp., Curtobacterium sp., Pantoea sp., and others. In order to evaluate the antagonistic power of these strains, pathogens responsible for surface infections were isolated from infected fruits of Moroccan origin (Penicilium and Geotricum). The antagonistic strains were tested by sowing disks soaked with antagonist on culture dishes, followed by incubation. The inhibition zones were measured. For further analysis, liquid cultures of the selected strains were prepared and subjected to LC/MS analysis to detect secondary metabolites produced. Additionally, total genomic DNA was extracted from the fruit samples, followed by amplification, purification and high-throughput sequencing. The sequencing results provided information on the microbial diversity presented in the samples, providing in-depth insight into the genetic makeup of the bacteria studied.

Sensors and Application in the Environment

Comparative Study between Two Green Inhibitors on the Corrosion of 5086 Aluminum in 1M HCl

Abderrahmane sihem (1), Moussaoui kamilia (1), Youbi asma (1), Khelfi hadil (1), Maalem badreddine (1) (2)

1 - Surface Engineering Laboratory (L.I.S), Faculty of Sciences; Badji Mokhtar-Annaba University, P.o.Box 12, Annaba. 23000, Algeria (Algeria), 2 - Research Center in Industrial Technologies (CRTI), P.O. Box 64 Cheraga 16014. Algiers. ALGERIA. (Algeria)

Date: November 15th, 2024 **Time:** 11:00:00 AM **Room:** A **Ref:** Env-O2

In accordance with green chemistry to evade toxicity and minimize waste, we have chosen to replace the usual inhibitors with an alternative not only ecological but also derived from biological wastes. In this context this work seeks to valorize the Black Cumin Cake (BCC) extracted by Soxhlet as two green inhibitors Ethanol extracts of BCC (Et-BCC) and Water extracts of BCC (Wa-BCC). These later are used as the corrosion inhibitors of 5086 aluminum in 1M HCl. The inhibitor characterization was carried out using FTIR, UV-visible spectroscopy, and phytochemistry.The anticorrosive activity was performed using different electrochemical techniques (potentiodynamic polarization (PDP) and electrochemical impedance spectroscopy (EIS)) and the weight loss (WL) method. Investigation of corrosion products and morphologies of the metal surface by FTIR, SEM-EDS and profilometry techniques reveals efficient surface protection through adsorption of Et-BCC and Wa-BCC. The polarization studies proved that Et-BCC and Wa-BCC are a mixed type inhibitor in 1M HCl, with a predominant cathodic effectiveness. The maximum efficiencies for 5086 aluminum are 99.35% at 4.10-2v/v Et-BCC and 99.48% at 4.10-2 v/v Wa-BCC. There adsorption on the aluminum surface follows the Langmuir isotherm, and the inhibitive molecules are physi-chemisorbed. Et-BCC and Wa-BCC are good corrosion inhibitors of 5086 aluminum in 1M HCl.

Fe0,05Bi0,95VO 4/CNS as a new efficient Paracetamol electrochemical Sensor.

Derbali maram (1)

1 - Salah Kouass (Tunisia)

Date: November 15th, 2024 **Time:** 3:00:00 PM **Room:** A **Ref:** Env-O3

The purpose of this research is to develop an electrochemical sensor in order to determine paracetamol (PC) levels. To reach this objective, an indium thin oxide (ITO) electrode was modified with a composite of carbon nanosphere (CNS), and Fe-doped BiVO 4 nanoparticles, which was tested, to evaluate its electrocatalytic properties for the anodic oxidation of PC. Exploiting their various structural advantages that include large exposed active surface sites, ultrathin nano-sheets, and unique three-dimensional spherical nano-structure, the as-obtained hybrid electrode Fe 0.05 Bi 0.95 VO 4 /CNS exhibits an excellent electrochemical performance. The fabricated nanocomposite electrode Fe 0.05 Bi 0.95 VO 4 /CNS/ITO reacted rapidly with enhanced anodic peak current when PC analyte is added. At optimized conditions, the proposed electrochemical platform enabled a linear plot over a concentration range of 1-80 µM with a detection limit of 1 µM of PC. This research's novelty consists of designing a new and effective electrochemical sensing system that can identify PC with high sensitivity and selectivity, helping to keep water quality under control and preventing negative effects on the environment and public health.

Biosourced materials for the design of environmental sensors

Zazoua ali (1)

1 - Energétique Appliquée et materiaux (Algeria)

Date: November 15th, 2024 **Time:** 11:30:00 AM **Room:** A **Ref:** Env-O4

Over the last decades, electrochemical sensors and biosensors have experienced a considerable development due to their simplicity, reliability, speed and selectivity. They have been the most attractive alternatives to classical analytical methods in fields as diverse as food processing, medicine and clinical biology, or environmental quality control. In this research work, we are interested in the design of an electrochemical biosensor for the detection of PBA and catechol, which is classified as an endocrine disruptor, in aqueous media. In the first part, a tannin gel (TG) and an amine-modified tannin gel synthesized from condensed green tea tannin molecules have a remarkable ability to adsorb various organic ions. Qualitative tests are established on the previously extracted products. The receptor matrix is immobilized by the appropriate technique for the functionalization of the transducers. This matrix has marked its retention efficiency of PBA and CC with very advantageous detection limits of the order of 10-6 to 10-18.

Chemical VOCs sensing of sol-gel ZnO and linear discriminant analysis for instantaneous selectivity

Souissi riadh (1) (2), Bouricha brahim (2), El Mir lassaad (3), Abderrabba manef (2)

1 - Carthage University, Laboratory of Materials, Molecules and Applications, Preparatory Institute for Scientific and Technical Studies (Tunisia), 2 - Carthage University, Laboratory of Materials, Molecules and Applications, IPEST, La Marsa Tunis (Tunisia), 3 - University of Gabes, FSG (Tunisia)

Date: November 15th, 2024 **Time:** 11:45:00 AM **Room:** A **Ref:** Env-O5

This work reports on the integration of ZnO pellets for use as virtual sensor array of volatile organic compounds (VOCs). ZnO pellets consist of nano-powder prepared by sol-gel technique. The microstructure of the obtained samples was characterized by XRD and TEM methods. The response to VOCs at different concentrations was measured in the range of operating temperatures 250°C-450°C using DC electrical characterization. The ZnO based sensor showed good response towards ethanol, methanol, isopropanol, acetone, and toluene vapors. Dynamic response was investigated to construct mathematical features with distinctly different values for each vapor. Basic linear discrimination analysis (LDA) shows a good job of separating two groups by combining features. In the same way we have shown an original reason embodying the distinction between more than two volatile compounds. With relevant features and VSA formalism, the sensor is clearly selective towards individual VOCs

---

Adsorption of perfluorobutanoic and perfluorooctanoic acids on chitosan: Modelling and interpretation of the adsorption mechanism

Sellaoui lotfi (1)

1 - CRMN, Centre for Research on Microelectronics and Nanotechnology of Sousse, NANOMISENE, LR16CRMN01, Code Postal 4054, Sousse, Tunisia (Tunisia)

Date: November 15th, 2024 **Time:** 2:45:00 PM **Room:** A **Ref:** Env-O7

This study reports a physicochemical analysis of the adsorption mechanisms of perfluorobutanoic acid (PFBA) and perfluorooctanoic acid (PFOA) on chitosan polyurethane foam (CPF). Experimental adsorption data and theoretical statistical physics calculations were employed to elucidate the adsorption mechanisms of PFBA and PFOA. A statistical physics adsorption model, suggesting that these two molecules were adsorbed via two different functional groups, was applied to simulate the adsorption data. The application of this model allowed the calculation of the number of bonded PFBA and PFOA molecules and the saturation adsorption capacity via both functional groups at different temperatures. For instance, the values of n1 and n2 were 1.6 and 5.5 at 298 K, respectively, suggesting that the PFAS molecules interacted with two functional groups on the CPF surface in a vertical adsorption orientation with different affinities. CPF was more effective at removing PFBA and PFOA at high solution temperatures, suggesting an endothermic process characterized by adsorption energies ranging from 12.62 to 33.52 kJ/mol. These interactions were associated with physisorption and DFT simulations were performed to identify the main functional groups and their roles in the adsorption process. Overall, this research integrates the experimental results with two different theoretical approaches to propose a novel interpretation of how two important industrial pollutants can be adsorbed on chitosan polyurethane foam.

Exploring CsPbBr3 as a Novel Electrochemical Sensor for Environmental Pollutant Detection: A First-of-Its-Kind Study

Brahim hafedh (1), Fredj hassen (1), Zribi rayhane (2), Giovanni neri (2)

1 - Laboratoire de Micro-Optoélectronique et Nanostructures (LMON) (Tunisia), 2 - Department of Engineering, University of Messina, Contrada Di Dio, 98166 Messina, Italy (Italy)

Date: November 15th, 2024 **Time:** 11:15:00 AM **Room:** A **Ref:** Env-O8

This study introduces the novel application of CsPbBr3, an all-inorganic perovskite, as an electrochemical sensor material for detecting key environmental pollutants such as hydroquinone (HQ), catechol (CC), and resorcinol (RS). To the best of our knowledge, CsPbBr3 has never been explored before as an electrochemical sensor material in the literature. This groundbreaking approach leverages the unique properties of CsPbBr3 to enhance the electrochemical response of screen-printed carbon electrodes (SPCE), creating a sensor platform with promising potential for high-performance detection in environmental applications.

The CsPbBr3/SPCE sensor was rigorously evaluated through a series of experiments utilizing Square Wave Voltammetry (SWV) to determine its sensitivity, selectivity, and overall efficacy in detecting the target analytes both individually and in mixed solutions. In the specificity and selectivity tests, the sensor demonstrated its ability to distinctly identify the oxidation peaks of HQ, CC, and RS at 0.004 V, 0.096 V, and 0.558 V, respectively. These well-separated peaks, even in complex mixtures, highlight the sensor's superior selectivity. Calibration curves generated from SWV measurements revealed remarkable sensitivity for HQ, with a slope of 0.58568 µA.µM^-1.cm^-2 and a low detection limit of 0.09 µM. For CC, the sensor achieved a sensitivity of 0.4 µA.µM^-1.cm^-2 with a detection limit of 3.5 µM. These results indicate that the sensor is highly effective at detecting trace amounts of these pollutants, which is critical for environmental monitoring applications where pollutants often occur at low concentrations.

Further tests were conducted to evaluate the sensor's performance in real-world conditions. Using undiluted mineral water as a complex matrix, the sensor's ability to maintain its sensitivity and selectivity was tested. The results were promising, with a progressive increase in current output correlating with the addition of HQ, ranging from 4 µA at 0 µM to 10.5 µA at 300 µM. This consistent performance in a challenging matrix underscores the robustness and practical applicability of the CsPbBr3/SPCE sensor in real-world environmental monitoring scenarios, where interference from other substances is a common challenge.

Moreover, the study explored the sensor's capability to simultaneously detect multiple analytes. In mixed solutions containing HQ, CC, and RS, the sensor effectively distinguished each compound with no significant interference, further affirming its potential for use in scenarios requiring multi-analyte detection.

In conclusion, the CsPbBr3-modified SPCE sensor developed in this study offers a combination of high sensitivity, selectivity, and durability, making it a promising tool for detecting hazardous pollutants in various environmental settings. The findings suggest that CsPbBr3-based sensors could significantly

enhance the efficiency of environmental monitoring, providing a reliable and cost-effective solution for real-time detection of pollutants. This work not only highlights the potential of $CsPbBr_3$ in sensor technology but also lays the groundwork for future research aimed at optimizing perovskite-based sensors for broader applications in environmental science and beyond.

MSA capped CdTe quantum dots as highly selective fluorescence chemsensors for mercury(II) ions detection

Ajroud mohamed (1), Lahnayen rabeb (1), Helaoui meryem (1), Haouari mohamed (1), Schneider raphaël (2), Ben Ouada hafedh (1)

1 - Laboratoire des Interfaces et des Matériaux Avancés (LIMA)_FSMonastir (Tunisia), 2 - Laboratoire Réactions et Génie des Procédés (LRGP), CNRS (UMR 7274) _Nancy (France)

Date: November 15th, 2024 **Time:** 3:15:00 PM **Room:** A **Ref:** Env-O9

CdTe Quantum .Dots (QDs) capped with Mercaptosuccinic.acid (MSA) ligands have been synthesized in aqueous solution with significant stability and good fluorescence properties. Photophysical characterization was performed using FTIR, XRD, HRTEM, UV-Vis. Absorption, PL and PLRT techniques, seeking their subsequent application as fluorescent probes for metal cations. CdTe-MSA QDs showed selective sensitivity towards Hg2+ ions by monitoring quantitative fluorescence quenching with increasing analyte content. Under optimal.conditions, the linear range for the detection was 0.2 mM to 6 mM with a detection limit of 0.05 mM. According to the Stern-Volmer model, it can be inferred that a static quenching mechanism via Hg2+ selective binding to MSA carboxylate groups is operating with electron transfer process. Excess of mercuric ions further decreased and red shifted the fluorescence possibly due to competitive cation exchanges. To further explain the corresponding ligation mechanisms, adsorption behavior study was conducted via several isotherms as well as statistical physics models. The pseudo-first order model can describe the adsorption kinetics of Hg2+ on CdTe-MSA QDs more accurately and the experimental data fitted well the Langmuir isotherm model of monolayer adsorption on homogeneous surface. Furthermore, this spontaneous process conforms to the Hill model as a physisorption with an adsorption energy of 32 kJ.mol−1 associated to the electrostatic interactions and hydrogen bonding. The relevant results demonstrated that CdTe-MSA QDs could be deployed as promising Hg2+ fluorescent chemosensing system with high sensitivity and selectivity over wide linear detection range that have great potential for real water samples analysis.

IMPROVING OF THE MOLECULARLY IMPRINTED POLYMERS PROPERTIES FOR APPLICATIONS IN ELECTROCHEMICAL SENSORS

Vautrin-Ul christine (1), Pain yves, Martinez Casanova ana, Hamadachi thinhinane, Nicolle jimmy, Coillot christophe, Contreras sylvie (2)

1 - Interfaces, Confinement, Matériaux et Nanostructures (1b rue de la Férollerie, CS 40059, 45071 Orléans cedex 2 France), 2 - Laboratoire Charles Coulomb (France)

Date: November 15th, 2024 **Time:** 3:30:00 PM **Room:** A **Ref:** Env-O10

The functionalization of electrodes with Molecularly Imprinted Polymers (MIP) is a strategy that has made it possible to develop sensitive and selective electrochemical sensors, pushing the limits of detection (LOD) and the limits of quantification (LOQ) to values compatible with current standards of the water directives frameworks. MIPs are polymer matrices that contain selective cavities for a given micropollutant. To obtain them, a monomer is electropolymerized in the presence of a "template" molecule, usually directly the micropollutant targeted. After extraction of the molecular template, the cavities created have a shape and functionalities complementary to those of the targeted analyte. The can be synthesized by chemical synthesis or by electropolymerization. However, the measurement and regeneration cycles necessary to regenerate the sensor decrease the robustness of the MIP-electrode dispositives, limiting the number of possible analyses with the same functionalized MIP electrode. In order to consider applications for continuous or semi-continuous measurements, it is essential to improve the robustness of these MIP sensors coupling. Our present work will study the influence of the MIP parameters synthesis or electrosynthesis for two kinds of electrochemical sensors: first for isoproturon electroanalysis in water and second for the detection of the stress in plants. The presentation will focus on the influence of key parameters at the different stages of the sensor elaboration and use: electropolymerization of the MIP, extraction of the target molecule and MIP regeneration after each micropollutant analysis. Keyword : Electrochemical sensors, Robustness, Molecular Imprinted Polymer
References: [1] Sadriu, I.; Bouden, S.; Nicolle, J.; Podvorica, F. I.; Bertagna, V.; Berho, C.; Amalric, L.; Vautrin-Ul, C.; Talanta 2020, 207, https://doi.org/10.1016/j.talanta.2019.120222.
Acknowledgement: We gratefully acknowledge the financial support provided to the JUNON project by the Region Centre – Val de Loire and to the French “Agence Nationale de la Recherche” for the project ANR-20-CE04-0011.

Assessment of the alpha volumetric activities of 238U and 232Th in drinking water using the DSTN method and the ICP-MS technique from wells in the industrial region of Safi, Morocco

Ait Nouh fatima (1), Bahsine saida (2), Mandi laila (3), Khajmi hassan (4), Bellaziz yassir (5), Lachguer chaymae (2)

1 - Centre National d'Etudes et de Recherches sur l'Eau et l'Energie (CNEREE), Université Cadi Ayyad Marrakech (Morocco), 2 - Laboratoire de physique fondamentale et appliquée, faculté polydisciplinaire de Safi, Université Cadi Ayyad de Marrakech (Morocco), 3 - Laboratoire d'hydrobiologie, d'écotoxicologie et d'assainissement, Département de biologie, Faculté des sciences Semlalia, Université Cadi Ayyad de Marrakech (Morocco), 4 - Institut supérieur des professions infirmières et des techniques de santé, Marrakech (Morocco), 5 - Laboratoire de Mécanique des Fluides et d'Energétique, Faculté des Sciences Semlalia, Université Cadi Ayyad (Morocco)

Date: November 16th, 2024 **Time:** 9:30:00 AM **Room:** A **Ref:** Env-O11

La croissance démographique rapide exerce une pression sur l'environnement en générant de grandes quantités de matières radioactives et de polluants. Ces substances sont rejetées dans les écosystèmes naturels sans traitement préalable, ce qui entraîne une contamination nocive de l'eau, du sol, des sédiments, de la faune et de la flore. Les risques pour la santé sont particulièrement graves lorsque les niveaux de nucléides radioactifs et de métaux lourds dans les eaux de surface et souterraines dépassent les normes de sécurité pour l'eau potable. Cette étude vise à évaluer la contamination de l'eau potable des puits de la zone industrielle de Safi par les radionucléides issus des déchets de phosphate en combinant les détecteurs de traces nucléaires à l'état solide SSNTD et la technique ICP-MS. L'étude a examiné les doses efficaces annuelles (ACED) résultant de l'ingestion de 238U et 232Th à travers l'eau de puits pour les individus appartenant aux tranches d'âge suivantes : moins de 1 an, 1-2 ans, 2-7 ans, 7-12 ans, 12-17 ans et plus de 17 ans. Selon la moyenne de 244,9 mBq.l-1, les niveaux de 238U et 232Th variaient de 168,2 mBq.l-1 à 325,4 mBq.l-1 et de 17,7 mBq.l-1 à 96,9 mBq.l-1 avec une moyenne de 58,6 mBq.l-1, respectivement. Il a été déterminé comment le pH, la conductivité et la concentration d'activité de 238U et 232Th sont liés les uns aux autres. Pour toutes les tranches d'âge, l'ACED totale résultant de la présence des radionucléides susmentionnés dans l'eau étudiée varie de 9,4 m Sv.y-1 à 135,2 m Sv.y-1. Les doses estimées étaient significativement plus élevées dans les zones proches de la zone industrielle de Safi, ce qui pose des risques sanitaires importants pour les populations, en particulier pour les enfants.

Synthesis and Sensing Performance of Three Chromogenic and Fluorogenic Schiff Bases: A Smartphone-Assisted Fluorometric Assay for Selective Metal Ion Detection in Drinking Water

Bhiri fatma (1), Chemli mejed, Sakly nawfel, Majdoub mustapha

1 - Laboratoire des Interfaces et Matériaux Avancés, (Tunisia)

Date: November 16th, 2024 **Time:** 9:45:00 AM **Room:** A **Ref:** Env-O12

This work investigates the application of Schiff bases as fluorescent probes for the selective detection of metal ions, focusing on the Al^{3+} ion due to its environmental and biological relevance. The detection mechanism was explored using ^1H NMR, UV-visible spectroscopy, and photoluminescence measurements, revealing the underlying processes responsible for fluorescence activation. The studied Schiff bases demonstrated excellent selectivity for Al^{3+}. The limits of detection (LoD) were determined to be 9.4 nM, 149 nM, and 33 nM for the different probes, all of which are significantly below the World Health Organization's recommended safety threshold of 7.4 µM for aluminum in drinking water. Furthermore, a portable, low-cost detection system was developed, comprising an endoscopic camera paired with a smartphone and an ultraviolet excitation source (λ_exc = 365 nm). This device enables rapid, field-based detection of Al^{3+} in water samples, with real-time fluorescence imaging and quantification through RGB analysis. The integration of this technology presents a promising tool for environmental monitoring, offering accessible and efficient water quality testing solutions.

Poster Communications

Material Devices for Sensors

Study and investigation of I-V-T measurements of Ti/6H-SiC and Ni/6H-SiC Schottky diodes for three contact area.

Bounab elhachani (1)

1 - fayssal mekaret (Algeria)

Date: November 14th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM1

The power components market is experiencing growth. Silicon's physical limitations hinder its production. The active surfaces of SiC rectifier diodes must be increasingly large, which goes against the constant desire to miniaturize devices (Bekaddour et al., 2023). Thus there's a need to explore semiconductor materials that can endure power and temperature conditions. Silicon carbide emerges as an option, with its bandgap properties suitable for voltage, frequency and temperature resilience. Recent advancements in SiC based devices and low complexity SiC tailored for high temperature operation show promise. However the performance of SiC power devices often suffers from defects in SiC wafers. Researchers are now focusing on creating a barrier with controlled interface states at the metal silicon contact, in Schottky diodes to address this issue. This research explores the measurement of reverse current-voltage characteristics in a wide range 77-500K of titanium and nickel/6H-SiC Schottky diodes for three contact area sizes. (Benmaza et al., 2008). The interface states play a critical role for device characteristics. The doping impurities, defects, dislocations, micropipes, and inclusions of different polytypes in the epitaxial layers existing in SiC are responsible for Schottky barrier inhomogeneities. Therefore, it is vital to identify these electrically active defects in the grown epitaxial layers and to know how they affect the detector performance in terms of leakage current, Schottky barrier inhomogeneities. In this work, three contact sizes (1.6 × 1.6, 1.6 × 0.4 and 0.4 × 0.4 mm2) of Ti and Ni Schottky diodes on n-type 6H–SiC epitaxial layers were fabricated. A "Semiconductor Parameter Analyzer" model HP4145B was utilized in order to obtain accurate readings of the electrical current. Each SMU is capable of being configured to generate an electrical potential ranging from 0V to ± 50 V The reverse bias I-V characteristics are investigated at different temperatures for an extensive analysis. To achieve an understanding of the common transport mechanisms (thermoionic current; tunneling current,...) in the study diodes, we compare the measured I-V characteristics with theoretical ones through the Matlab environment. Upon examining the I -V -T readings, from Ti and Ni/6H SiC(n) Schottky diodes with varying contact areas the study revealed that the size of the contact area greatly impacts the properties of these diodes. Whatever the type of diode, there is an increase in leakage current with temperature but this increase varies from one diode to another. For Ti/6H-SiC Schottky diode: The larger and medium-sized diodes exhibited near-ideal behavior, adhering to the thermionic emission current theory across varying temperatures. However, the smaller diode demonstrated abnormal interface inhomogeneities and deviated from ideality at lower temperatures, Thats shows the importance of contact area on the performance of the Schottky diodes. For Ni/6H-SiC Schottky diode: In large (very leaky) diodes, the increase in leakage current with temperature is continuous. Each time the size of the diode is reduced, the leakage current becomes more and more independent of temperature (the average and the small diode).

Impact of Quantum and Semi-Classical Descriptions on Charge Behavior in Al2O3/Si MIS Devices

Hlali slah (1), Hizem neila, Kalboussi adel

1 - University of Science of Monastir (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM2

In this work, quantum correction in the inversion layer charge density calculation was investigated. This study is carried out for one-dimensional Metal-Insulator-Semiconductor (MIS) structure with (100) oriented P-type silicon as substrate. The purpose of this paper is to point out the differences between the semi-classical and quantum-mechanical charge description at the interface Al2O3/Si, and identify some electronic properties of our MIS device using different thickness of the high-K oxide and diverse temperature with both Fermi-Dirac statics and Boltzmann statics. In particular, capacitance voltage (C-V) and Sheet electron density are performed to examine qualitatively and quantitatively the electron states and charging mechanisms in our device.

A theoretical study of the electronic structure and spectroscopic properties of the ground and low-lying electronic states of the SiLi+ molecular ion

Nawres abbasi (1), Jamila dhiflaoui , Hamid berriche

1 - Laboratory of Interfaces and Advanced Materials LR11ES55 (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM3

Ab-initio multireference configuration interaction (MRCI) calculations [1], using aug-pV5z [2] optimized basis sets for both Si and Li atoms, have been performed on the SiLi+ molecular ion. These calculations encompass the ground state and various highly excited electronic states, including those of 1,3Σ, 1,3Π and 1Δ symmetries. Potential energy curves of the ground and low-lying excited states have been obtained as well as the corresponding spectroscopic constants. Permanent and Transition dipole moments have also been computed. The vibrational energy level spacing ()for the ground states, as well as those of their excited states, have been determined using the Numerov algorithm [3]. We remark that the (11Σ+) state system presents more vibrational levels than other state, which can be explained by the difference in the well depths.

Laser-Printed Metal-Organic Framework Electrodes for High-Performance Microsupercapacitors

Toumia hiba (1), Yu Kyoung ryu (2), Martinez javier (2), Haj Said ayoub (3)

1 - Laboratoire des Interfaces et des Matériaux Avancés (Tunisia), 2 - Instituto de sistemas optoelectronicos y microtecnologia, Universidad Politécnica de Madrid (Spain), 3 - Research Center for Microelectronics and Nanotechnologies Technopole (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM4

Laser-induced graphene (LIG) functionalized with copper-based metal-organic frameworks (Cu-MOFs) offers a promising platform for flexible electronic devices [1]. This study presents a facile one-step synthesis method that combines laser photothermal processing with drop-casting deposition [2]. Characterization studies confirm the successful integration of Cu-MOF crystals on the surface LIG. Cu-MOF-LIG electrodes demonstrate exceptional electrochemical performances for supercapacitor applications. Compared to LIG-only electrodes, Cu-MOF-LIG electrodes exhibit a significant increase in specific capacitance, energy density, and cycling stability, making them ideal candidates for high-performance flexible energy storage devices

---

Non-Covalent Interactions in Fullerene-Based Adsorption: A Study Using RDG and NCI

Bejaoui mohamed (1), Nakbi hayfa , Jamila dhiflaoui, Ghanmi chedli, Hamid berriche

1 - Laboratoire des Interfaces et Matériaux Avancés [Monastir] (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM5

In this study, density functional theory (DFT) is employed to explore the structural, electronic, and adsorption properties of graphene functionalized with LiF and fluorine atoms. The geometric stability of pristine and functionalized graphene is analyzed by examining the optimized configurations and adsorption energies. The study focuses on the adsorption behavior of lithium fluoride (LiF) and fluorine atoms on a graphene surface, as well as their effects on the electronic properties and charge distribution. Additionally, the potential application of LiF-functionalized graphene for hydrogen (H$_{2}$) storage is evaluated. Total and partial density of states (DOS) calculations reveal significant modifications in the electronic structure, suggesting a strong interaction between graphene and the adsorbed species. The charge transfer mechanisms and their impact on the overall conductivity of graphene are also discussed. These findings provide insights into the potential of functionalized graphene for energy storage and related applications.

Chitosan-derived biosourced material with fluorescent side chain for metal cation detection

Essid meriam (1), Hassine khaoula (1), Hriz khaled (1), Majdoub mustapha (1)

1 - Faculty of Sciences of Monastir (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM6

The use of biomaterials offers significant ecological benefits, promoting a more sustainable approach across various fields. These materials are characterized by their unique properties, which provide distinct advantages such as flexibility, adsorption capacity, biodegradability, biocompatibility, and biological activity. Biosourced materials are used to develop highly sensitive and selective sensors, with potential applications in environmental monitoring (metal pollutant detection) and medical diagnostics (monitoring metal ion levels in biological systems). In this context, our contribution focuses on the design and development of a novel fluorescent biobased material for the detection of metal cations. We aim to incorporate a complexing heterocycle through click chemistry, along with aromatic fluorescent groups in the side chain. The obtained polymer (Cs-Tri-An) exhibits good solubility in DMSO and THF and shows high thermal stability (up to 280°C). Optical studies in dilute solution reveal that Cs-Tri-An is a fluorescent bioorganic semiconductor with blue emission. Cs-Tri-An was then used as a fluorescent sensor for diverse metal cations, demonstrating good sensitivity and selectivity.

Advanced Electrode Materials for Supercapacitors: A Study of CNTs and ZIF-8 Derived Porous Carbon.

Bellali saher (1), Kahri hamza (1), Gross andrew J. (2), Barhoumi houcine (1)

1 - Laboratory of Interfaces and Advanced Materials, Faculty of Sciences, University of Monastir, 5019 Monastir, Tunisia. (Tunisia), 2 - Département de Chimie Moléculaire (DCM), Univ. Grenoble Alpes-CNRS, 570 Rue de La Chimie, 38041 Grenoble, France.Univ. Grenoble Alpes (France)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM7

In this study, we primarily tested several electrode materials, including commercial carbon nanotubes (CNTs), Zeolitic Imidazolate Framework-8 (ZIF-8), and its derived porous carbon (PC), with 5% polyvinylidene fluoride (PVDF) added as a binder. To enhance the properties of each material, we conducted an electrochemical study. Initially, we assessed the electrochemical behaviour in a reversible system using a ferry-ferrocyanide solution (5 mM) in 0.1M $LiNO_3$. The results from cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) indicated that both CNTs and porous carbon exhibited favourable electrochemical properties, characterized by high peak currents in redox reactions, a large active surface area, and excellent conductivity. Subsequently, we investigated the performance of the materials in a neutral aqueous electrolyte (5M $LiNO_3$), finding that porous carbon demonstrated higher specific capacitance with a rectangular shape in cyclic voltammetry tests compared to CNTs and ZIF-8. Furthermore, galvanostatic charge-discharge (GCD) analysis revealed a linear charge-discharge curve, indicating that porous carbon can function effectively as an electric double-layer capacitor (EDLC) electrode material. Notably, it exhibited excellent cyclic stability, retaining 91.48% of its capacitance after 2000 cycles. Overall, the electrochemical measurements suggest that porous carbon is a promising electrode material for electrochemical energy storage applications.

Anodic synthesis of semiconducting oligomer deriving from m-fluoroanisole

Bergaoui souad (1), Haj Said ayoub (2)

1 - Faculté des Sciences de Monastir (Tunisia), 2 - Research Center for Microelectronics and Nanotechnologies Technopole (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM8

The electrochemical behavior of m-fluoroanisole (m-FA) is examined by cyclic voltammetry and preparative electrolysis in acetonitrile on a platinum electrode. The voltammetric study indicates the formation of a compact and homogeneous film on the anode during successive scans of the potential. The preparative application at high concentration gives access to the synthesis of two oligomers: one soluble and the other insoluble in all common solvents. Their chemical structures are characterized by FTIR, NMR and UV. A thermal study of these new materials showed that the oligomer was stable up to 252°C.

Biosynthesis optimization and characterization of silver nanoparticles prepared using aqueous extract of solo garlic from the region of Zelfi in Saudi Arabia and their catalytic activity in the degradation of crystal violet

Hadj Lajimi ramzi (1, 2), Alanazi fahad (1), Alshammari odeh (1)

1 - Department of Chemistry, College of Science, University of Ha'il, P.O. Box 2440, Ha'il 2440 (Saudi Arabia), 2-Laboratory of Water, Membranes and Environmental Biotechnologies, Center of Research and Water Technologies,

P. B 273, Soliman 8020, Tunisia

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM9

Biosynthesized silver nanoparticles have been widely used for their potential as antibacterial agents and for their catalytic activities as well for the degradation of toxic dyes. Using aqueous plant extracts as reducing and capping agents makes the synthesis process ecofriendly and costless as compared to chemical methods. In this study, we synthesized silver nanoparticles (SGZ-AgNPs) using the aqueous extract of solo garlic growing in the region of Zelfi in Saudi Arabia. The phytochemical composition of the dried aqueous extract (DAE-SGZ) was screened using HR-LCMS. The synthesis of SGZ-AgNPs was optimized by changing the concentration of DAE-SGZ, the reaction time and temperature while keeping the concentration of Ag+ constant (1 mM). The kinetic study of SGZ-AgNPs formation was followed by UV-Vis spectroscopy from 0.5 h to 72 h reaction time at 80 °C. The concentration of DAE-SGZ was changed from 0.0075% to 0.2000% (w/w). The presence of surface plasmon resonance (SPR) peak, within the range 400-450 nm, confirmed the formation of SGZ-AgNPs for all concentrations at 80 °C. SGZ-AgNPs prepared with a DAE-SGZ concentration of 0.2000% (w/w), 1 mM Ag+, 80 °C and 48 h reaction time gave the highest yield, smallest size and narrowest size distribution. Under these conditions, reducing the temperature to 60 °C and 40 °C gave fewer SGZ-AgNPs with larger size. The prepared SGZ-AgNPs under optimal conditions (SGZ-DAE 0.2000% (w/w), 1 mM Ag+, 80 °C and 48 h reaction time) were characterized and tested for the degradation of crystal violet (CV). SGZ-AgNPs have an average size, r (nm) = 10.062 ± 2.787 as determined by TEM and r (nm) = 88.7 ± 66.8 as determined by DLS. They have a crystalline structure as confirmed by PXRD, formed by 65 % of cubic Ag and 35% of Ag4.00Cl4.00 (Chlorargyrite). The thermogravimetric analysis showed that SGZ-AgNPs were stable until 182 °C. Moreover, we evaluated the catalytic activity of the prepared SGZ-AgNPs for the degradation of CV with a concentration of 25 mg/L in the presence of sodium borohydride in the dark. Sodium borohydride degraded 100% of CV after 5 min reaction time when the ratio of [NaBH4]:[CV] was 6.12. Adding 1 mL from the SGZ-AgNPs reaction mixture reduced the time needed to decompose all CV to less than 2 min in the dark. Adding more SGZ-AgNPs reduced the degradation percentage and increased the time needed to reach equilibrium. These results suggested that keeping the ratio of [NaBH4]:[CV] ≥ 6.12 and the ratio of [NaBH4]:[SGZ-AgNPs] ≥ 30 will degrade 100% of CV (25 mg/L) in less than 2 min and adding more SGZ-AgNPs will favor the adsorption of CV on SGZ-AgNPs.

Comparative electrochemical study based on two different natural polysaccharides for the detection of L-Tryptophan

Sondes Bourigua[a*], Feriel Boussema[a], , Houcine Barhoumi[a], Hatem Majdoub[a,] Nicole Jaffrezic-Renault[b]

[a]Laboratory of Advanced Materials and Interfaces, Faculty of Sciences, University of Monastir, Monastir, Tunisia

[b]Institute of Analytical Sciences, University of Lyon, Villeurbanne, France

---

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM10

Thanks to their proprieties, natural polysaccharides open a new way to the fabrication of sensors, in this context, two glassy carbon electrodes modified with two different natural polysaccharides: anionic cellulose nanofibers (NFC^-) and pectin were developed for the L-Tryptophan detection. The characterization of the two modified electrodes was performed by cyclic voltammetry (CV) and was subsequently verified by differential pulse voltammetry (DPV) in the presence of $Fe(CN)_6^{-3/-4}$ as a redox probe. The two modified electrodes were used for the detection of L-tryptophan by cyclic voltammetry and by differential pulse voltammetry in a phosphate buffer solution (pH = 7). The sensitivity of the NFC^- modified electrode for the detection of tryptophan was higher than the sensitivity of the pectin modified electrode but a low limit of detection was obtained for the pectin modified electrode. Also the studied sensors exhibited high selectivity, stability and reproducibility.

Keywords: modified electrode, cellulose nanofibers, pectin, electrochemical detection, L-tryptophan

---

III-V-Bi semiconductor materials for mid-infrared detection

Ammar ikram (1), Sfina noureddine

1 - LMCN (Tunisia)

Date: November 15th, 2024 **Time:** 12:15:00 PM **Room:** B **Ref:** PM11

We have investigated electrical and optical characteristics of InxGa1−x As1−y Biy/InxGa1−x As heterostructure, grown on conventional (001) InP substrate, dedicated for the optimization of a short wave infrared p-i-n detector. The incorporation of 6 % dilute bismide reduce the band gap of about 305 mev. The determination of the energies has shown us that there is a red shift from about 2.2 to 2.8 µm at room temperature. In order to investigate dark current contributing mechanisms, we have studied the temperature dependence of zero-bias resistance area product (R0A) and the bias dependent dynamic resistance. As a result, we have found an encouraging dark current of 1.25x10-8 A at bias voltage of -10mV at 300 K. These results derived from this investigation will be useful for the design of a short wave infrared photodetector.

Relativistic ab initio investigation on the spectroscopic and radiative properties of the low lying electronic states of LiTe and LiTe+ molecules

Azza Ammar(1), Wissem Zrafi(1), Hela Ladjimi (1), Mohamed Bejaoui(1), Jamila Dhiflaoui and Hamid Berriche(1, 2)

1Interfaces and Advanced Materials Laboratory, Physics Department, Faculty of Science, University of Monastir, Avenue de l'environement 5019 Monastir, Tunisia

2Department of Mathematics and Natural Sciences, School of Arts and Sciences, American University of Ras Al Khaimah, Ras Al Khaymah, P.O. Box, RAK, United Arab Emirates

Date: November 15th, 2025 **Time:** 4:30:00 PM **Room:** hall **Ref:** PM12

Exploring the properties of LiTe and LiTe+ could pave the way for advancements in energy storage, environmental remediation, chemical synthesis, making them promising candidates for developing novel technologies [1-3]. Thus, we present an ab initio investigation of LiTe and LiTe+ neutral and ionic molecules. The potential energy curves of the ground and low-lying excited states of LiTe and LiTe+ are calculated at the MRCI+Q level of theory associated with the aug-cc-pV5Z and ECP-46-MWB basis sets for Li and Te, respectively. Several properties such as the equilibrium distances, dissociation energies, harmonic and anharmonic frequencies, rotational constants, permanent and transition dipole moments, vibrational energies. The spin orbite coupling is also included for the LiTe system. Its effect is significant on potential energy curves. Besides, Franck-Condon factors, and radiative lifetimes including bound-bound and bound-free transitions are predicted. The data obtained will be useful for further experimental and theoretical studies.

References:

[1] da Silva, R. S., and Ballester, M. Y. (2021). Chemical Physics, 545, 111123.

[2] Zeid, I., El-Kork, N., Farjallah, M., Ladjimi, H., Berriche, H., and Korek, M. (2021). Electronic Structures and Transition Properties of BeSe and BeTe Molecules. ACS omega, 6(45), 30335-30343.

[3] Mehnen, B., Akkari, S., Zrafi, W., Jendoubi, I., Bejaoui, M., Bulut, N., Berriche, H., and Hochlaf, M. (2024)

Effects of Probiotic, Prebiotic, and Synbiotic Supplementation on the Growth and Health of Broiler Chickens

Arhlam khaoula (1), Boukaiss mariem (2), El Aayadi soufiane (3), Majid mounir (1)

1 - Biotechnology and Biotransformations Laboratory, Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, Morocco (Morocco), 2 - Department of biology, Ibn Tofail University, Kenitra,Morocco (Morocco), 3 - 3- Department of Animal Production and Biotechnologies, Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, Morocco (Morocco)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PAg1

L'augmentation de la consommation de poulet, stimulée par son prix abordable et son accessibilité, a conduit à l'utilisation généralisée d'antibiotiques comme stimulateurs de croissance. Cependant, cette pratique a fait l'objet de nombreuses critiques en raison des inquiétudes concernant la résistance aux antibiotiques chez l'homme et la présence de résidus chimiques dans la viande et les déchets. En réponse à ces inquiétudes, les scientifiques ont étudié des additifs alimentaires alternatifs comme les pro-prébiotiques, les enzymes et les acides organiques. Nos recherches se concentrent sur l'évaluation de trois traitements pour leur impact sur les performances de croissance des poulets de chair Ross. Ces traitements comprennent l'administration de Bacillus subtilis comme probiotique, de FOS comme prébiotique ou d'un synbiotique combiné par l'intermédiaire de l'eau d'alimentation. Nous avons surveillé de près la consommation alimentaire quotidienne et hebdomadaire (FI), le gain de poids corporel et les taux de mortalité tout au long de l'étude. Au cours de l'essai, le poids moyen des poulets est passé de 50 g à 2 500 g. Notamment, le groupe recevant le traitement probiotique présentait le taux de conversion alimentaire (FCR) le plus bas, en particulier à partir du 29e jour. De plus, les analyses post-mortem ont révélé que le traitement probiotique était associé à une incidence et une gravité réduites des lésions intestinales macroscopiques. Il est remarquable de constater que les groupes probiotiques et synbiotiques ont affiché un taux de mortalité de 0 % tout au long de l'étude. Ces résultats suggèrent que la supplémentation alimentaire en Bacillus subtilis, seule ou en association avec des FOS, est prometteuse en tant qu'alternative viable aux antibiotiques pour favoriser les performances de croissance et maintenir la santé intestinale des poulets de chair.

Sensors and Application in Health

Development of a novel and cost-effective electrochemical sensing platform based on polyamine functionalized calix [4] arene for the determination of oxytetracycline

Rouis ahlem (1), Mliki haifa (1), Echabaane mosaab (2), Ceron laura (3), Perol nathalie (3), Darbost ulrich (4), Bonnamour isabelle (4), Bessueille francois (5), Ayed dhekra (5), Jaffrezic Renault nicole (5)

1 - Laboratory of advanced Materials and interfaces (LIMA), Faculty of Sciences of Monastir, University of Monastir , Tunisia (Tunisia), 2 - CRMN, Centre for Research on Microelectronics and Nanotechnology of Sousse, NANOMISENE, LR16CRMN01, 4034 Sousse, Tunisia (Tunisia), 3 - Université Claude Bernard Lyon 1 (France), 4 - Université Claude Bernard Lyon 1 (France), 5 - University of Lyon, (France)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH1

Oxytetracycline (OTC) is one of the most common tetracycline antibiotics. It has a good antibacterial effect and can be used in many fields, such as preventive and therapeutic agents in animal husbandry and aquaculture. However, the indiscriminate use of OTC in food-producing animals leaves residues in animal products. The presence of these residues in animal products causes economic losses and harmful effects on consumers, which will seriously impact human health. Therefore, developing a simple, fast, sensitive, and low-cost detection technology to detect OTC in the environment is necessary, and electrochemical sensors have these advantages. This study used a new polyamine functionalized calix [4] arene (EDCA [4]) to modify indium thin oxide (ITO) electrodes to fabricate high sensitivity electrochemical sensors. EDCA [4] membrane was successfully prepared using a simple drop-cost method. In order to evaluate its performance, static contact angle measurement (CA), cyclic voltammetry measurement (CV), electrochemical impedance spectroscopy (SIE), and microscopic surface imaging (SEM) analysis were performed. The results showed that the developed ITO/EDCA [4] electrochemical sensor had excellent performance for OTC detection. It exhibited a wide linear concentration range of 10− 10 M to 10− 5 M and a lower detection limit of 2.3 10− 11 M. Also, the proposed sensor demonstrated great selectivity and reproducibility. The sensor proposed in this study shows several advantages, including the simplicity and low cost of electrode preparation, and this method provides a new route to fabricate electrochemical sensing platform for OTC detection in milk samples.

A novel acoustic features based on fuzzy description for Speech Emotion Recognition

Snani cherifa (1), Ramdani messouad (1), Zermi narima (1), Abderrahmanesihem sihem (2)

1 - Laboratory of Automatic Control and Signals –Annaba (LASA) , Faculty of Engineering, Badji Mokhtar -Annaba University. PO. Box. 12, 23000 Annaba, Algeria. (Algeria), 2 - Laboratory of LIS –Annaba , Faculty of Science, Badji Mokhtar -Annaba University. PO. Box. 12, 23000 Annaba, Algeria. (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH2

The automatic Speech Emotion Recognition (SER) has attracted a high interest in multidisciplinary research communities such as computer science and speech processing over the last few decades. The main objective of this active area of research is to improve human-computer interaction (HCI) and make it more reliable, efficient, and adaptable to the speaker's emotions. Although a lot of research on the SER has been devoted to the extraction of relevant acoustic features and the design of robust classifiers from suitable emotional databases, the challenge of optimizing recognition accuracy has not yet been achieved and is the subject of further research. In this study, we propose a novel method called Fuzzy MFCC for extracting acoustic features based on the fuzzy description where the membership function was used instead of the Mel filter bank in the conventional Mel frequency cepstral coefficient (MFCC). Seven discrete emotional states were used from the Berlin Emotional Database (EMO-DB) and were trained and classified using Gaussian Mixture Model (GMM) technique. In order to evaluate these features and to find the best combination to improve the accuracy rate, we were tested three types of parametres: MFCC, Fuzzy MFCC and Fuzzy MFCC combined with prosodic parameters. To present the diagnostic results for various feature extraction techniques and GMM models on the dataset, we used the 4-fold cross-validation approach. Experimental results indicate that use of the novel features improved the performance of system. The highest classification accuracy for MFCC, Fuzzy MFCC and Fuzzy MFCC combined with prosodic parameters is 81.26%, 87.42%, and 89.62%, respectively.

Effect of temperature and doping on charge transport mechanisms for polytype-SiC based Schottky diodes.

Mekaret fayssal (1), Bounab elhachani (1), Bekadour abdelrahmane (1)

1 Université Djillali Liabès [Sidi Bel Abbès, Algérie] = Djillali Liabes University [Sidi Bel Abbès, Algeria] (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH3

Silicon carbide is a promising semiconductor material for harsh environment sensing applications thanks to its superior material properties compared with silicon and other semiconductor materials. The wide bandgap, high thermal conductivity, and high breakdown field allow SiC based devices to work under extreme conditions, therefore many researchers have studied the properties of SiC Schottky rectifiers on 3C–SiC, then on 6H–SiC , and more recently on 4H–SiC . In this work an analytical simulation was conducted using MATLAB to investigate the behavior of semiconductors, specifically focusing on conduction mechanisms and the formation of the Schottky barrier. The charge transport mechanism in a Schottky contact consists of four models: thermionic emission, diffusion, tunneling, and generation-recombination, however, due to the low intrinsic concentration of the three SiC prototypes, the generation-recombination current is neglected for the Schottky diodes based on the three SiC prototypes. Also, considering the relatively low mobility of the three SiC prototypes, the diffusion current is neglected too, therefore only the thermionic and tunneling current will be taken into consideration.

A straightforward gold nanoparticle-based electrochemical sensor for the detection of ascorbic acid and novel molecule 1,3-di(4-bromophényl)-5-tert-butyl-1,3,5- triazinane gold nanoparticle-based ascorbic acid detecting sensor

Mecheri nacira (1)

1 - Laboratoire de capteurs, instrumentation et processus (CLIP), Institut des sciences et technologies, Université de Khenchela (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH4

1,3-di(4-bromophényl)-5-tert-butyl-1,3,5-triazinane (1, 3-di (4-Brph)-5-t-Bu-1, 3, 5-TAC) is produced via the condensation of a tert-butylamine and a 4-bromoaniline with formalin in basic solution. The structures of this molecule have been clarified by spectroscopic techniques, including IR, 1H NMR, and 13C NMR. Herein, we report a label-free electrochemical non-enzymatic sensor for Ascorbic Acid detection in water. For this, a nanocomposite combining the advantages of gold nanoparticles (AuNPs), 1, 3-di (4-Brph)-5-t-Bu-1, 3, 5-TAC was constructed and used for AA detection. First, the glassy carbon electrode was changed by 1, 3-di (4-Brph)-5-t-Bu-1, 3, 5-TAC was created using twenty cycles of a 10-1 M 1, 3-di (4-Brph)-5-t-Bu-1, 3, 5-TAC aqueous solution, and cyclic voltammetry in the potential range of (1 to 1.4 V).as supporting electrolyte. Then, AuNPs were deposited on 1, 3-di (4-Brph)-5-t-Bu-1, 3, 5-TAC /GCE using chrono-amperometry. Finally, This study established the immobilization of the modified 1, 3-di (4-Brph)-5-t-Bu-1, 3,5-TAC/AuNPs/GCE/AA. The different synthesis steps of the 1, 3-di (4-Brph)-5-t-Bu-1, 3, 5-TAC / AuNPs /GCE/AA were characterized by cyclic voltammetry. Ascorbic Acid in buffer solution is detected by square wave voltammetry (SWV) in the absence and presence of (6 uL) gold nano-particles (Au-NPs). The current peak obtained at the 1, 3-di (4-Brph)-5-t-Bu-TAC/AuNPs/AA/GCE With a detection limit of 10−5 M, the electrode was proportional to the logarithm of the AA concentration in the range of 5 ×10−3 M to 1 ×10−1 with very good correlation parameters. It was also found that this sensor exhibited reproducibility and excellent selectivity against molecules with Acid urique, Acid aspartic, and Glucose. The proposed sensor was utilized for the recognition of AA in orange, palatable outcomes were acquired.

The development of Schiff base optodes for detecting dopamine

Ben Khalifa maryem (1), Besbes fatma , Hassouna chaima, Ben Chaabane rafik, Allouche abdul-Rahman, Baouab mohamed Hassen V, Mlika rym

1 - Laboratoire des Interfaces et des Matériaux Avancés (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH5

Dopamine, a well-known catecholamine, functions as a neurotransmitter in the brain and nervous system. It plays a crucial role in various biological processes related to emotions and perception. Abnormal dopamine levels in biological fluids are directly associated with several diseases, including schizophrenia, anorexia, and Parkinson's disease. Although these diseases cannot be completely cured, early detection through medication can significantly improve prognosis and manage aftereffects. Therefore, it is highly desirable to develop highly sensitive and selective optical sensors to measure dopamine levels for early disease detection and patient monitoring. In this study, we focus on developing new optodes based on Schiff base for dopamine detection.

Investigation of Saharan dust influence on PM10 concentration in Tunisia

Bouchlaghem karim (1), Gazzah mohamed Hichem (2)

1 - Karim Bouchlaghem (Tunisia), 2 - Mohamed Hichem Gazzah (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH6

Our main concern through this research is the extent of the contribution of desert dust on PM10 concentration, depending on two different methods in the Tunisian region called Gabes during a desert dust period. To make sure of the desert dust phenomenon we used the surface concentration measurements. Using calculation equations, this study stresses the importance of the Saharan dust component of the total PM10 concentration measured at an industrial traffic monitoring station. The anthropogenic, re-suspension, and Saharan dust contributions were assessed for such events. The Saharan component is estimated to daily PM10 concentration reaching up to 88%. The anthropogenic component has been found to represent up to 12% during dust days. In spite of the subtraction of the Saharan dust contribution, the daily anthropogenic PM10 concentration remained high in the considered region compared to the limit values. This study shows a frequent exceedance of the average daily value of the PM10 concentration during Saharan dust outbreaks. For instance, a value of 705µg/m3 is measured in Gabes. This average value is reduced to 160µg/m3 after subtracting the contribution of Saharan dust. The African dust inputs are, in fact, the main source of natural atmospheric events at Tunisian sites. These results can be used to support source apportionment studies in the Mediterranean regions that are significantly affected by natural aerosol contribution, including the influence of African dust outbreaks. The finding of this study can play a major role in improving air quality monitoring in Tunisia and provide information about the contribution of Saharan dust to PM10 levels in the Mediterranean regions, which is a key issue for air quality assessment and health.

Green Synthesis of Silver Nanoparticles Using Thymelaea Hirsuta Extract: Characterization and Antifungal activity

Belhadj Mbarek Mkacher najoua (1)

1 - NANOMISENE RD Laboratory [Sousse] (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH7

Rihem HAMMOUDA1 , Najoua BELHADJ MBAREK MKACHER 1,2, Fatma BELKHIRIA1, Nader SEBAI3, Ridha TOUATI1,2, Chérif DRIDI1 1 NANOMISENE Laboratory, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology (CRMN), Sousse Technopole, B.P. 334, 4054 Sahloul Sousse, Tunisia 2 University of Sousse, High School of Sciences and Technology of Hammam Sousse, Rue Lamine Abbassi, 4011 hammam sousse, Tunisia 3 Mahdia Hospital Tahar Sfar, 5100 Madia, Tunisia Green synthesis of nanoparticles has many advantages compared to chemical and physical methods: it is non-toxic, pollution-free, environmentally friendly, economical, and more sustainable. In this work, we report the green synthesis for Ag NPs by mixing of silver nitrate solution with reducing substances extracted from Thymelaea Hirsuta growing wild in the center of Tunisia. The energy required for this extraction and synthesis was supplied by microwave radiation. This green synthesis method characterized by its simplicity, speed and environmental friendliness. We have optimized the experimental conditions for the synthesis. The influence of the concentration of the metallic precursor solution and of the aqueous extract was studied. The reaction time was optimized. We also varied the heating methods of the solution, using both classical reflux heating and microwave heating, which is a very rapid and energy-efficient synthesis method. The synthesized silver nanoparticles were characterized by UV-visible Spectroscopy, Fourier transform infrared FTIR spectroscopy, Scanning electron microscopy, energy-dispersive X-ray spectroscopy and zeta potential analysis. These analysis confirmed the formation of nanoparticles with good stability. The ultraviolet-visible spectroscopy exhibited a single peak related to the surface plasmon resonance absorbance of AgNPs at 418 nm. The AgNPs with high stability (a zeta potential of −22,5 mV) and hydrodynamic size distribution of about 40 nm were obtained through a 2 min process. The obtained nanoparticles and the aqueous extract of Thymelaea Hirsuta leaves was evaluated for their antifungal properties the results showed high activity against Candida spp. and could represent an alternative for fungal infection treatment.

Microwave-assisted green synthesis of silver nanoparticles using extract of Rhus Tripartita leafs growing wild in Tunisia

Belhadj Mbarek Mkacher najoua (1)

1 - NANOMISENE RD Laboratory [Sousse] (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH8

Rihem EL GHOUL1 ,Najoua BELHADJ MBAREK MKACHER 1,2, Fatma BELKHIRIA1, Nader SEBAI3, Ridha TOUATI1,2, Chérif DRIDI1 1 NANOMISENE Laboratory, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology (CRMN), Sousse Technopole, B.P. 334, 4054 Sahloul Sousse, Tunisia 2 University of Sousse, High School of Sciences and Technology of Hammam Sousse, Rue Lamine Abbassi, 4011 hammam sousse, Tunisia 3 Mahdia Hospital Tahar Sfar, 5100 Madia, Tunisia A cost-effective and eco-friendly method for synthesizing silver nanoparticles using Rhus Tripartita leafs mediated by microwave-assisted extraction is presented. Rhus tripartita is a shrub species of the botanical family of Anacardiaceae. This species is distributed in Tunisia from south to north. Therefore, many studies reported the bio-activity potential of the shrub against a wide range of microorganisms [1]. The uses of biosynthesized AgNPs in different fields, including antifungal, antibacterial, antiviral, and agronomic are booming [2]. This study describes the practical green synthesis of silver nanoparticles (AgNPs) through the reduction of silver nitrate solution using the aqueous extract of Rhus tripartita leaves as a reducing and stabilizing agent. The energy required for this synthesis was supplied by microwave radiation. Short reaction periods and higher efficiency to produce pure NPs are significant factors to be considered while choosing a method to synthesize NPs. We studied the effects of several parameters on the synthesis of silver nanoparticles. The obtained nanoparticles were characterized by different techniques, including UV-Visible spectroscopy, Fourier transform infrared FTIR spectroscopy, scanning electron microscopy, energy dispersive X-ray spectroscopy and zeta potential. These analyzes confirmed the formation of nanoparticles with good stability.In fact, the AgNPs with high stability (a zeta potential of –22,4mV) and hydrodynamic size distribution of 31 nm were obtained through a 2 min process. This research offers a promising avenue for the eco-friendly and cost-effective green synthesis of silver nanoparticles using the microwave-assisted method, with significant potential in various applications. We have tested their antifungal activities. The silver nanoparticles and the aqueous extract of of Rhus Tripartita leafs possess high antifungal activity against candida. References: 1. [a] H. Ben Miled, M . Saadaa , I. Jallalia , Z. Ben Barkab , M. Tlilib , H. Alimib , M. Saklyb , K. Ben Rhoumab , M. Abderrabbac , H. Abdelmelekb , O. Tebourbib , R. Ksouria , “Variability of antioxidant and biological activities of Rhus tripartitum related to phenolic compounds”, EXCLI Journal , 16, 439-447, 2017 [b] K. Benlembarek, T. Lograda, M. Ramdani, G. Figueredo, P. Chalard, “Chemical composition and antibacterial activities of Rhus tripartita essential oils from Algeria”, BIODIVERSITY , 22, 480-490 , Number 1, January 2021 [c] K. Benlembarek, T. Lograda, M. Ramdani, G. Figueredo, P. Chalard, “Chemical composition and antibacterial activities of Rhus tripartita essential oils from Algeria”, Biodiversitas, 22(1) : 480-490, 2021. 2. A. Dhaka , S. C. Mali , S. Sharma , R. Trivedi, A review on biological synthesis of silver nanoparticles and their potential applications Results in Chemistry 6 (2023) 101108

Colorimetric Sensors based on Nano-materials for Chemical and Medical Sensing Applications

Touati amina (1)

1 - University of Abbes Laghrour, Khenchela (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH9

Ascorbic acid, commonly known as vitamin C, is an essential nutrient that plays a crucial role in various biological functions within the human body. In this study, we developed a new sensor utilizing nanoparticles for ascorbic acid detection. Our objective was to characterize the chemical interaction mechanism between ascorbic acid and gold nanoparticles using UV-visible spectroscopy, with measurements in the wavelength range of 300 to 800 nm. After treating the samples for 5 minutes at room temperature, we observed a color change from colorless to yellow, accompanied by a strong absorption peak near 420 nm. We found a significant correlation between the absorbance at 420 nm and the concentration of ascorbic acid, establishing a spectrophotometric method capable of sensing ascorbic acid concentrations ranging from 0 to 200 µM. These findings suggest that this nanosensor provides an effective solution for monitoring ascorbic acid in environmental and medical applications..

Innovative Biopolymer-Based Dressings for Wound Healing

Jrad fatouma (1), Mzoughi zeineb (1), Dems lobna (1), Le Cerf didier (2), Majdoub hatem (1)

1 - University of Monastir, Laboratory of Interfaces and Advanced Materials, Faculty of Sciences of Monastir, Monastir 5000, Tunisia (Tunisia), 2 - Normandie Univ, UNIROUEN, INSA Rouen, CNRS, PBS, UMR 6270 & FR 3038, 76000 Rouen, France (France)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH10

Diabetes is one of the most prevalent chronic diseases worldwide, with high mortality and severe complications such as diabetic foot ulcers (DFUs). Affecting approximately 15% of diabetic patients globally, DFUs are notorious for their delayed wound healing due to infection, inflammatory imbalances, lack of extracellular matrix (ECM), and poor angiogenesis. Addressing these challenges, nanofibers produced by electrospinning offer significant promise for DFU treatment. These fibers provide high porosity, efficient moisture absorption, and superior oxygen exchange rates, all essential for enhancing wound healing processes. Polysaccharides, particularly bioactive natural polymers, have garnered attention for their biocompatibility and role in tissue regeneration. Various polysaccharides such as alginate, cellulose, chitin, and chitosan are well documented for their wound healing properties. Pectin, a polysaccharide with angiogenic and epithelialization- enhancing properties, also plays a critical role in wound healing. However, pectin's mechanical limitations, such as poor durability and insufficient antimicrobial properties, necessitate further modification to meet the complex demands of DFU treatment. To overcome these limitations, this study integrates pectin with prickly pear seed oil (PPSO), which promotes wound healing. Rich in essential fatty acids, PPSO helps reduce inflammation and stimulate critical factors like angiogenesis and epithelialization, making it an ideal candidate for diabetic wound healing. In this work, nanofibers were fabricated using electrospinning, incorporating pectin and bioactive oils. The composite material was characterized using FT-IR, GC-MS, NMR (1D and 2D), and SEC techniques, followed by in vitro and in vivo testing to evaluate its wound healing potential for DFU treatment. As a future perspective, the development of biosensors will also be explored to monitor and further optimize the healing process.

The Compelementary Role of Mathematical Modelling to Disease Management and Control

Nampala hasifa (1)

1 - Kyambogo University (Uganda)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH11

Mathematical modelling has a long history dating back from the 1900 as being a supporting tool in the fight against emerging and persistent epidemics. Mathematical modelling has enabled decision makers to derive evidence-based policies in public health. Modelling can be applied to analyze key areas, including disease burden estimation, evaluating the potential impact of control interventions, cost effectiveness of various control strategies, as well as informing product development. The principles behind mathematical modelling from a simple basic model are highlighted, and how this basic tool has been advanced and employed to curb various disease both at population and immune levels is discussed.

Electrchemical sensor Based on IRON oxide modified SPCE for detection of oxytetracycline in human urine sample

Imliki haifa (1), Elkalla eslam (2), Khizar sumera (3), Echabaane mosaab (4), Rouis ahlem (5), Ayed dhekra (6), Bessueille françois (7), Elaissari abdelhamid (2), Jaffrezic-Renault nicole (2)

1 - Laboratory of Interfaces and Advanced Materials (LIMA) Faculty of Sciences of Monastir, University of Monastir (Tunisia), 2 - University of Lyon, Institute of Analytical Sciences, UMR-CNRS (France), 3 - Institute of Analytical Sciences, UMR-CNRS 5280 (France), 4 - NANOMISENE Lab, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology CRMN of Technopark of Sousse, Sahloul. 334, 4034 Sousse Tunisia (Tunisia), 5 - Laboratory of Interfaces and Advanced Materials (LIMA), Faculty of Sciences of Monastir (Tunisia), 6 - Institute of Analytical Sciences, UMR-CNRS (France), 7 - University of Lyon, Institute of Analytical Sciences, UMR-CNRS (France)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH12

Iron oxide nanoparticle have attracted a great deal of scientific attention due to their special properties, which can be used for the production of semiconductors innovative nanodevices. Therefore, in the current study, a synthetized Ferrofluid nanoparticles Fe 3 O 4 by a simple coprecipitation of a mixture of ferrous salts (FeCl 2) and iron salts (FeCl 3) was investigated in the electrochemical determination of oxytetracycline in human urine sample. Using a simple drop-casting method for preparing Fe 3 O 4 modified screen-printed carbon electrodes (SPCE) offers a convenient and resource-efficient approach for successful deposition. The prepared sensor can then be characterized using different techniques to

confirm the successful deposition and assess its structural and chemical properties. X-ray diffraction (XRD) confirm whether iron oxide has been successfully deposited on the electrode and provide information about the crystal structure and phase composition. Scanning electron microscopy (SEM) reveals the morphology size and distribution of the deposited material on the electrode surface which we can visually confirm the presence of iron oxide particles and evaluate the uniformity of the deposition. X-ray photoelectron spectroscopy (XPS) were was used to confirm the presence of iron and oxygen and assess any changes in the chemical environment compared to the starting materials. The electrochemical and electrocatalytic properties were recorded using square wave method (SWV), cyclic

voltammetry (CV) and electrochemical impedance spectroscopy (EIS). By optimizing parameters such as concentration of iron oxide deposited, scan rate, pH value, we achieve a wide linear concentration range from 10 -11 to 10 -2 mol/L, and a low detection limit (S/N = 3). The advantageous features of this electrode for OTC determination are its exceptional catalytic activity, selectivity and simplicity. In particular, our sensor shows excellent electrocatalytic activity in the determination of oxytetracycline traces in human urine samples.

Sensor-based Image Processing and Chemometric Tools for Rapid and Precise Saffron Origin identification

Digua khalid (1), Ouarda el Hani (1), Aziz amine (1)

1 - Laboratory of Process Engineering and Environment, Faculty of Sciences and Techniques, Hassan II University of Casablanca, Mohammedia (Morocco)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH13

Crocus sativus, commonly known as "Red Gold," is prized for its medicinal properties but is challenging to cultivate due to its labor-intensive harvesting and adulteration. Additionally, saffron's price can vary greatly depending on its geographic origin, making authenticity verification crucial. However, traditional methods for authenticating its origin are often sophisticated and costly, posing significant challenges, especially for small cooperatives, which are major distributors of this valuable spice. This study introduces a novel, cost-effective smartphone-based sensor approach to saffron provenance using digital imaging as an alternative method. Over 110 saffron samples from Morocco (Taroudant, Ouarzazate, and Azilal), Afghanistan, Iran, Spain, and Tunisia were analyzed. Smartphone-captured images were processed, and multiple color spaces were evaluated, including RGB (Red-Green-Blue), HSB (Hue-Saturation-Brightness), LAB (Lightness-Green to Red-Blue to Yellow), and Luminance and chrominance components using ImageJ software, generating 2712 variables per sample. The resulting data was analyzed using chemometric and machine learning techniques. Principal component analysis (PCA) showed good separation and distribution of samples, facilitating effective origin identification based on calculated image parameters. Hierarchical clustering analysis (HCA) accurately grouped most samples, while linear discriminant analysis (LDA) demonstrated an impressive classification accuracy of approximately 96%. Partial least square regression (PLS) further provided excellent calibration results for Safron's aroma, taste, and color, based on the image data. This innovative sensing approach offers a practical, efficient alternative for saffron origin authentication, particularly benefiting small producers and quality control laboratories.

Urea Molecularly Imprinted Polymer-ZIF-7 Sensor for Human Serum Samples analysis

Barhoumi houcine (1), Essoussi houda, Missaoui nadhem, Hamza Kahri hamza, Echouchene fraj, James Gross andrew

1 - Laboratory of Interfaces and Advanced Materials, Faculty of Sciences, University of Monastir, 5019 Monastir, Tunisia. (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PH14

A molecularly imprinted polymer (MIP) of Urea (Ur) followed by ZIF-7 layer was investigated by using the electropolymerization of pyrrole (Py) on glassy carbon electrode (GCE). The preparation of ZIF-7/MIP matrix and quantitative measurements were performed by cyclic voltammetry (CV) and differential pulse voltammetry (DPV), respectively. Various physiochemical parameters monitoring the analytical performances of the developed MIP structure such as Py and Ur concentration in prepolymerization mixture, number of cyclic voltammetric scans, pH of electrolyte solution and accumulation time. The optimization of parameters was achieved using Plackett–Burman Design and Central Composite Design. The calibration curve demonstrated linearity over urea concentration range from 1×10-7 M to 1×10-5 M with a correlation coefficient of 0.98. The detection limit of urea was about 7×10-8 M. The developed MIP sensor has been successfully applied to detect urea in human blood serum matrices with good recovery between 109% and 123%.

Sensors and Application in the Environment

Synergistic effect of two ecofriendly green inhibitors and potassium iodide on the corrosion of AISI 410 steel in 0.5M H2SO4

Boulmerka rihane (1), Abderrahmane sihem (1), Moussaoui kamilia (1), Youbi asma (1), Messast messast Sarah (1) (2), Abderrahim karima (1), Bouasla nabila (1) (3) (4), Athmani sameh (1) (5)

1 - Surface Engineering Laboratory (L.I.S); Department of chemistry; Faculty of Sciences, Badji Mokhtar -Annaba University.BP 12, 23000 Annaba, Algeria. (Algeria), 2 - Materials Physicochemical Laboratory, Sciences and Technology faculty, Department of Physics, Chadli Bendjedid University, 36000, ELTarf, Algeria. (Algeria), 3 - BOUASLA (Algeria), 4 - Sciences and Technology Faculty, department of Chemistry, Chadli Bendjedid University, 36000, ELTarf, Algeria (Algeria), 5 - Scientific and Technical Research Center in Physico-chemical Analysis. BP 384, Bou-ismail industrial zone. RP 42004.Tipaza, Algeria (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE1

The synergistic inhibitory effect of potassium iodide (KI), with plants (Grated Agave Americana (GAA) and Grated Opuntia Ficus Indica (OFI)), has been studied by stationary electrochemical techniques (polarization potentiodynamic (PPD)), transients (Electrochemical Impedance Spectroscopy (EIS)), and microscopic observations by SEM-EDX and AFM. It has been found that the inhibitory efficacy of KI alone increases with the increasing of it concentration. The maximum inhibitory efficiencies of KI at 10-4M, the synergies (10% (v/v) G.A.A + 10-4M KI) and (10% (v/v) O.F.I + 10-4M KI) are respectively 62.96%; 85.96% and 90.83%. The synergy of the three inhibitors (10% (v/v) G.A.A + 10% (v/v) O.F.I + 10-4M KI) increased the inhibitory efficacy to 98.36%. All the efficiencies were obtained after 2 hours of immersion at 25°C.The microscopic characterizations by SEM-EDX and AFM confirm the results obtained by the different methods used. In conclusion, the three synergies studied improve the resistance of AISI 410 stainless steels to corrosion in 0.5M H2SO4 at 25°C.

Synthesis, Experimental and theoretical studies of 2-amino-5,7-dimethyl-1,2,4-triazolo [1,5-a] pyrimidine as a corrosion inhibitor for Aluminum in 1M HCl

Kamilia moussaoui (1), Abderrahmane sihem (1), Cheraiet zinelaabidine (2) (3), Larkem hamama (1), Abderrahim karima (1), Messast sarah (1) (4), Dehmchi farouk1 (1)

1 - Surface Engineering Laboratory (L.I.S), department of chemistry; Faculty of Sciences; BADJI MOKHTAR -ANNABA University. (Algeria), 2 - Laboratory of Organic Materials and Heterochemistry. Echahid Larbi University Tebessa ALGERIA (Algeria), 3 - Laboratoire de synthèse organique modélisation et optimisation des procédés chimique université Badji Mokhtar Annaba ALGERIA (Algeria), 4 - Materials physicochemical laboratory; Sciences and Technology Faculty; CHADLI BEN DJDID University, B.P73, El Tarf 36000, Algeria (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE2

A novel substituted pyrimidine derivative (2-amino-5,7-dimethyl-1,2,4-triazolo [1,5-a] pyrimidine (ADTP)) was synthesized, and its ability to protect an aluminum alloy AlMg-4Mn in 1M HCl was investigated by combining electrochemistry, surface analysis, and theoretical calculations. The results showed that the maximum inhibition efficiency is 93.67% at 10–5M ADTP at 298 K. ADTP acts as a mixed-type inhibitor. The phenomena responsible for ADTP adsorption are charge transfer, followed by induction, and obey the Langmuir adsorption isotherm. The adsorption is spontaneous and chemi-physisorbed (ΔG= -39.3937 kJ/mol). Scanning electron microscopy (SEM-EDX) and profilometry confirmed the presence of inhibitor film. Density Functional Theory (DFT), Monte Carlo (MC), and Molecular Dynamics (MD) simulations showed that ADTP is a good green corrosion inhibitor to prevent aluminum corrosion.

Eco-friendly inhibitor for 304L stainless steel corrosion in 1 M HCl using electrochemical study

Athmani sameh (1) (2), Sedik amel (1), Saoudi adel (1), Abderrahmane sihem (2), Youbi asma (2), Lerari djahida (1)

1 - Centre de Recherche Scientifique et Technique en Analyses Physico-chimiques (CRAPC), Zone Industrielle, BP 384 Bou -Ismail, Tipaza, Algeria. (Algeria), 2 - Surface Engineering Laboratory, Badji Mokhtar University, ANNABA, B. P. 12 (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE3

The inhibition effects of the green extract inhibitor on 304L stainless steel in 1 M HCl at different concentrations are investigated by open circuit potential (OCP) and electrochemical impedance spectroscopy (EIS). The chemical composition of extract was determined by Fourier transform infrared spectroscopy (FTIR). The characteristics of the electrode surface after an exposition to corrosive solutions were investigated using scanning electron microscopy combined with energy dispersive spectroscopy (SEM-EDS) and atomic force microscopy (AFM). According to the FTIR results, dominant functional groups that found in this extract are hydroxyl and carbonyl groups. The results of the electrochemical measurements showed that extract reduces sufficiently the rate of 304L SS corrosion, the decreasing in the double layer capacitance obtained from EIS measurements refer to increasing the thickness of the formed double layer. The SEM, AFM studies confirmed the formation of inhibition layer unto the metal surface.

Study of the inhibiting effect of a green plant on the corrosion of X70 steel in hydrochloric acid using the mass loss method

Bouasla nabila (1), Athmani sameh (2), Abderrahmane sihem (3), Lalaymia imen (1), Messast sarah

1 - 1. Chadli Bendjedid University - El Tarf ALGERIA (Algeria), 2 - Center for Scientific and Technical Research in Physico-chemical Analyzes. BP 384, Bou-ismail industrial zone. RP 42004. Tipaza, Algeria. (Algeria), 3 - Surface Engineering Laboratory (LIS)-Badji Mokhtar University-Annaba ALGERIA-Faculty of Sciences (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE4

Corrosion refers to the deterioration of materials due to physico-chemical interactions with their environment. This process leads to an alteration in the properties of the metal, often followed by functional degradation such as an alteration in its mechanical, electrical properties, etc. Ordinary steel is widely used in pipelines (to transport oil and gas), infrastructure (such as buildings and bridges) and downhole casings, thanks to its low cost, significant mechanical properties and ease of use. However, it is subject to various levels of corrosion depending on the environments in which it is applied. The aim of this work is to study the inhibitory effect of the extract of a green plant prepared by maceration in HCl, on the corrosion of ordinary X70 steel in hydrochloric acid, using the loss of mass. The optical microscope (OM) was used to characterize the state of the steel surface in 1M HCl, in the absence and presence of this plant. The results obtained show that the maximum efficiency obtained is 93.49% at 4% (V/V).

Study on Black Cumin Cake extract as a corrosion inhibitor for A9M ordinary steel in acidic environments

Dehmchi farouk (1) (2), Abderrahmane sihem (3), Abderrahim karima (3), Moussaoui kamilia (3), Dehmchi djenet Amel (4)

1 - 1Laboratory of Surface Engineering,Badji Mokhtar University (LIS),Faculty of Sciences, (Algeria), 2 - 1Laboratory of Surface Engineering,Badji Mokhtar University (LIS),Faculty of Sciences,Chemistry Department,Annaba, 23000,Algeria (Algeria), 3 - Laboratoire d'Ingéniérie des Surfaces (LIS), Faculté des Sciences , Université Badji Mokhtar ,Dept Chimie, BP 12, 23000, Annaba , Algérie. (Algeria), 4 - LCAO Laboratory, Synthesis of biomolecules and Molecular Modeling Group, Faculté des Sciences , Université Badji Mokhtar ,Dept Chimie, BP 12, 23000, Annaba , Algérie. (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE5

 The goal is to demonstrate the inhibitory efficacy of Black Cumin Cake (BCC) on the corrosion of A9M ordinary steel in 1M HCl, and to improve the corrosion resistance of the latter. This study was conducted by Potentiodynamic Polarization (PDP), Electrochemical Impedance Spectroscopy (EIS), and the weight loss (WL) method. Characterization of the inhibitor was performed by FTIR, UV-visible and that of the steel surface by SEM-EDX and profilometry. The values of the polarization resistance (Rp) increase with increasing inhibitor concentration. The maximum efficiencies obtained are 96.27% at 8.10-2(v/v) BCCE. The adsorption of BCCE on the steel surface obeys to the Langmuir isotherm, and inhibitor molecules are physisorbed. The effect of temperature on the inhibition process shows that at 25°C, the inhibitory efficacies are maximum. The SEM-EDX and profilometry characterizations of the steel surface condition confirm the results obtained by the study methods.

Cebuano Chichewa Chinois (simplifié) Chinois (traditionnel) Cingalais Corse Coréen Croate Créole haïtien Danois Espagnol Espéranto Estonien Finnois Français Frison Galicien Gallois Gaélique (écosse) Grec Gujarati Géorgien Haoussa Hawaïen Hindi Hmong Hongrois Hébreu Igbo Indonésien Irlandais Islandais Italien Japonais Javanais Kannada Kazakh Khmer Kirghiz Kurde Laotien Latin Letton Lituanien Luxembourgeois Macédonien Malaisien Malayalam Malgache Maltais Maori Marathi Mongol Norvégien Néerlandais Népalais Ouzbek Pachtô Panjabi Persan Polonais Portugais Roumain Russe Samoan Serbe Sesotho Shona Sindhî Slovaque Slovène Somali Soundanais Suédois Swahili Tadjik Tagalog Tamoul Tchèque Telugu Thaï Turc Ukrainien Urdu Vietnamien Xhosa Yiddish Yorouba Zoulou browserDisable browserDisable Enregistrer CONTINUER view saved words → Ne pas traduire lors d'un double-clique. Ne pas afficher le bouton flottant Examiner la version déjà traduite de ce site Upgrade to Pro to unlock more features Aucune connexion Internet Ajouter au lexique Aucune liste de mots pourAnglais → Anglais... Créer une nouvelle liste de mots... Copier

---

Green Synthesis of Zinc Oxide (ZnO) Nanoparticles from Nigella sativa Paste Extract

Messast sarah , Sihem abderrahmane (1), Bouasla nabila (2), Abderrahim karima (3), Moussaoui kamilia (4), Youbi asma (5)

1 - Surface Engineering Laboratory (L.I.S), department of chemistry; Faculty of Sciences; BADJI MOKHTAR -ANNABA University. (Algeria), 2 - 1. Chadli Bendjedid University - El Tarf ALGERIA (Algeria), 3 - Surface Engineering Laboratory (L.I.S), Badji Mokhtar – Annaba University.12.P.O.Box. 23000 Annaba, Algeria (Algeria), 4 - Surface Engineering Laboratory (L.I.S), Faculty of Sciences; Badji Mokhtar-Annaba University, P.o.Box 12, Annaba. 23000, Algeria (Algeria), 5 - LIS Chemistry department Annaba university (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE6

The green synthesis of zinc oxide (ZnO) nanoparticles from Nigella sativa paste (black cumin seeds) waste is an eco-friendly and sustainable method that uses natural extracts to produce nanostructures materials. ZnO nanoparticles are prized for their unique properties, such as high photo catalytic activity and antibacterial capabilities. Unlike traditional chemical methods, green synthesis reduces environmental impact by using biological materials. Nigella sativa seeds, rich in bioactive compounds like alkaloids and flavonoids, can act as reducing and stabilizing agents. The waste from these seeds, often unused after oil extraction, is utilized to produce nanoparticles. The process involves preparing an aqueous extract of Nigella sativa waste, which is then mixed with a zinc precursor solution, allowing the bioactive compounds to reduce zinc ions and form ZnO nanoparticles. This procedure, carried out at room temperature or slightly heated, produces nanoparticles of varying sizes and morphologies, with physicochemical properties comparable to those obtained by conventional methods, but with ecological advantages. The applications of ZnO nanoparticles thus obtained are numerous, including sensors, optoelectronic devices, water disinfection, and cosmetics. In summary, this method valorizes agricultural waste, promotes a circular economy, and reduces production costs, paving the way for more environmentally friendly nanoparticle manufacturing.

Valorization of black cumin cake as an eco-friendly inhibitor of corrosion on Stainless Steel 316L in 1M HCl through chromatography analysis, experimental and theoretical studies

Maalem badreddine (1), Abderrahmane sihem (2), Athmani sameh (2), Bezzina belgacem (3), Youbi asma (2), Khelfi hadil , Moussaoui kamilia , Berdjane djamel

1 - 1Surface Engineering Laboratory (L.I.S), Faculty of Sciences, BADJI Mokhtar -Annaba University, P.O.Box 12, Annaba. 23000, Algeria (Algeria), 2 - LIS Chemistry department Annaba university (Algeria), 3 - 2Research Center in Industrial Technologies CRTI P.O.Box 64, Chéraga 16014 Algiers, Algeria (Algeria)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE7

In this work, austenitic stainless steel (316L SS) in 1M HCl was treated with Black Cumin Cake Extract (BCCE), which was made using a soxhlet with ethanol solvent. The inhibitory behavior was investigated using weight loss technique (WL), potentiodynamic polarization (PDP) and electrochemical impedance spectroscopy (EIS). UV-visible, FTIR, and gas chromatography mass spectrometry (GC-MS) were the methods used to characterize BCCE. The identification of the principal compounds included in BCCE was made possible using GC-MS. Inhibition effciency increases with increase in concentration of the inhibitor. Kinetic, thermodynamic and adsorption behaviour of the process were investigated. Results revealed that the inhibition occurred due to the molecular adsorption of the constituents of the extract on austenitic stainless steel in an acidic medium. In addition, computational calculations were carried out using the B3LYP functional and density functional theory (DFT), using adsorption locator modules on basis set 6-311G+ (d, p), Monte Carlo (MC) simulation was carried out to corroborate the experimental results; scanning electron microscopy, and spectrometric dispersive energy (SEM-EDX) with and without an inhibitor, the obtained micrographs of 316L SS confirm the existence of a protective film, the BCCE of an effective corrosion inhibitor. We can conclude that the BCCE has two benefits: it effectively inhibits corrosion for 316L in 1M HCl and, by recovering this waste, acts as a good environmental protection agent. The surface condition of 316L SS was investigated using profilometry, the maximum inhibitory efficacy is 99 % at 4.10-2 v/v BCCE during 72 hours of immersion by WL technique; induction and charge transfer phenomena led to the latter's adsorption. BCCE exhibits inhibitory efficience behavior. The presence of the inhibitor film is confirmed by profilometry and SEM micrographs.

Electrode Materials for Supercapacitors: Interactions between electrode and electrolyte

Lamata Bermejo irene (1), Waldemar keil (2), Schmidt claudia (1), Odziomek mateusz (3), López-Salas nieves (1)

1 - Paderborn University (Germany), 2 - Hochschule Bielefeld (HSBI)- University of Applied Sciences and Arts (Germany), 3 - Max Plank Institute of Colloids and Interfaces (Germany)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE8

Understanding how the electrolyte interacts with nanopores of carbonaceous electrodes is crucial for green energy storage and conversion applications as carbon–electrolyte (carbon-water) interfaces have a dominant influence on the capacitance and electrocatalytic performance. The standard strategy to increase the affinity of water to pores is doping carbon materials with nitrogen introducing polar sites. Highly nitrogen-doped carbons are expected to increase the hydrophilicity of the pores and the wettability. However, in the case of nanopores, the concept of surface hydrophilicity might be misleading as water confined in pores shows properties different from those of bulk water. NMR spectroscopy is a versatile tool to probe local environments of water in pores. The ring currents originating from π-electrons within conjugated carbon ring structures affect molecules within a few tens of ångströms of pore walls. The effect of the ring currents affects the chemical shift of the atoms in their vicinity. The observed average chemical shift of mobile solvents also depends on the pore diameter. As only ions in pores of few nanometers will exhibit a sizeable shift, 1H NMR spectra of water will give us information whether an adsorbate reaches the nanopores or not. We used two C1N1 carbons with different porosity and a pure nanoporous carbon as a reference. The NMR results showed that in C1N1 carbons, liquid water fills only a very small fraction of pores in comparison to the carbon reference. This surprising finding agrees with the cyclic voltammetry experiments in which we do not observe the high capacity in C1N1 materials typical for highly porous N-doped materials. Probing the interaction of water with the surface by water sorption and calorimetric studies revealed the formation of a layer of strongly bound non-freezing water at the surface, preventing the water from diffusing into the pores.

Ab initio study of cationic alkali dimers emerged in Ar: The Ar–Na2+ van der Waals complex

Nesrine mabrouk (1), Dhiflaoui jamila , Bejaoui mohamed , Berriche hamid

1 - LIMA

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE9

Les PES de surface d'énergie potentielle du complexe Ar-Na2+ ont été générés par la méthode du cluster couplé avec des excitations simples, doubles et triples perturbatives (CCSD(T)) [1-2] utilisant des ensembles de base atomiques cohérentes en termes de corrélation (aug-cc-pVXZ, X = Q, 5) [3] et extrapolées à la limite de l'ensemble de base complet (CBS) [4-6]. Dans notre travail, le système de coordonnées de Jacobi a été utilisé. Les calculs ont été réalisés en approximation d'une molécule rigide interagissant avec r(Na2+) = 3,60 Å, correspondant à la distance d'équilibre expérimental et la géométrie du complexe Ar–Na2+ est définie par l'angle θ et R. Ensuite, pour la molécule diatomique Na2+, nous avons considéré quatre autres distances de liaison différentes autour de la distance expérimentale pour évaluer l'effet de vibration de ré. La topologie de surface est étudiée par une méthode d'interpolation basée sur l'approche RKHS de re(exp). Ensuite, les PES interpolés RKHS sont utilisés pour calculer l'état lié vibrationnel des états fondamentaux Ar – Na2+ vdW (J=0). Nous représentons les distributions radiales et précises pour ces états liés de symétrie paire et impaire. Les états situés en dessous de la barrière de 90° correspondent à des atomes d'Ar fortement localisés dans une des géométries linéaires. pour les états en dessous de la barrière, les distributions radiales et angulaires ont une structure nodale plus compliquée et correspondant à un « mode » d'étirement vibrationnel de l'atome d'Ar.

Chemical sensing of iodide ions-based anil: A theoretical and experimental Investigation

Moulahia nadhem (1), Echabaane mosaab (2), Chaabene marwa (3), Baouab mohamed Hassen V (4), Ben Chaabane rafik (3)

1 - Laboratory of Advanced Materials and Interfaces (LIMA), Faculty of Sciences of Monastir, University of Monastir, Avenue of the Environment, 5000 Monastir, Tunisia (Tunisia), 2 - NANOMISENE Lab, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology CRMN of Technopark of Sousse, B.P. 334, Sahloul, 4034 Sousse, Tunisia (Tunisia), 3 - Laboratory Interfaces and Advanced Materials, Faculty of Science of Monastir, University of Monastir, 5019 Monastir, Tunisia (Tunisia), 4 - cResearch Unit Materials and Organic Synthesis (UR17ES31), Preparatory Institute for Engineering Studies of Monastir, University of Monastir, Avenue of the Environment, 5000 Monastir, Tunisia. (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE10

Un capteur chimique à base d'anil a été développé pour la détection des anions iodures. La capacité de complexation de l'anil avec I-, Br-, Cl-, CN-, SCN-,, CH3COO-, a été explorée par spectroscopie UV-vis. Les résultats ont montré que la sonde propose une sélectivité élevée pour la détection de I-, avec des changements d'intensité d'absorption dus à la formation du complexe anil-I-. L'anil et l'anion iodure se lient par une stoechiométrie complexe 1:1 et la constante d'association est déterminée à 8,5 × 103 M-1. De plus, le film de détection a été élaboré par revêtement trop sur une électrode de platine. Les capteurs chimiques proposés pour la détection de I- ont été analysés par CV. Il a montré une réponse linéaire dans la plage de 0,5 à 500 µM, avec une limite de détection de 0,2 µM. Ce résultat expérimental a été préconisé par les calculs DFT-D3. Les FMO et le NBO ont permis de comprendre l'interaction de transfert de charge entre la molécule d'anil et l'ion I-. L'analyse QTAIM a été certifiée pour déterminer la nature et le type d'interaction formé entre les anions iodure et la sonde anil.

Enhanced photocatalytic properties of zinc oxide in the photodegradation of organic pollutant under natural solar irradiation through niobium doping

Tarrach fredj (1,2), Elkar tahar (1), Ben Salem basma (1), Guermazi hajer (1)

1 - University of Sfax, Faculty of Science of Sfax, Road of Soukra Km 3.5, B.P:1171, 3000, Sfax, Tunisia. (Tunisia)

2 -Institut Supérieur des sciences Appliquées et de Technologie de Sousse, University of Sousse.

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE11

The current study aims to investigate the effect of niobium doping on the ZnO efficiency in the degradation of organic dye. Thus, ZnO nano-powders, with different Nb molar percentage (x = 1, 2, 3, 4 and 5 %) were synthesized using co-precipitation method. The photocatalytic activities of the synthesized samples are evaluated in the degradation of Methylene blue (MB) dye as a model of organic pollutant, under natural sun irradiation. The photocatalytic efficiency of ZnO is significantly improved when low-doped at 1%. So, it reaches about 92 % after 80 min under sunlight irradiation. The photoluminescence (PL) spectra display emission bands in the visible range related to the presence of defects, such as oxygen vacancies, as well as shallow trap levels near the conduction band edge, besides of the band-to-band emission. The photocatalytic improvement of doped ZnO can be explained by the significant reduction in the excitonic emissions. This can be explained by a decrease in the charge recombination rate, thus an increase in the charge life time, which results in an enhancement in the photodegradation efficiency by low Nb doping of ZnO.

Impedimetric sensor for the detection of Al^{3+} ions in water based on a novel imidazole derivative

Meguebli ramzi (1), Echabaane mosaab (2), Baouab mohamed Hassen V (3), Ben Chaabane rafik (1)

1 - Laboratory Interfaces and Advanced Materials, Faculty of Science of Monastir, University of Monastir, 5019 Monastir, Tunisia (Tunisia), 2 - NANOMISENE Lab, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology CRMN of Technopark of Sousse, B.P. 334, Sahloul, 4034 Sousse, Tunisia (Tunisia), 3 - Research Unit Materials and Organic Synthesis (UR17ES31), Preparatory Institute for Engineering Studies of Monastir, University of Monastir, Avenue of the Environment, 5000 Monastir, Tunisia. (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE12

Les ions aluminium jouent un rôle essentiel dans les réactions biologiques au sein du corps humain. Cependant, les effets toxiques de la consommation incontrôlée d'aliments ou d'eau contaminés par l'aluminium nécessitent le développement de méthodes de détection sensibles. Dans cette étude, nous avons développé un capteur électrochimique à base de dérivé d'imidazole (IMI-BF) pour la détection d'ions aluminium dans l'eau. Les propriétés optiques ont été évaluées à l'aide de la spectroscopie UV, qui a confirmé que l'imidazole se lie aux ions aluminium, entraînant la formation d'un complexe stoechiométrique 1:1. Une électrode de platine modifiée par IMI-BF a été caractérisée à l'aide de la spectroscopie électrochimique d'impédance (EIS) pour effectuer la détermination analytique des ions Al^{3+}. Dans des conditions optimales, le capteur a montré une réponse linéaire aux ions Al^{3+} sur une large plage de concentrations de 1 nM à 10 mM, avec une limite de détection de 8,17 nM. De plus, le capteur a montré une bonne sélectivité, reproductibilité et répétabilité. L'efficacité du capteur proposé a été confirmée par la détection d'aluminium dans des échantillons d'eau réels.

Non-Relativistic and Relativistic Study of Ground and Low-Lying Electronic Excited States in $BaNa^+$ Diatomic Molecular Ion

Akkari sana (1), Zrafi wissem , Ladjimi hela , Bejaoui mohamed , Dhiflaoui jamila , Berriche hamid

1 - Sana (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE13

Ion-atom interactions are a recent field of research, that has applications in areas of

quantum chemistry and quantum simulation that has drawn the attention of many researchers because of their exciting electronic structure adapted to laser cooling [1-6]. In this work, we present a thorough theoretical structure and spectroscopic study of the ground and low-lying excited states of BaNa+ molecule. High-level ab-initio calculations are performed, using MCSCF/MRCI level of method, based on the effective core potential (ECP) and core polarization potential (CPP) approach. The potential energy curves, spectroscopic parameters, vibrational energy levels of the first electronic states, with respect to the low-lying dissociation limits were calculated. The comparison of the spectroscopic constants of the ground state with the available theoretical work, are in good agreement with those of Śmiałkowski.M, and Tomza.M [4]. The study of all the excited states is performed in this work for the first time. Afterwards, the spin orbit operator is incorporated in valence MRCI calculation using optimized relativistic spin orbit pseudopotentials were generated and split into Λ-S states. Furthermore, the elastic scattering proprieties at low energy for the ground states of both molecules are theoretically investigated. References [1] Hall, F. H., Eberle, P., Hegi, G., Raoult, M., Aymar, M., Dulieu, O., &Willitsch, S (2013). Molecular Physics, 111(14-15), 2020-2032. [2] R. Ben-shlomi, R. Vexiau, Z. Meir, T. Sikorsky, N. Akerman, M. Pinkas, O. Dulieu, and R. Ozeri (2020). Phys. Rev. A, 102:031301 [3] Wissem Zrafi, Hela Ladjimi, Halima Said, Hamid Berriche and Michał Tomza, New J. Phys. 22 (2020) 073015. [4] Śmiałkowski, M., and Tomza, M. (2020). Physical Review A, 101(1) 012501. [5] Akkari, S., Zrafi, W., Ladjimi, H., Bejaoui, M., Dhiflaoui, J., & Berriche, H. (2024). Physica Scripta, 99(3), 035403. [6] H. A. Fürst, N. V. Ewald, T. Secker, J. Joger, T. Feldker, and R. Gerritsma (2018).51(19):195001.

Cadmium (II) porphyrin and gold nanoparticles modified Screen-Printed Carbon Electrode for electrochemical sensing of bisphenol A

Rejab fatma (1)

1 - Laboratory of Advanced Materials and Interfaces (LIMA), Faculty of Sciences of Monastir, University of Monastir (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE14

In this work we present a highly sensitive and specific electrochemical sensor utilizing [(5,10,15,20-tetrakis(p-bromophenyl) porphyrinato] cadmium (II): (CdTBrPP) and gold nanoparticle AuNPs for detecting bisphenol A (BPA). The sensing platform was constructed on a screen-printed electrode (SPCE) working electrode via deposition of AuNPs followed by deposing CdTBrPP by drop-coating. The efficacy of the sensitive film immobilization was confirmed through cyclic voltammetry (CV). The resulting SPCE/ AuNPs /CdTBrPP electrode was employed for BPA monitoring using the Square Wave Voltammetry (SWV) technique, demonstrating a linear response within the concentration range of 10-11 M to 10-2 M with a low detection limit (LOD) of approximately 9,5 10−12 M.

Silicon vs. Silicon Nanowires: Impacts on Structural and Electrochemical Performance for Electrochemical Sensor

Jebali milaine (1) (2), Daboussi sameh (1) (3), Ben Fadhel naoures (1) (2), Khalifa marouan (4), Ben Ali mounir (1) (3), Hassen mohamed (1) (3)

1 - CRMN, Centre for Research on Microelectronics and Nanotechnology of Sousse, NANOMISENE, LR16CRMN01, 4054, Sousse, Tunisia (Tunisia), 2 - Higher school of sciences and technology of Hammam Sousse (ESSTHS) (Tunisia), 3 - Higher Institute of Applied Sciences and Technology in Sousse (ISSATSo) (Tunisia), 4 - Photovoltaic Laboratory, Centre for Research and Energy Technologies (CRTEn), Technopôle de Borj-Cédria , Hammam-Lif (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE15

This work presents a comparative study between bulk silicon and silicon nanowires (SiNWs) fabricated via metal-assisted chemical etching (MACE). A range of characterization techniques are employed to analyze the structural, optical, and electrical properties of both materials. UV-Visible spectroscopy is used to evaluate the optical properties of the SiNWs, while Fourier-transform infrared (FTIR) spectroscopy provides insights into their chemical composition and surface functional groups, which may influence their reactivity and sensor performance. X-ray diffraction (XRD) analysis reveals detailed information about the crystalline structure of the SiNWs, confirming their successful formation and the level of crystallinity achieved through the MACE process. Additionally, electrochemical impedance spectroscopy (EIS) highlights the superior electrochemical response of SiNWs compared to bulk silicon, further demonstrating their potential for biosensing applications. Overall, this study demonstrates how the transition from bulk silicon to SiNWs can optimize fabrication techniques and significantly improve the performance of sensor devices.

Activation of Peroxymonosulfate using Green synthesis of CuO/ZnO nanocomposite for degradation of Tetracycline antibiotic under visible light irradiation

Atri afrah (1), Echabaane mosaab (2), Barras alexandre (3), Ben Chaabane rafik (1), Boukherroub rabah (4)

1 - Laboratory Interfaces and Advanced Materials, Faculty of Science of Monastir, University of Monastir, 5019 Monastir, Tunisia (Tunisia), 2 - NANOMISENE Lab, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology CRMN of Technopark of Sousse, B.P. 334, Sahloul, 4034 Sousse, Tunisia (Tunisia), 3 - Univ. Lille, CNRS, Centrale Lille, Univ. Polytechnique Hauts-de-France, UMR 8520 - IEMN, F-59000 Lille, France (France), 4 - Univ. Lille, CNRS, Centrale Lille, Univ. Polytechnique Hauts-de-France, UMR 8520 - IEMN, F-59000 Lille, France (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE16

This study discusses the influence of visible light on the activation of peroxymonosulfate (PMS) using green synthesis of a copper oxide/zinc oxide nanocomposite for photocatalysis of tetracycline (TC). Copper oxide/zinc oxide nanocomposite was prepared by green synthesis method using an aqueous extract of the plant Ephedra Alata as a reducing and capping agent, and its structure, morphology and composition were assessed using various techniques, including X-ray diffraction (XRD), UV-VIS spectroscopy, transmission electron microscopy (TEM), emission scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), Raman spectroscopy, thermogravimetric analysis (TGA), and X-ray photoelectron spectroscopy (XPS). The photocatalytic performance of CuO/ZnO nanocomposite has been evaluated in activating PMS for the elimination of TC in water. According to high-performance liquid chromatographic (HPLC) examination, the CuO/ZnO nanocomposite/PMS system degraded TC in 60 minutes at room temperature under optimal conditions. Sulfate radicals SO4- were found to be the main participants in the degradation process in quenching studies. Additionally, the cycling test showed that the CuO/ZnO nanocomposite catalyst has favourable stability and recyclability after 5 cycles of PMS activation with no obvious activity loss. The findings of this study suggest that CuO/ZnO nanocomposite could be used for PMS activation for the degradation of different organic contaminants.

Polyaniline based Flexible Sensors for pH monitoring

Lakard sophie (1), Ramsamy catheline (2), Magnenet claire (3), Bignall liam (2), Vassal simon (2), Lakard boris (3)

1 - Institut UTINAM (France), 2 - LINXENS (France), 3 - Institut UTINAM (France)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE17

Advancements in pH sensor technology offer opportunities for improved sensitivity, accuracy, and miniaturization, enabling real-time monitoring in diverse environments, such as aqueous solutions, biological systems, and harsh industrial conditions. More specifically, oxidizing media, characterized by the presence of substances that readily accept electrons, such as chlorine or hypochlorite, are prevalent in various industrial processes like chemical manufacturing, water treatment, and environmental monitoring. pH measurement in such environments is crucial for ensuring product quality, process efficiency, and environmental safety. With this in mind, we set out to develop flexible sensors using electrodeposited polymer films as pH-sensitive layers to manufacture pH sensors that are effective even in oxidizing environments. On one hand, the choice to use flexible sensors is explained by the fact that flexible sensors are becoming more and more important today due to their lightness, conformability, wearability, customizability, and versatility. On the other hand, conductive polymers, such as polyaniline (PANI), are lightweight, resistant and can be deposited on flexible substrates either by chemical oxidation if the flexible substrate is insulating or by electrochemistry if the substrate is conductive. Considering the advantages of using polyaniline and flexible electrodes, we therefore developed a potentiometric flexible sensor using a polyaniline film electrodeposited on a Cu/Ni/Au stack as the pH-sensitive material was developed. The pH sensor exhibited interesting detection performances in aqueous solution, leading to sensitive (73.4 mV per unit pH) and reproducible responses for pH values going from 3 to 8. However, these sensors were ineffective in solutions containing oxidizing hypochlorite ions, which made it necessary to incorporate Tritonx100 surfactant during the electrodeposition of the polyaniline film to make the sensitive material more stable in an oxidizing environment. The pH sensors based on polyaniline and Tritonx100 surfactant were then proved to be sensitive (62.3 mV per pH unit) and reproducible in aqueous solutions containing hypochlorite ions.

Eco-Friendly Synthesis of Silver Nanoparticles using Nigella Sativa Oil: A Novel Approach for Enhanced Electrochemical Sensing

Chelly sabrine (1) (2), Chelly meryam (1) (2), Sarah Ben Haj Fraj sarah (1) (3), Afthal imen (4), Fazio enza (5), Bouaziz-Ketataa hanen (2), Sellami hanen (4), Neri giovanni (1)

1 - Department of Engineering, University of Messina, C.da Di Dio, I-98166 Messina, Italy (Italy), 2 - Laboratory of Toxicology-Microbiology Environmental and Health, LR17ES06, University of Sfax, Faculty of Sciences of Sfax, BP1171, CP 3000 Sfax, Tunisia. (Tunisia), 3 - Physico-Chemistry Laboratory of Innovative Materials (LR 24ES16), Preparatory Institute for Engineering Studies of Monastir, University of Monastir, Tunisia (Tunisia), 4 - Laboratory of Treatment and Valorization of Water Rejects, LR15CERTE05, University of Carthage, Water Researchesand Technologies Center, BP 273, CP 8020, Tunis, Tunisia (Tunisia), 5 - CNR-DSFTM, URT LabSens Beyond Nano Messina, Viale F. Stagno d'Alcontres, 31 I-98166, Messina, Italy (Italy)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE18

The eco-friendly synthesis of silver nanoparticles (AgNPs) using natural reducing agents has gained considerable attention in recent years. In this study, Nigella sativa (black seed) oil was employed as a reducing agent for the synthesis of AgNPs, capitalizing on its intrinsic reductive properties. The Ag nanoparticles were thoroughly characterized through a variety of complementary analytical techniques. Scanning electron microscopy (SEM) and scanning transmission electron microscopy (STEM) revealed the spherical shape and small size of the Ag nanoparticles. When suspended in water and analyzed by UV-Vis spectroscopy,the nanoparticle samples exhibited a peak at 424 nm, corresponding to an average size of nanoparticleabout 37 nm. Fourier-transform infrared spectroscopy (FTIR) confirmed the presence of residual functional groups in Nigella sativa oil responsible for reducing silver ions and incorporating them into the AgNP structure. The synthesized AgNPs were thenused for developing modified screen-printed carbon electrodes (SPCE).Cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) tests demonstrated the highest sensitivity and lower resistance compared to the bare electrode, confirming its improved electrochemical performance. The modified electrodes were then employed for the detection of polyphenols (catechol, hydroquinone, resorcinol) and biomolecules (dopamine, tyrosine, uric acid), exhibited significantly higher sensitivity compared to the bare electrode, especially for catechol detection. The preliminary findings here reported highlight the potential of Nigella sativa oil as an effective green reducing agent for the synthesis of AgNPs and demonstrate the utility of these nanoparticles in electrochemical applications, particularly in sensitive analyte detection.

Schiff Modified Chitosan for Electrochemical Sensitive Sensor: Simultaneous Determination of Catechol, Hydroquinone, and Resorcinol

Ben Haj Fraj sarah (1) (2), Chelly meryam (1) (3), Chelly sabrine (1) (3), Baouab mohamed Hassen V (2), Neri giovanni (1)

1 - Department of Engineering, University of Messina, C. da Di Dio, I-98166 Messina. (Italy), 2 - Physico-Chemistry Laboratory of Innovative Materials (LR 24ES16), Preparatory Institute for Engineering Studies of Monastir, University of Monastir. (Tunisia), 3 - Laboratory of Toxicology-Microbiology Environmental and Health, LR17ES06, University of Sfax, Faculty of Sciences of Sfax, BP1171, CP 3000 Sfax (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE19

Developing sensitive and selective electrochemical sensors for detecting environmental pollutants is crucial for monitoring and protecting water quality. This work presents the design of a Schiff-base modified chitosan (SBC) electrochemical sensor for the simultaneous detection of hydroquinone (HQ), resorcinol (RS), and catechol (CT), key phenolic pollutants in water. Chitosan, a biocompatible and biodegradable polysaccharide, was modified with a Schiff base to enhance its electrical conductivity and catalytic activity. The material was characterized with different methods such as FTIR, XRD, SEM. The Schiff base functionalization introduces active sites that improve the sensor's sensitivity and selectivity towards the target analytes. The SBC electrode demonstrated an excellent electrochemical performance in detecting HQ, RS, and CT, with distinct oxidation peaks for each compound, allowing for accurate and simultaneous quantification. Furthermore, the sensor exhibited good stability and selectivity even in the presence of common interfering substances, which underscores its potential for environmental applications in water quality control and pollutant detection.

Smartphone-assisted fluorescence assay for Hg2+ detection using Bio-nanocomposite blend based on Chitosan-Carbazole/silver nanoparticles as fluorescent probe: synthesis and enhancing sensor performances

Bouhlel inès (1), Bahy amira (1), Sakly nawfel (2), Chemli mejed (1), Majdoub hatem (1)

1 - Faculté des sciences de Monastir (Tunisia), 2 - Institut Supérieur des Sciences Appliquées et de Technologie de Mahdia (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE20

According to the US Government Agency for Toxic Substances and Diseases Registry (ATSDR), mercury ranks first in the list of the most toxic heavy metals. Toxicological studies evidenced that even at ppm levels, the mercury ion (Hg2+) released into the soil by refineries, mining, electronics, and chemical industries can cause damages to the brain, immune system, renal system and endocrine system. Accordingly, there is an urgent need to incessantly assess the water quality and evaluate the safety of drinking-water. Despite their high sensitivity, reliability and accuracy, elemental analysis techniques including atomic spectroscopy (AAS), selective atomic spectroscopy fluorescence (SASF) and specific analytical methods (EPA 1631 and 7471) remain unaffordable, labor, cumbersome and require painful sample preparation. In response to the shortcoming, we propose an environmentally friendly, economical, sensitive and portable Smartphone-assisted fluorescence assay for Hg2+ detection based on a modified biopolymer as fluorometric probe. The latter results from the modification of chitosan (Cs) by carbazole (Carb) throughout a simple alkylation reaction at the level of the primary alcohol of biopolymer. Although satisfactory results in term of selectivity, primary results proved that the use of Cs-Carb solely as probe remains scarce to attain a limit of detection (LoD) close to that mandated by the World Health Organization (6 ppb). In this context, we demonstrated that the use of a bio-nanocomposite probe based on Ag Nps/Cs-Carb blend significantly enhanced response time and make possible to reach LoD of the order of hundred nanomoles/L.

Innovative Solar Collector Drying System for Phosphate Washing Sludge with Water Recovery: Applications in Sustainable Phosphate Waste Management

Bellaziz yassir (1), Berroug fatiha, Ouazzani naaila, Mandi laila, Ait Nouh fatima, Hejjaj abdessamed, Boukhattem lahcen, Idlimam ali, El Mahmoudi hamid

1 - Université Cadi Ayyad [Marrakech] (Morocco)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE21

This research presents an innovative approach for drying phosphate washing sludge, addressing a significant environmental challenge in the phosphate industry. The treatment of phosphate ores generates large volumes of sludge, posing issues related to storage and operational costs. In response, this study proposes a sustainable solar drying system, combining a solar greenhouse with a cylindrical-parabolic concentrator, to reduce sludge volume and recover valuable resources. An industrial-scale prototype has been developed and installed at the National Center for Studies and Research on Water and Energy (CNEREE). Prior simulations using TRNsys and COMSOL software guided the optimal design of the system. Key components such as a dehumidifier and a heat exchanger have been incorporated to enhance drying performance and enable the recovery of evaporated water and heat. The system consists of five main components: a greenhouse, a heated floor, a solar loop with cylindrical-parabolic concentrators, an air-water heat exchanger, and a dehumidifier. Solar radiation concentrated by the parabolic collectors heats the water in an absorber tube. This thermal energy is then transferred either to the air inside the greenhouse via the heat exchanger or to the greenhouse floor, enabling both convective and conductive heat transfer to accelerate sludge drying. Experimental trials conducted on 200 liters of sludge showed promising results, with up to 95% dry matter achieved after 57 hours in conductive mode and 77 hours in convective mode. Furthermore, up to 58% of the evaporated water was recovered using the dehumidifier during conductive drying in the greenhouse. Further optimization of humidity, temperature, and airflow parameters is expected to improve these results. This solar drying system offers a scalable, environmentally friendly solution for waste management in the phosphate industry, with potential applications in agriculture and environmental protection through the recovery of resources.

Poly(vinyl alcohol)-based films for optical humidity sensing

Ben Doudou bessem (1)

1 - NANOMISENE Laboratory, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology (CRMN) of Sousse Technopole (Tunisia)

Date: November 15th, 2024 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE22

Depending on the application and the corresponding requirements, various techniques have been applied for humidity measurements and different types of sensors have been developed. Traditional humidity sensors are based on the electrical measurement. Optical sensing of humidity, where detection relies on change of optical properties such as refractive index, emerges as an alternative approach due to the offered advantages like immunity to electromagnetic field, lower risk of short circuit, safe to work in risky environments, etc. In this study the optical and humidity-sensing properties of poly(vinyl alcohol) PVA -based composite films are investigated. Various thin and free-standing polymer films are fabricated by dip-coating and drop casting methods, respectively and their refractive index are measured by using prism coupler technique at different relative humidities in the range 5 – 95 % RH in order to probe the sensing behavior. The feasibility of applying poly(vinyl alcohol) thin films for optical sensing of humidity is demonstrated and discussed.

Development of a Citrate-modified ZnO Nanoparticles Electrochemical Sensor for Copper Detection

Hjaiji ghada (1), Echabaane mosaab (2), Ben Chaabane rafik (1)

1 - Laboratory Interfaces and Advanced Materials, Faculty of Science of Monastir, University of Monastir, 5019 Monastir, Tunisia (Tunisia), 2 - NANOMISENE Lab, LR16CRMN01, Centre for Research on Microelectronics and Nanotechnology CRMN of Technopark of Sousse, B.P. 334, Sahloul, 4034 Sousse, Tunisia (Tunisia)

Date: November 15th, 2024 **Time:** 12:00:00 PM **Room:** A **Ref:** PE23

The sensitive detection of copper is crucial for environmental monitoring. In this study, we present a novel electrochemical sensor based on citrate- zinc oxide (CA-ZnO) for copper determination. Citric acid was immobilized onto the surface of ZnO. these nanoparticles were subsequently characterized using Fourier-transform infrared spectroscopy (FTIR) and thermogravimetric analysis (TGA) to assess their functionalization and thermal stability. Glassy carbon electrode (GCE) was modified using citric acid-ZnO for the development of electrochemical sensor, which was characterized by Differential pulse anodic stripping voltammetry (DPASV). Under optimal parameters. The proposed sensors exhibit a linear response ranging from 10-10 to10-6 M, with a limit of detection (LOD) of approximately 8×10-11M. It was successfully used to detect copper ions in real water samples.

Study and Optimization of Gallium Arsenide Nano-Texturization for Microsystems Applications

Sameh DABOUSSI* [1,2], Yosr Ben Khalifa [1,2], Milaine JEBALI [2,3] and Mohamed HASSEN [1,2]

[1] Higher Institute of Applied Sciences and Technology in Sousse (ISSATSo)

[2] CRMN, Centre for Research on Microelectronics and Nanotechnology of Sousse,

NANOMISENE, LR16CRMN01, 4054, Sousse, Tunisia

[3] Higher school of sciences and technology of Hammam Sousse (ESSTHS)

Date: November 15th, 2025 **Time:** 4:30:00 PM **Room:** hall **Ref:** PE24

The push towards miniaturization has profoundly impacted electronics, optoelectronics, and microsystems, paving the way for the rise of nano-microsystems. These technological advancements are designed to maximize data storage capacities and facilitate the integration of nano-microsystems into various devices, including sensors, biosensors, supercapacitors, and photovoltaic cells.

This study centers on the nano-texturization and comprehensive characterization of gallium arsenide (GaAs) for advanced nanosensor applications. Employing a cost-effective metalassisted chemical etching (MACE) method, the GaAs surface is nano-textured to harness its exceptional semiconductor properties, significantly enhancing electronic sensor performance. The research emphasizes the optimization of etching duration and process conditions to achieve ideal GaAs texturization.

The textured GaAs samples underwent thorough characterization through sophisticated techniques, including scanning electron microscopy (SEM), UV-Vis spectroscopy, and Fouriertransform infrared spectroscopy (FTIR).

This research makes a substantial contribution to the development of high-performance GaAsbased nanosensors, showcasing promising potential for diverse applications in fields such as

biomedical sensing, environmental monitoring, and beyond.