ROYAUME DU MAROC
MINISTÈRE DE L'ENSEIGNEMENT SUPÉRIEUR, DE LA RECHERCHE SCIENTIFIQUE ET DE L'INNOVATION

المملكة المغربية
وزارة التعليم العالي و البحث العلمي و الإبتكار

CNRST

COSTEE
Centre de l'Oriental des Sciences et Technologies de l'Eau et l'Environnement

UNIVERSITÉ MOHAMMED PREMIER
Faculté des Sciences Oujda - Maroc

Centre de l'Oriental Des Sciences et Technologies
de L'Eau et de l'Environnement (COSTEE)
Organisent

2ème

COLLOQUE INTERNATIONAL 2025

BIORESSOURCES, BIOTECHNOLOGIES ET DEVELOPEMENT DURABLE

Abstract Book

PARTENAIRES

PHC Maghreb

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Association des Compétences Universitaires Marocaine des études scientifiques de l'Eau, l'Environnement et le Développement Durable

CBS CENTRE DE BIOTECHNOLOGIE DE SFAX

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HTDS Hi-Tech Detection Systems

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In a context marked by the challenges of climate change, food security, and energy transition, this conference served as a valuable platform for exchange among researchers, policymakers, farmers, and industry professionals. The main objective was to explore the opportunities and challenges associated with the development of the agri-food sector through biotechnology and artificial intelligence.

Particular attention was given to current issues such as food safety, water resource conservation, the circular economy, and environmental protection, with the aim of promoting a strategic and sustainable valorization of bioresources.

This event was also part of a dynamic effort to strengthen the skills and employability of young Moroccan researchers and entrepreneurs by integrating the "innovation" component, one of the pillars of the national strategy "Green Generation 2020–2030," launched by His Majesty King Mohammed VI in February 2020. This approach helped reinforce the openness of the Oriental region and Morocco as a whole, while contributing to the enhanced competitiveness of Moroccan companies on the global market.

Program of the 2nd International Conference: Bioresources, Biotechnology and Sustainable Development Mohammed First University, Oujda, Morocco

Mercredi 18 Juin 2025	
15:00 – 18:00	**Accueil et inscription des participants / Affichage des posters** • **Lieu :** au niveau du COSTEE (à côté de la présidence de l'Université Mohammed premier d'Oujda, UMPO).
Jeudi 19 Juin 2025	
09:00 – 09:30	**Mots d'ouverture :** ▪ Président de l'Université Mohammed Premier - Oujda ▪ Doyen de la Faculté des Sciences - Oujda ▪ Doyen de la Faculté Polydisciplinaire - Nador ▪ Directeur de l'École Supérieure de Technologie - Oujda ▪ Directeur de l'École de Commerce et de Gestion - Oujda ▪ Comité d'organisation
09:30 – 09:50	**Conférence inaugurale :** **Cinzia CAGGIA, University of Catania, Italy:** « Microbial biotechnology for food chain sustainability: beyond the limits of fermentation ». ***Local*** *: Salle A (Salle de conférences)* ***Modérateurs*** *: Pr. Abdeslam ASEHRAOU, Pr. Jamal HADADI* ***Rapporteur*** *: Dr Amine EL BOUZIDI*
09:50 – 10:00	**Discussions**
10:00 – 10:30	**Pause-café + visite des posters et stands d'exposition**
<u>Session I :</u> Production primaire innovante et durable intégrant l'Analyse du Cycle de Vie (ACV) : *(préservation des ressources en eau, lutte biologique et biopesticides, biostimulants des plantes...)* --- • ***Local*** *: Salle A (Salle de conférences)* • ***Modérateurs*** *: Pr. Noureddine MEZRIOUI, Pr. Ennouamane SAALAOUI* • ***Rapporteur*** *: Pr. Redouane BENABBES*	
10:30 – 10:50	**Conférence introductive 1 :** **Brahim SABOUR, Université Chouaib Doukkali, El Jadida, Maroc** : « Algues marines et algoculture : Une filière émergente répondant aux objectifs d'une économie bleue durable au Maroc ».
10:50 – 11:10	**Conférence introductive 2 :** **Noureddine EL MTILI, Université Abdelmalek Essaadi, Tétouan, Maroc :** « A la recherche des gènes cachés pour contrer l'érosion génétique »
11:10 – 11:20	**Discussions**

Sous-session T1-A : Biotechnologies et pratiques innovantes pour une agriculture durable

(Biocontrôle, biofertilisation, biochar, valorisation de résidus agricoles, amélioration de la productivité végétale)

- ***Local*** *: Salle A (salle de conférences)*
- ***Modérateurs*** *: Pr. Mohamed ADDI, Pr. Brahim BOUIZGARNE*
- ***Rapporteur*** *: Pr. Redouane BENABBES*

11:20 - 12:50	• **CO11 –** Advancing Sustainable Agriculture: Biocontrol of Tomato Root Rot Caused by *Rhizoctonia solani* Using Antagonistic Microorganisms **Oumaima BENAISSA, Zineb BELABESS, Dina AKROUTE, Abderrahim LAZRAQ, Rachid LAHLALI** • **CO12–** Evaluation of seaweed biostimulatory effects on Durum Wheat (*Triticum durum L.*) growth, physiology, and antioxidant System **Ismail EL BZAR, Oumaima OUALA, Mohammed HAIDA, Hamza SABIR, Yasser ESSADKI, Brahim OUDRA, Fatima EL KHALLOUFI** • **CO13–** Impact of Biochar on the Physico-Chemical Properties of Soils Under Water Stress: A Comparative Study **H'anane Sahil, Zaina Idardare, Hakima Assendal, Chafia Hajji, Lamia Yakkou, Fatima El Aamri d, Mohamed Lamsaih, Laila Bouqbis** • **CO14–** Isolation and Characterization of Actinobacteria from Moroccan Arid Zones and Their Role in Seed Germination **Omaima MARHANE, Badra BANANE, Mohamed BAKKI and Brahim BOUIZGARNE** • **CO15–** Biofertilizing potential of Sargassum muticum for improving *Capsicum annuum L.* plant growth **Oumaima Ouala, Yasser Essadki, El Mahdi Redouane, Ouafa Cherifi, Fatima El Khalloufi and Brahim Oudra** • **CO16–** Agricultural Waste-Based Biochar: Enhancing Sandy Soil Properties and Tomato Growth Under Water Stress **Hakima Assendal, Laila Bouqbis, H'anane Sahil, Lamia Yakkou, Chafia Hajji, Idardare Zaina** • **CO17–** Alternative de lutte contre les ennemis des cultures : Contribution à l'étude des potentialités des bio pesticides à base d'extraits d'algues pour une valorisation en protection des plantes **Khadija Sbahou, Reda Bellaouchi, Idrissi Yahyaoui Meryem, Lamyae Mehane, Sara Moumnassi, Amine Elbouzidi, Mohamed Taibi, Bouaiadi El Bachir, Hammada Abdelilah, Talha Mohamed, Abdeslam Asehraou, Zouhir Chafik** • **CO18–** Valorization of essential oil waste of two medicinal and aromatic plants as bioactive compounds **Salahddine Chafiki, Soumaya El Assri, Redouan Qessaoui, Abdelmalek Mahroug, Hasna Lahchimi, Abdallah Oukarroum, Mohamed Alouani, Hicham El Arroussi, Rachid Sabbahi and Rachid Bouharroud** • **CO19–** Endemic Bacillus from the Souss region: biopesticides and PGPR against fungal diseases of tomato (*Botrytis, mildew*, *Oidium and Alternaria*) **Hasna Elhjouji, Redouan Qessaoui, Khadija Dari, El Hassan Mayad, Hinde Aassila**

Sous-session T1-B : Gestion durable des ressources naturelles et des milieux aquatiques

(Qualité de l'eau, contamination, biodiversité aquatique, valorisation des écosystèmes marins)

- ***Local*** *: Salle B*
- ***Modérateurs*** *: Pr. Brahim OUDRA, Pr. Anouar OUIZGANE*
- ***Rapporteur*** *: Dr. Mounir HADDOU*

11:20 - 12:50	• **CO110–** Potentially Toxic Elements Contamination in Surface Water of Moulouya Estuary (Northeastern, Morocco) **BASRAOUI Nour-Elhouda, BEN-TAHAR Rihab, BOUKICH Oualid, MIMOUMI Yassine, EL GUERROUJ Bouchra, CHAFI Abdelhafid** • **CO111–** Impact des caractéristiques sédimentaires sur la répartition de la faune associée aux herbiers marins de la lagune de Nador

	Bouaiadi El Bachir, Zidane Hakima, Rezzoum Nor-Eddine, Idrissi Mohamed, Ouztato Tariq, Elhaddaoui Marwa, El Fatehy Fath Allah, Akodad Mustapha, El Ouamari Najib, Fadili Mohamed, Makaoui Ahmed, Abid Abdeslam, Oujidi Bouchra, Skali Ali • **CO112–** Biologie des populations du merlu européen (*Merluccius merluccius*, Linnaeus, 1758) dans la mer Méditerranée marocaine **SLIMANI Douaa, ABDELLAOUI Souad, KADDOURI Nassir, MOUEDDEN Rajae, KASMI Khaoula, El OUAMARI Najib, CHAABANE Khalid** • **CO113–** Desalination Brine: Characterization, Management Strategies, and Environmental Impact **Zarzoun Hind And Bitar abdelali** • **CO114–** Assessment of Pyrethroid Resistance in a Moroccan field population of *Cydia pomonella* (Lepidoptera: Tortricidae) **Dina Akroute, Muhammed Baala, Rachid Benkiran, Abdelaziz Alaoui, Rachid Lahlali, Ahmed El Bakali And Salma El Iraqui El Houssaini** • **CO115–** Investigation study of physicochemical properties of Schiff bases (SF) complexes and their innovative applications in heterogeneous catalysis **Ayoub Badi, Mohamed Azzouzi, El Hassan El Majidi, Abdeslam Mouadili, Mohamed Abboud, Adyl Oussaid, Abdelouahad Oussaid** • **CO116–** Assessment of mineral oils, black soap, and essential oils for controlling *Dactylopius opuntiae* (Cockerell. 1929) (Hemiptera: Dactylopiidae) **Asmae Azzouzi, Hamza Anejjar, Aicha Id-M'hamed, Mustapha Ait Chitt, Abdelmalek Boutaleb Joutei, Rachid Lahlali and Taoufiq Benziane** • **CO117–** Seasonal Dynamics and Stocking Density: Key Factors Influencing the Growth of *Gracilaria gracilis* in the Nador Lagoon, Morocco **Rajae Mouedden, Douaa Slimani, Souad Abdellaoui, Nassir Kaddouri, Khaoula Kasmi, Amira Kharkhache, Najib El Ouamari, Khalid Chaabane** • **CO118–** Analyse et simulation du transfert des éléments traces métalliques issu des activités minières vers les eaux superficielles **Yassine Mimouni, Abdelhafid Chafi, Nour-Elhouda Basraoui, Bouchra El guerrouj and Jean Francois Deliege**
<u>Sous-session T1-C</u> : Agroécologie, systèmes intégrés et résilience climatique (Aquaponie, désertification, stress abiotiques, interactions sol-plante, lutte bio, économie circulaire) --- • ***Local*** *: Salle C* • ***Modérateurs*** *: Pr. Mohammed YACOUBI-KHEBIZA, Pr. Mohamed BOURIOUG* • ***Rapporteur*** *: Dr Fatima Zahra EDDABBEH*	
11:20 - 12:50	• **CO119–** Rhizobia-soybean (Glycine max) varietal interaction and substrate preferences under controlled conditions **Noura Bechtaoui, Mohammed Onli, Anas Raklami, Muhammad Kabir Rabi, Alfred Balenor, Khalid Oufdou, Mohamed Hafidi and Martin Jemo** • **CO120–** Introduction of Aquaponic systems in the Oriental region in the face of desertification challenges **Mohamed Amine Elouerdani, Legsseyer Bouchra, Souad Ben El Mostafa, Mariam El Bakali** • **CO121–** Antifungal potential of Warionia saharae essential oil against Botrytis cinerea **Soumaya El Assri, Salahddine Chafiki, Anouar Bouanga, Redouan Qessaoui, Rachid Bouharroud, Rachid Sabbahi** • **CO122–** Assessment of Nitrogen Fertilizer Strategies for Wheat Cropping Systems Under Semi-Arid and Sub-Humid Climatic Zones in Morocco Under Semi-Arid and Sub-Humid Climatic Zones in Morocco **Mohamed Boullouz, Mohamed Louay Metougui, Ngonidzashe Chirinda** • **CO123–** Influence de la composition du milieu de culture sur la multiplication in vitro de deux variétés de *Cannabis sativa L.* cultivées au Maroc **TAHTAH Meryem, IBRAHIM Toufik, SAMIR Karima, NORDINE Aicha**

	• **CO124–** Drought- and Salinity-Tolerant PGPR Actinomycetes: Effects on Date Palm Seed Germination and Antagonism of Date Palm Bayoud Disease Agent **BANANE Badra, MARHANE Omaima., BAKKI Mohamed & BOUIZGARNE Brahim** • **CO125–** Bacteriological Quality Assessment of Drinking Water in the Rural Region of Ouichane **Tarik Moubchir, Sanae Rezouki, Aimad Allali, Noureddine Eloutassi, and Ilham Zahir** • **CO126–** Diversité des champignons endomycorhiziens et ectomycorhiziens dans la rhizosphère d'*Helianthemum ledifolium* dans la zone de Bni Guil (Maroc oriental) **Halima Bouchentouf, Wissame Chafai, Elhassane Rejmil, Abdelmajid bechchari, Khalid Ahmed** • **CO127–** Molecular and morphological identification of indigenous arbuscular mycorrhizal fungi (AMF) associated with *phoenix dactylifera* L. in the Figuig Oasis, Morocco **Elmostafa Gagou, Claire Guérin, Halima Bouchentouf, Khadija Chakroune, Mahmoud Abbas, Mondher El Jaziri, Abdelkader Hakkou**
12:50 – 13:00	**Discussions**
13:00 – 14:30	**Pause-déjeuner**
<u>Session II :</u> Transformations post récolte : lutte contre les altérations et les pertes : *(1) défis des fermentations, (2) voies de valorisation des protéines alternatives, (3) antimicrobiens, (4) emballages (actifs, biosourcés, intelligents), (5) approches innovantes dans le nettoyage et désinfection, (6) métabolites secondaires des plantes aromatiques et médicinales, (7) stratégies innovantes pour la biopréservation des aliments …* --- • ***Local*** *: Salle A (Salle de conférences)* • ***Modérateurs*** *: Pr. Fouad MALEK, Pr. Abdeslam ASEHRAOU* • ***Rapporteur*** *: Pr. Houssam ABOULOIFA*	
14:30 – 14:50	**Conférence introductive 1:** **Ramzi KHIARI, Higher Institute of Technological Studies of Ksar Hellal, Department of Textile, Tunisia:** « Polysaccharide Nanomaterials »
14:50 – 15:10	**Conférence introductive 2:** **Tuba ESATBEYOGLU, Leibniz University Hannover, Germany:** « Influence of fruit juices on Antioxidant activity and Bioavailability»
15:10 – 15:20	**Discussions**
15:20 – 16:00	**Pause-Café + Posters & visite des Stands d'exposition**
<u>Sous-session T2-A</u> : Valorisation des sous-produits agricoles et extraits bioactifs : *Exploitation de résidus de cultures, feuilles, pépins, racines, etc. pour des usages alimentaires, pharmaceutiques ou agricoles…* --- • ***Local*** *: Salle A (salle de conférences)* • ***Modérateurs*** *: Pr. Hassan LATRACHE, Pr. Yahya ROKNI* • ***Rapporteur*** *: Pr. Houssam ABOULOIFA*	
16:00 - 18:00	• **CO21–** Anticancer activity of macroalgal proteins treated with cold plasma and ultraviolet radiation applications **Aysun Yücetepe, Emine Şükran Okudan, Susanne Neugart, Tuba Esatbeyoğlu**

- **CO22–** Biotechnological strategy for functional table olives production
  Irene M. Zingale, Amanda Vaccalluzzo, Giacomo Antonio Calandra Checco, Vita Maria Marino, Margherita Caccamo, Cinzia L. Randazzo, Dilara Nur Dikmetas, Tuba Esatbeyoglu, Esra Capanoglu, Cinzia Caggia

- **CO23**– Biotechnological Stimulation of Phenolic Biosynthesis in Geranium (*Pelargonium graveolens Hort.*): Elicitor Strategies, LC-MS/MS Phytochemical Profiling, and Bioactivity Exploration
  Amine Elbouzidi, Mohamed Taibi, Abdellah Baraich, Mounir Haddou, Yousra Hammouti, Francois Mesnard, Mohamed Addi

- **CO24–** Valorisation des sous-produits du safran (*Crocus sativus L.*) : l'application foliaire d'extraits aqueux de tépales stimule la croissance et améliore les propriétés antioxydantes des plants d'aubergine en conditions sous serre
  Amine Khoulati, Said Ezrari, Ennouamane Saalaoui, Adil Maleb

- **CO25–** Involvement of Characterized Polysaccharides Extracted from ginger in Food Applications
  Sirine Ben Slima, Imen Trabelsi, · Mohamed Amine Taktak, Sami Bouf, · Riadh Ben Salah, Naourez Ktari

- **CO26–** Composition phénolique et activité antibactérienne de trois variétés d'avocats (*Persea americana*) cultivées au Maroc
  Jihane LAARIFI, Asmaa AOUBIHI, Fatima-Zahra MEKAOUI, Douae EL MERABET, Fatima Zahra RHEBBAR et Youness TABOZ

- **CO27–** Assessing the Volatile Composition by GC/MS-MS and Biological Efficacy of *Rosa damascena* Essential Oil: Examining its Antimicrobial and Antioxidant Capabilities
  Nezha Lebkiri, Ghizlane Diria, Fatima Gaboun, Karim Saghir, Driss Iraqi, Maha El Hamdani, Taha El kamli, Aouatif Benali, Hasna Yachou, Rabha Abdelwahed, Younes Abbas

- **CO28–** Antioxidant and Antimicrobial Activities of *Olea europaea* Leaf Extracts: A Study on Food Preservation
  Kaouthar El Bekkali, Fatima El Lamti, Wail Afroun, Noureddine El Mtili, Mohammed Mrani Alaoui

- **CO29–** Optimized Formulation of a Three-Component Extract Mixture from *Crocus sativus* L. (Stigmas, Leaves, and Tepals) for Enhanced Antioxidant Activity
  Abdellah Baraich, Amine Elbouzidi, Mohamed Taibi, Mounir Haddou, Samira Mamri, Reda Bellaouchi, Ramzi A. Mothana, Mohamed Addi, Redouane Benabbes, Mohammed Choukri, Abdeslam Asehraou, Bassem Jaouadi, Ennouamane Saalaoui

- **CO210–** Antioxidant and Antimicrobial Activities of Argan Leaf Extracts: A Study on Food Preservation
  Wail Afroun, Fatima El Lamti, Kaouthar El Bekkali, Noureddine El Mtili, Mohammed Mrani Alaoui

- **CO211–** Antioxidant and Antimicrobial Properties of Ramalina canariensis: HPLC-UV Identification of Usnic and Divaricatic Acids
  Othmane Erradi, Nedeljko Manojlović, Muhammad Usman, Zahira Belattmania, Brahim Sabour

- **CO212–** Dermatoprotective Potential of Clinopodium nepeta and Thymus vulgaris Essential Oils: Phytochemical Profiling, Anti-Elastase and Anti-Tyrosinase Activities, Photoprotection, and Antimicrobial Effects Against Dermatopathogens
  Reda Bellaouchi, Mohamed Taibi, Amine Elbouzidi, Mounir Haddou, Abdellah Baraich, Idrissi Yahyaoui Meryem, Lamyae Mehane, Ibrahim Sadougui, Mohamed Amine Meziane, Bouchra El Guerrouj, Khalid Chaabane and Abdeslam Asehraou

- **CO213–** Evaluation of Key Quality Parameters in Honey from Different Moroccan Regions
  A.Beenmehdi , H. Loukili, E.Garayev, B.Baghdikian, M.Ramdani.

<u>Sous-session T2-B</u> : Extraction verte, stimulation métabolique et valorisation médicinale :

(*Approches durables pour enrichir les extraits végétaux, phytothérapie, stimulation des composés secondaires…)*

- ***Local*** *: Salle B*
- ***Modérateurs*** *: Pr. Nadia GSEYRA, Pr. Khalida MOKHTARI*
- ***Rapporteur*** *: Pr. Khadija CHAKROUNE*

16:00 – 17:40	• **CO213**– Antimicrobial Potential of the lichen *Pseudevernia furfuracea* Volatile Compounds from Morocco **Yasser Essadki, Adel Hilmi, Mariana Girão, El Mehdi Darrag, Rosário Martins, Abderrahmane Romane, Soukaina El Amrani Zerrifi, Richard Mugani, Zakaria Tazart, El Mahdi Redouane, Vitor Vasconcelos, Alexandre Campos, Fatima El Khalloufi, Brahim Oudra, Mustapha Barakate, Maria de Fátima Carvalho** • **CO214** – Phytochemical Profiling and Bioactivity of *Petroselinum crispum* Hydroethanolic Extract **Ibrahim SADOUGUI, Meryem IDRISSI YAHYAOUI, Mohamed TAIBI, Mohamed Amine MEZIANE, Lamyae MEHANE, Amine Elbouzidi, Alexandre NOIRIEL, Reda BELLAOUCHI, Bouchra EL GUERROUJ, Ennouamane SAALAOUI, Abdeslam ASEHRAOU** • **CO215** – Phytochemical, antioxidant, and antimicrobial insights into *Cuminum cyminum L.* essential oils **Lamyae MEHANE, Ibrahim SADOUGUI, Mohamed Amine Meziane, Meryem Idrissi Yahyaoui, Mohamed Taibi, Reda BELLAOUCHI, Rachid SABBAHI, Mounir Haddou, Amine Elbouzidi, Aleksandar Széchenyi, Bouchra El Guerrouj, Abdeslam ASEHRAOU** • **CO216** – Exploring the multifaceted bioactivities of *Lavandula pinnata L.* essential oil: promising pharmacological activities. **Mounir Haddou, Amine Elbouzidi, Mohamed Taibi, Abdellah Baraich, El Hassania Loukili, Tarik moubchir, Aimad Allali, Reda Bellaouchi, Ennouaamane Saalaoui, Abdeslam Asehraou, Mohamed Addi, Bouchra El Guerrouj, and Khalid Chaabane** • **CO217** – Impact of Xylooligosaccharides on Metabolic Activity of *Lactiplantibacillus plantarum S61*: Generation of Bioactive Metabolites with Antioxidant and Antimicrobial Activities. **Meryem Idrissi Yahyaoui, Nour Eddine Bentouhami, Sara Moumnassi, Amine Elbouzidi, Mohamed Taibi, Doha Berraaouan, Reda Bellaouchi, Lamyae Mehane, Ibrahim Sadougui, Mohamed Amine Meziane, Mounir Haddou, Bouchra El Guerrouj, Bassem Jaouadi, Abdelkarim Abousalham, Ennouamane Saalaoui and Abdeslam Asehraou** • **CO218** – Enhanced production of secondary metabolites in medicinal plant cell cultures: effects of melatonin and salicylic acid on bioactive compounds **Yousra HAMMOUTI, Amine ELBOUZIDI, Soukaina TERROUFI, Francois MESNARD, Mohamed ADDI** • **CO219–** Valorization of polysaccharide from *Laurus nobilis* leaves: Structural analysis and in vitro and in vivo biological applications **Imen Trabelsi, Naourez Ktari, Wafa Gargouri, Sirine Ben Slima, Sana Bardaa, Amina Maalej, Lobna Jlaiel, Mohamed Chamkha and Riadh Ben Salah** • **CO220**– Exploration of Moroccan medicinal plants traditionally used in the treatment of infectious diseases **OUASTI Imane, OUASTI Mohammed and ELACHOURI Mostafa** • **CO221**– Prise en charge du stress et des états anxieux par phytothérapie **Salah-Eddine El Jabiry, Bouchra Oneib** • **CO222**– Effect of Moroccan Saffron By-Product Extracts Against Some Pathogenic and Multidrug-Resistant Bacteria **Ikram BERAOUZ, Assya AHARRAR, Khadija LACHGUER, Mohamed BEN EL CAID, Fatima HAMADI and Mohammed Amine SERGHINI**

Sous-Session T2-C : Matériaux biosourcés, composites et procédés durables de transformation

(Transformation post-récolte en matériaux ou ingrédients durables, textiles, emballages, bioplastiques, additifs)

- ***Local*** *: Salle C*
- ***Modérateurs*** *: Pr. Abderrahmane EL IDRISSI, Pr. Mohamed JABRI*
- ***Rapporteur*** *: Pr. Tarik HARIT*

16:00 – 18 :00	• **CO223**– A Green Approach to Synthesizing Flame Retardant and Antifungal Materials by Phosphorylation of Allyl Cellulose via a Radical-Mediated "Click" Reaction **Ayoub Abarkan, Nafea Achalhi, Ridouan El Yousfi, Brahim Elmekaoui, Sara Moumnassi, Meryem Idrissi Yahyaoui, Abdeslam Asehraou, Abderahmane El Idrissi** • **CO224**– Physicochemical Characterization of Celluloses Extracted from "Quinoa" stems of eastern Morocco **Nafissa Benchellal, Nafea Achalhi, Ridouan El Yousfi, Ayoub Abarkan, Abderahmane El Idrissi**

	• **CO225**– Synergistic Effects of PCL and PBS in Biodegradable Polyurethanes: Impact on Properties and Biodegradation Rate. **Chaimae Kheddar, Nafea Achalhi, Abderrahmane El Idrissi** • **CO226**– Study of new composites based on cellulosic fibers **Ahmed RAMDANI, Chakib MOKHTARI, Fouad MALEK** • **CO227**– Isocyanate-and phosgene-free routes to polyfunctional cyclic carbonates from castor oil **Chakib MOKHTARI, Ahmed RAMDANI, Fouad MALEK** • **CO228**– Eco-Extraction of Phenolic Compounds from Moroccan Olive Fruits, Leaves, and their Potential use as Antimicrobial Agents **Wafa LAABOUDI, Meriame RTEL BENNANI, Meryem MRANI ALAOUI and Hanae NACEIRI MRABTI.** • **CO229**– Optimization of the post-harvest process for Moroccan dates and valorization of the sorting residues **MISBAH Asmae, EL ANSARI Meryeme, AIT-NOUNOU Safae, BENAMAR Houria, BENAJI Chaimaa, MOUTAOUKIL Ayoub, AIT HIDA Mehdi, AZIZ Siham, ZYADI Fatimzehra, EL AMMARI Hajar, ESSARIOUI Adil, NOUTFIA Younes** • **CO230**– Cumin and Sustainable Development: An Innovative Agroecological Model to Address Climate Challenges **BOUAKKA CHOUKRI** • **CO231**– Advances in Bioplastics for Ecological Transition and Sustainable Development **Chaimae MERIMI, Rachid TOUZANI, TADEUSZ SZUMIATA, Mohamed SIAJ, Belkheir HAMMOUTI** • **CO232**– Cosmetic valorization of acid-hydrolyzed extracts from cladodes and fruit by-products of Opuntia species resistant to *Dactylopius opuntiae* **Abderrahmane Hadini, Amine El Bouzidi, Mouhamaddine Moumou, Tayebi Amani, Imane Mokhtari, Mourad Bendada, Reda Bellaouchi, Solimane Amrani, Khalid El Bekkaye, Hicham Harnafi.** • **CO233**– Synthesis and Antimicrobial Evaluation of Novel Pyrazole-Based Ligands **Islam QORRI, EL Mehdi HAILY, Aziz BOULOUIZ, Rachid TOUZANI, Ismail OZDOMIR.** • **CO234**– Antimicrobial Potential of Pyrazole Derivatives: Biological Evaluation, Pharmacokinetic Prediction, and Molecular Docking Insights **Zakariae Abbaoui, Hüseyin Karci, İsmail Özdemir, Rachid Touzani**
18:00 – 18:10	**Discussions**

Vendredi 20 juin 2025	
<u>Session III</u> : Qualité, Sécurité, Nutrition, et Santé : un engagement pour l'avenir (pathogènes, xénobiotiques, antimicrobiens, probiotiques, nutraceutiques, …) --- • ***Lieu*** *: Salle A (Salle de conférences)* • ***Modérateurs*** *: Pr. Rachid SABBAHI, Pr. Samir ANANOU* • ***Rapporteur*** *: Pr. Reda BELLAOUCHI*	
09:00 – 09:20	**Conférence introductive 1:** **Riadh BENSALAH, Centre de Biotechnologie de Sfax, Tunisia:** « New insights on probiotic lactic acid bacteria activities ». (prebiotics, probiotics, postbiotics) »
09:20 – 09:40	**Conférence introductive 2:** **Aleksandar Széchenyi, University of Pécs, Hungary:** « Targeted Delivery of Natural Antimicrobials ».

09:40 – 09:50	**Discussions**
09:50 – 10:30	**Pause-Café + Posters & visite des Stands d'exposition**

Sous-session T3-A : Prévention et traitement des maladies : nouvelles approches thérapeutiques et alternatives naturelles
(Couvre les stratégies innovantes, extraits naturels, probiotiques, molécules bioactives ou synergies pour la santé humaine)

- ***Local*** *: Salle A (salle de conférences)*
- ***Modérateurs*** *: Pr. My Mustapha ENNAJI, Pr. Abderrazak SADDARI*
- ***Rapporteur*** *: Pr. Reda BELLAOUCHI*

10:30 – 12:20

- **CO31:** *A Green Weapon Against Antibiotic Resistance: Silver Nanoparticles to Eradicate Klebsiella Infections*
  Assya Aharrar, Elmahdi Blalouz, Soufiane Elmegdar, Oussama Aboulkassim, Asma Laktib, Fouad Msanda, Hassi Mohamed, Fatima Hamadi
- ***CO32:*** *Advancing the Fight Against Antimicrobial Resistance of Pathogenic Bacteria: Unleashing the Power of Alternative Combinational Therapies Through Drug Repurposing Approach: Case of Staphylococcus aureus Multidrug Resistant Strains.*
  Zaineb Chagra, Wessal Ouedrhiri, Rachid El Fatimy, Reda Ben Mrid
- **CO33:** *Study of the Cytotoxic Activity of Pyrethrum Anacyclus Against Cancer Cells*
  Aziza El Baz
- ***CO34:*** *Synthesis, Biological Evaluation, and Computational Docking Analysis of Novel 1,2,3-Triazole-8-quinolinol Derivatives*
  M. El Faydy, L. Lakhrissi, B. Lakhrissi, K. Ounine, B. Tüzün, A. Zarrouk, Dafali
- **CO35:** *Fusobacterium nucleatum in Colorectal Cancer: Diagnostic and Therapeutic Implications*
  Messaoudi Meryem, Bennani Amal
- ***CO36:*** *Innovative Bacteriocin OF71 Based Hydrogel for Targeted Treatment of Mycobacterial Skin and Mucosal Infections*
  Meryem Bouraqqadi, Ghita Benkirane, Zoubir Oumaima, Laila Manni, Samir Ananou
- ***CO37 :*** *Rôles des nutraceutiques dans la prévention des effets négatifs associés à la consommation de la viande rouge*
  ZAKI RABAB
- ***CO38:*** *The Role of Probiotics in the Management of Biofilm-Associated Infections: A Promising Therapeutic Strategy*
  Oussama Grari, Said Ezrari, Imane Elyandouzi, Mohammed Karim Elazzouzi, Mohammed Lahmer, Abderrazak Saddari, Adil Maleb.
- ***CO39:*** *Optimization of Therapeutic Strategies Against Multiresistant Acinetobacter Baumannii: New Challenges and Future Prospects*
  Imane El Yandouzi, Said Ezrari, Oussama Grari, Mohammed Lahmer, Abderrazak Saddari, Adil Maleb
- ***CO310:*** *Anti-inflammatory Potential of Pistacia lentiscus L. Seed Extract: A Natural Alternative with Comparable Efficacy to Indomethacin*
  Sara Seddoqi, Ghizlane Nouioura, Ouahiba Laout, Nadia Gseyra
- ***CO311:*** *Extraction, Purification, Characterization, and Wound Healing Effects of Novel Prickly Pear (Opuntiaficus-indica (L.) Mill.) Heteropolysaccharides*
  Naourez Ktari, Wafa Gargouri, Lobna Jlaiel, Imen Trabelsi, Sirine Ben Slima, Sana Bardaa, Farida Bendali, and Riadh Ben Salah

Sous-session T3-B : Nutrition, antioxydants et ingrédients fonctionnels pour la santé
(Miels, huiles, extraits végétaux, nutraceutiques et analyses de la qualité nutritionnelle…)

- ***Local*** *: Salle B*
- ***Modérateurs*** *: Pr. Samir ANANOU, Pr. Reda BELLAOUCHI*
- ***Rapporteurs*** *: Dr. Noureddine BENTOUHAMI*

10:30 – 12:10	• ***CO312:*** *Polyphenol-Rich Honey from Northern Morocco: A Potential Source of Antioxidant and Antibacterial Agents* **Achtoun Omaymaa, Elmtili Noureddinea, Mennane Zakariaa** • ***CO313:*** *Ceratonia siliqua L. Pulp from the Middle Atlas of Morocco: Biochemical Composition, Antioxidant and Antimicrobial Activities* **Fatima-Ezzahra Eddabbeh, Sabir Ouahhoud, Sara Moumnassi, Ayoub Ainane, Meryam Idrissi Yahyaoui, Salma Kadda, Anas Ziani, Sanae Baddaoui, Reda Bellaouchi, Bouchra El Guerrouj, Ennouamane Saalaoui, Abdeslam Asehraou, Tarik Ainane.** • ***CO314:*** *The Effect of Drying Modes on the Chemical Composition and Bioactivities of Cannabis sativa L. Seeds Oil from Morocco* **O. Boussetta, M. Idrissi Yahyaoui, A. Asehraou, M. Ramdani.** • ***CO315:*** *Newly Synthesized Benzimidazole Derivatives: Synthesis, Characterization and Theoretical Investigation* **Nouhayla Riadi, Mohamed Azzouzi, Israe Aiadi, Walid Daoudi, Abdelouahad Oussaid, Adyl Oussaid** • ***CO316:*** *Unveiling the Differential Antioxidant Activity of Maslinic Acid in Murine Melanoma Cells and Rat Embryonic Healthy Cells After Sodium Nitroprusside (SNP) Treatment* **Khalida Mokhtari, Amalia Pérez-Jiménez, Leticia García-Salguero, Cristina E. Trenzado, José A. Lupiáñez And Eva E. Rufino-Palomares** • ***CO317:*** *Evaluation of the Interaction Between Menthol and Camphor, Major Compounds of Clinopodium nepeta Essential Oil: Antioxidant, Anti-inflammatory and Anticancer Activities Against Breast Cancer Cell Lines* **Mohamed Taibi, Amine Elbouzidi, Mounir Haddou, Abdellah Baraich, Meryem Idrissi Yahyaoui, Reda Bellaouchi, Amine Khoulati, Abdeslam Asehraou, Mohamed Addi, Bouchra El Guerrouj, And Khalid Chaabane** • ***CO318:*** *Synergistic Effects of Ormenis multicaulis and Carum carvi in Preventing Hepatobiliary Calcifications and Microlithiasis in Sprague Dawley Rats: A Histopathological Study* **El Mahdi Wakrim, Abderrahman Chait, Brahim Bouizgarne** • ***CO319:*** *Valorisation des Métabolites Secondaires de l'Arganier (Argania spinosa L.): Analyse du Taux de Polyphénols et de l'Activité Antioxydante* **Hachimi Fatehellah, Ibrahim Toufik, Oudija Fatiha, Ilham Belkoura.** • ***CO320:*** *Co-production of Enzymes and Biosurfactants for Eco-friendly Biodetergent Formulation* **Slaoui Chaymae, Bahafid Wifak, Bouraqqadi Meryem, Zaazoui Nouhaila, Ananou Samir Et Manni Laila** • ***CO321:*** *The Microencapsulation Effect on Lactobacillus plantarum S61: Enhancing Viability and Gastrointestinal Stability* **Moumnassi Sara, Gharsallaoui Adem, Brahmi Mohamed, Idrissi Yahyaoui Meryem, Bentouhami Nour Eddine, Bellaouchi Reda, Dumas Emilie, Saalaoui Ennouamane, Asehraou Abdeslam** • ***CO322:*** *Phytochemical Study and Evaluation of the Antioxidant and Antimicrobial Activities of an Aqueous Extract Obtained by Reflux Heating of Piper nigrum Seeds* **Nouhaila AMRANI, Meryem IDRISSI YAHYAOUI, Abdeslam ASEHRAOU, Mohammed RAMDANI** • ***CO323:*** Étude multidisciplinaire de l'huile essentielle de Laurus nobilis : Composition chimique, bioactivités et interactions moléculaires **Yousra Belbachir, Mohamed ED Dahmouny, Reda Bellaouchi, Abdessamad Beraich, Abdeslam Asehraou and Abdelmoneam Talhaoui**

Sous-session T3-C : Santé environnementale, sécurité et nouvelles technologies pour la santé

(Pollution, microbiologie environnementale, intelligence artificielle, évaluation des risques et biotechnologies)

- ***Local*** *: Salle C*
- ***Modérateurs*** *: Pr. Khalid OUFDOU, Pr. Wafae MRABTI, Pr. Elmiad KERKOUR,*
- ***Rapporteur*** *: Dr. Mohamed TAIBI*

10:30 – 12:30	• ***CO323:*** *Impact de la pollution sur les eaux de la nappe phréatique de Sidi Allal Tazi Gharb, Maroc* **Noura Ait Said, Noura Lmoudn** • ***CO324:*** *Effect of Fabric Dyes on the Physicochemical Characteristics of Cloth Facemasks* **Chennoufi Ikhlas Hani, El Louali Mostafa, Zahir Hafida, Latrache Hassan** • ***CO325:*** *Physicochemical Characterization of Gallstone Surfaces and Their Influence on Salmonella Typhi Adhesion* **Fadoua LOUGLALI, Abdeslam JAAFARI, Souad LEKCHIRI, Iman MEFTAH, Hafida ZAHIR, Mostafa EL LOUALI And Hassan LATRACHE** • ***CO326:*** *Effects of Road Leaching on Lake Water Quality: An Analysis of Health Risks Linked to Heavy Metals* **Ihsane Ougrad, Zahra Elassassi, Abdessamad Mrabet, Ibrahim Mssillou, Adrian Lim, Abdelaaty Abdelaziz Shahat, Sanae Rezouki, Tarik Moubchir** • ***CO327:*** *Age, Growth and Exploitation of Chamelea gallina (Bivalvia: Veneridae) on the Eastern Mediterranean Coast of Morocco* **Amira Kharkhache, Souad Abdellaoui, Douaa Slimani, Imane Khamlichi, Rajae Mouedden, Nassir Kaddouri, Mohamed El Yaakoubi, Youssef Smiri** • ***CO328:*** *The Impact of PECS in the Context of AAC in Individuals with ASD* **Lamiae Hajji, Pr Fatima El Ghazouani** • ***CO329:*** *Commercial Fish as a Bioindicator of Microplastic Pollution in Morocco* **Maryam Ouheddou, Mohamed Rida Abelouah, Mohamed Ben-Haddad, Nour.Eddine Laaraj, Karim Sahla, Aicha Ait Alla.** • ***CO330:*** *Temporomandibular Joint and Machine Learning: Systematic Review* **Oussama Abali, Aissa Kerkour Elmiad, And Abdlekrim Daoudi** • ***CO331:*** *Biocontrol Potential of Olive Mill Wastewater (OMWW) as a Sustainable Approach to Mitigate Pseudomonas savastanoi Adhesion* **Soukaina Mitro, Taoufik Hakim, Chorouk Zanane, Mostafa El Louali, Hassan Latrache, Hafida Zahir.** • ***CO332:*** *Machine Learning Applications in Biofilm Research: A Bibliographic Review* ***Yasser Chouhari, Iman Meftah, Fadoua Louglali, Soukaina Mitro, Chaima Oujaba, Hassan Latrache, Hafida Zahir.*** • ***CO333:*** *Contamination of Irrigation Water with Microcystins: Assessment of Their Bioaccumulation and Related Health Risk, Case Study Lalla Takerkoust Lake, Marrakech, Morocco* **Majida Lahrouni, Khalid Oufdou, El Mahdi Redouane, Brahim Oudra, Alexandre Campos, Vitor Vasconcelos** • **CO334:** Search for metabolomic signatures to determine the exposome of honey bees (*Apis mellifera*), a colony health indicator. **Safae Ouali, Serena Giuliano, Anne Claire Martel, Sabine Lindenthal, Thierry Pourcher, Veronique Duquesne, Sonia Dagnino.**
12:30 – 12:40	**Discussions**

12:40 – 14:30	**Pause-Déjeuner**
<u>Session IV</u> : Coproduits et économie circulaire : vers une gestion responsable des bioressources (dessalement, traitement et réutilisation des eaux usées, bioremédiation, biotransformation, bioénergie,…) --- • ***Lieu*** *: Salle A (Salle de conférences)* • ***Modérateurs*** *: Pr. Nour Eddine CHIHIB, Pr. Nabil GHABOUR* • ***Rapporteur*** *: Pr. Khalida MOKHTARI*	
14:30 – 14:50	**Conférence introductive 1:** **Jaouadi BASSEM, Centre de Biotechnologie, Sfax, Tunisie** : « Advancing Extremozymes Discovery: Exploiting Next-Generation Sequencing for Sustainable Industrial Innovation through Genomic and Metagenomic Approaches ».
14:50 – 15:10	**Conférence introductive 2 :** **Abdelkarim ABOUSALHAM, Université de Lyon 1, France** : « Structure-Function Relationships of Fungal Lipases/Phospholipases isolated from extreme environments »
15:10 – 15:20	**Discussions**
<u>Sous-session T4-A</u> : Valorisation énergétique, bioénergies et traitement des effluents *(coproduits, sous-produits, déchets, énergie et bioremédiation)* --- • ***Local*** *: Salle A (Salle de conférences)* • ***Modérateurs*** *: Pr. Mustapha BARAKATE, Dr. Hassan ERRAJI* • ***Rapporteur*** *: Dr. Sanae BADDAOUI*	
15:20 - 17:30	• **CO41:** Extraction and Characterization of Maltenes from a Bio-Oil Produced via Hydrothermal Liquefaction of Olive Mill Wastewater: Towards Bioenergy Valorization **Basaoud Soumaya, Ouahouah Zineb, Miftah Amine, El Harfi Khalifa, Aboulkas Adil** • **CO42:** Hydrothermal Carbonization of Wood Sawdust: Process Optimization and Material Characterization **Amine Miftah, Leila Azaryouh, Zineb Ouahouah, Soumaya Basaoud, Khalifa El Harfi, Adil Aboulkas** • **CO43:** Preparation and modification of Nanocellulose for wastewater treatment: A review **Israe Aiadi, Nouhayla Riadi, Mohamed Azzouzi, Adyl Oussaid,** • **CO44:** Comparative Study of Bacterial Consortiums for the Simultaneous Degradation of Synthetic Dyes and Hexavalent Chromium **Nouhaila Zaazoui, Naima Elghachtouli, Meryem Bouraqqadi, Chaymae Slaoui And Wifak Bahafid** • **CO45:** Optimization of Dye Adsorption in Aqueous Solutions: A Kinetic and Thermodynamic Study of Mechanically Treated Biochar **Zineb Ouahouah, Amine Miftah, Soumaya Basaoud, Khalifa El Harfi, Adil Aboulkas** • **CO46:** Enhanced Biomethane Production from Olive Mill Wastewater through Co-Digestion with Cow Dung, Fruit, Vegetable, and Fish Wastes: An Experimental and Kinetic Study **Hassan Erraji. Essadek Abdessadek. Anas Tallou. Abdeslam Asehraou** • **CO47:** Exploring the Potential of Treated Dairy Factory Wastewater Reuse (Whitewater) in Agriculture: A Comprehensive Analysis of Its Viability for Crop Irrigation in the Meknes Region **Oulaya Zoui, Mustapha Barodi, Aziz Abouabdillah, And Mohamed Bourioug** • **CO48:** Isolation of a Chromium-Resistant Bacterial Strain from Oued Martil, Morocco for Environmental Bioremediation **Hafsa Zlali, Khay El Ouardy, Samira Bouhdid** • **CO49:** Impact of Microcystins-contaminated water on Strawberry (*Fragaria vulgaris*) hydroponic culture: Phytotoxic effects, antioxidant defense, microcystins transfer and health risk assessment **Fatima El Khalloufi, Mohammed Haida, Yasser Essadki, Richard Mugani, Alexandre Campos, Vitor Vasconcelos, And Brahim Oudra**

	• **CO410:** Plants-beneficial microorganisms-nature bioremediation of mine tailing's sites **Tarik Sahlaoui, Anas Raklami, Stefanie Heinze, Bernd Marschner, Adnane Bargaz, Khalid Oufdou** • **CO411:** Biochemical profiling and seasonal trends of Alginates in *Cystoseira humilis* (Phaeophyceae): Implication for Potential Commercial Harvesting Strategy **Khaoula Khaya, Khansae Kamal, Fouad Bentiss, Charafeddine Jama, Zahira Belattmania, Brahim Sabour** • **CO412:** Biochar: An innovative solution for CO_2 capture and environmental remediation **Afaf El Idrissi, Dalia Allouss, Ines Esma Achouri, Bouflja Bouammali, Rachid Touzani.** • **CO413:** Microbial Fuel Cells performances using a Photocathode for Energy Production and Wastewater Treatment **Fatima Ezzahra Al Azhari, Noureddine Touach, Fouzia Allali, Abdellah Benzouak, El Mostapha Lotfi**
<u>Sous-session T4-B</u> : Valorisation matière et extraction de composés bioactifs à partir de coproduits, sous-produits, déchets, matériaux et extraits bioactifs… --- • ***Local*** *: Salle B* • ***Modérateurs*** *: Pr. Houssam ABOULOIFA, Pr. Rachid SABBAHI* • ***Rapporteur*** *: Dr. Meryem IDRISSI YAHYAOUI*	
15:20 – 17:30	• **CO414:** Discovery, Purification, and Functional Analysis of Two Novel Thiol Peroxidases (TP24p15 and TP37m5) Uncovered via Metagenomic Library Screening **Nadia ZARAI JAOUADI, Rihab AMERI, Monia MEZGHANI and Bassem JAOUADI** • **CO415:** Evaluation of Total Phenolic and Flavonoid Content, and Antioxidant Activity of Clove Extracts **Ziani Anas, Baddaoui Sanae, Eddabah Fatima Zahra, Sabir Ouahhoud, Amine Khoulati, Samira Mamri, Iliass Lahmass, Redouane Benabbes, Abdeslam Asehraou, And Ennouamane Saalaoui.** • **CO416:** Production of a thermal endo-polygalacturonase from *Aspergillus niger* HO32: Purification, characterization, and application **Nour Eddine Bentouhami, Meryem Idrissi Yahyaoui, Sara Moumnassi, Reda Bellaouchi, Houssam Abouloifad; Nabil Ghabbourz, Abdelkarim Abousalham, Ennouamane Saalaoui, Loubna Firdaous, Bassem Jaouadi, Abdeslam Asehraou** • **CO417:** Biotechnological Valorization of Olive Leaf Extracts Through Fermentation: Enhancing Antimicrobial, Antioxidant, and Bioremediation Potential **Mohamed Amine Meziane, Jean-François Deliège, Abderrahim Boughrara, Ibrahim Sadougui, Meryem Idrissi Yahyaoui, Lamyae Mehane, Mohamed Taibi, Amine Elbouzidi, Reda Bellaouchi, Bouchra El Guerrouj, Ennouamane Saalaoui, Abdeslam Asehraou** • **CO418:** Valorization of olive by-products in the Tangier-Tetouan-Al Hoceima, Fez and Rabat regions: case of olive and argan tree grignons **Mennane Zakaria, Zinedine Mohamed, Mrani Alaoui Mohammed, Elmtili Nourredine** • **CO419:** History of microalgae: from their origin to modern applications **Soukaina Terroufi, Yousra Hammouti, Abderrahmane Belkasmi, Eva E. Rufino-Palomares, Amalia Pérez-Jiménez, Cristina E. Trenzado, José A. Lupiáñez, Said Ezrari, Adil Maleb, Hosam M. Safaa, Abdeslam Asehraou, Reda Bellaouchi, Redouane Benabbes, David Correa-Galeote, Alejandro González-Martínez, Jesús González-López And Khalida Mokhtari.** • **CO420:** Sustainable valorization of shrimp by-products in the region of Laayoune-Sakia El Hamra: Potential for chitin and chitosan production **Anouar Bouanga; Soumaya El Assri; Mounsef Neffa; Naima Boumezrague; Rachid Sabbahi** • **CO421 :** *Crocus sativus* (le safran) et ses sous-produits : éléments préventifs, thérapeutiques et génoprotecteurs **Ben Mbarek Soufiane, Asabir Ouahhoud, A Iliass Lahmass, A Abdellah Baraich, Aanas Ziani, Bamine Elbouzidi, Asanae Baddaoui, Aamani Teybi, Aghorbal Khadija, Aredouane Benabbes, And Aennouamane Saalaoui.** • **CO422:** Multi-residue methods for the analysis of priority organic micropollutants in aqueous environmental matrices **A.Azzal, B. Elguerrouj, A. Ouasrhir, H. Madani, Y. Smiri** • **CO423:** Towards eco-friendly alternatives to prevent $CaCO_3$ scale formation in brackish water demineralization processes

	Ilham Karmal, Sara Darbal, Mustapha Nassiri, Jamila El Gaayda, M'barek Belattar, Said Ben-Aazza, Naima Hafid, Abdelaziz Ait Addi, Rachid Ait Akbour, Ali Driouiche • **CO424:** Chemical Characterization of Biodiesel Derived from *Jatropha curcas* for Use in Combustion Engines **Imane Elkhamlichi, Ouafae Mokhtari, Fatima Brahmi, Amira Khachkhach, Chaymae Himri, Youssef Smiri.** • **CO425:** 3D-QSAR, ADMET and Molecular Docking Study of a Series of 2-Substituted 1H-Benzimidazole-4-Carboxamide Derivatives Inhibitors Against Enteroviruses **Nidal Naceiri Mrabti, Hanae Naceiri Mrabti, Mouna Mekkaoui, Jamal Sayah, Yassir El Ouadi, Mohamed Er-rajy, Abdelhakim Bouyahya, Menana Elhallaoui.** • **CO426:** Exploring alginate potential in benthic and newly encountered pelagic *Sargassum* species (Brown Seaweeds) on the Moroccan Atlantic Coast **Khansae Kamal, Khaoula Khaya, Fouad Bentiss, Charafeddine Jama, Zahira Belattmania, Brahim Sabour**
17:30 – 17:40	**Discussions**
17:40 – 17:50	**Pause-Café + Posters & visite des Stands d'exposition**
17:50 – 18:20	**Remise des prix** (meilleures communications : orale et poster)
Samedi 21 Juin 2025	
<u>Workshop</u> : Biotechnologies et intelligence artificielle : Opportunités pour l'Entrepreneuriat, le Développement Durable et l'Économie Circulaire --- • ***Local*** *: Salle A (Salle de conférences)* • ***Modérateurs*** *: Pr. Saad IBNSOUDA, Pr. Bouchra EL GUERROUJ* • ***Rapporteur*** *: Pr. Redouane BENABBES*	
09:00 – 09:20	**Noureddine CHIHIB, Université de Lille, France :** « Enzymatic and Microencapsulated Terpenes-Based Hurdle Approach to Target pathogenic bacterial Biofilms ».
09:20 – 09:40	**Adem GHARSALLAOUI, Université de Lyon 1, France :** « Microencapsulation of natural bioactive molecules and microorganisms: an innovative approach for food preservation».
09:40 – 09:50	**Discussions**
09:50 – 10:15	**Pause-café**
10:15 – 10:35	**Mohamed CHIKHAOUI, IAV Hassan II, Rabat, Maroc:** « Intelligence Artificielle au service de la gestion durable des ressources naturelles »
10:35 – 10:55	**Jabir CHAOUI, Entreprise GLOBAL DIAGNOSTIC DISTRIBUTION (GDD), Témara, Maroc :** « Sur la trace des gènes : la PCR digitale QIAcuity vers une nouvelle ère de précision en biotechnologie »:
10:55 - 11:15	**Mohamed BOUDCHICHE & Mohamed ADDI, Université Mohammed Premier, Oujda, Maroc**: « Cultures hors sol: smart farm »

11:15 - 11:30	**Témoignages (entreprises , coopératives) :** • **Entreprise TRIFFA Conserves, SARL :** « Production des olives de table » • **Coopérative « Oulad Meryem » :** « Valorisation des coproduits du cactus » • **Coopérative « Oriental Gold » :** « Production de produits cosmétiques »
11:30 - 11:50	**Table ronde :** Recherche scientifique en biotechnologies et Intelligence artificielle au service de la société. --- • **Modérateurs** : Saad IBNSOUDA, Bouchra EL GUERROUJ, Abdeslam ASEHRAOU, Pr. Elmiad KERKOUR, Pr. Wafae MRABTI • **Rapporteurs** : Nabil GHABOUR, Redouane BENABBES
11:50 - 12:15	**Cérémonie de clôture** du 2ème Colloque International de Bioressources, Biotechnologies et Développement Durable
12:15 - 20:00	**Excursion : Dans la région de Saïdia**

SESSION POSTERS

Session I : Production primaire innovante et durable intégrant l'Analyse du Cycle de Vie (ACV) : *(préservation des ressources en eau, lutte biologique et biopesticides, biostimulants des plantes...)*	
CA11	Evaluating the Efficacy of Rhizobium Isolates as Biological Control Agents Against and *Clavibacter michiganensis subsp. Michiganensis* (Bacterial Canker) in *Solanum lycopersicum* (Tomato) **Firaouni Abderrahim, Bouharroud Rachid, Aidi Huo, Chafiki Salahddine, Chabbi Naima, Mahroug Abdelmalek, El Assri Soumaya, Aberkani Kamal And Qessaoui Redouan**
CA12	Assessment of Ultrasonic Processing Effects on the Stability and Therapeutic Potential of Bioactive Compounds in Mastic Gum (*Pistacia lentiscus*) **Beraich Abdessamad, Burak Dikici, Krastena Nikolova, Daniela Batovska, Belbachir Yousra, Asehraou Abdeslam, and Talhaoui Abdelmoneam**
CA13	Le contexte des changements globaux et leur impact sur la distribution d'herbiers marins et de la faune associée dans la lagune de Nador **Bouaiadi El Bachir, Skali Ali, Rezzoum Nor-Eddine, Akodad Mustapha, El Ouamari Najib, Fadili Mohamed, El Bouch Mohammed, Oujidi Bouchra, Zidane Hakima**
CA14	Valorization of Strawberry Tree Leaves from Tazekka Natural Park through nutritional and phytochemical assessments **Fatine ELHLOU, Najat ASSEM, Nabil GHABBOUR, Mohammed El HAOUARI**

CA15	Dynamique Spatio-Temporelle des Communautés Bentho-Demersales Capturées par Chalutage de Fond le Long de la Côte Méditerranéenne Marocaine en Relation avec les Conditions Environnementales : Implications pour la Gestion des Pêcheries **Slimani Douaa, Abdellaoui Souad, Kaddouri Nassir, Mouedden Rajae, Kasmi Khaoula, El Ouamari Najib, Chaabane Khalid**
CA16	Biotransformation of *Crocus sativus L.* By-products: Evaluation of Enzymatic, Antioxidant, and Antimicrobial Activities after Microbial Fermentation **EL GICH Oussama, Abdellah Baraich, Ennouamane SAALAOUI, Abdeslam Asehraou**
CA17	Optimizing Cultivation Depth for Enhanced Biomass and Agar Production in *Gracilaria gracilis* from the Nador Lagoon **Rajae Mouedden, Douaa Slimani, Souad Abdellaoui, Nassir Kaddouri, Khaoula Kasmi, Amira Kharkhache, Najib El Ouamari, Khalid Chaabane**
CA18	Assessment of groundwater contamination with heavy metals and risks to human health - Case of the Angads plain, Morocco **Oualid BOUKICH, Rihab BEN-TAHAR, Nour-elhouda BASRAOUI, Bouchra EL GUERROUJ, Youssef SMIRI**
CA19	Development of biopesticides against fungal diseases **Ouassila Missaoui, Meryem Idrissi Yahyaoui, Lamyae Mehane, Ibrahim Sadougui, Mohamed Amine Meziane, Mohamed Taibi, Bouchra El Guerrouj, Reda Bellaouchi, Abdeslam Asehraou**
CA110	Harnessing Rhizospheric Pseudomonas Isolates to Control *Botrytis cinerea* on Tomato **Qessaoui Redouan, Salahddine Chafiki, Abdelmalek Mahroug, Soumaya El Assri, Abderrahim Firaouni and Rachid Bouharroud**
CA111	Exploring Pseudomonas Siderophores: Production, Spectrophotometric Detection, and Botrytis Inhibition **Qessaoui Redouan, Salahddine Chafiki, Abdelmalek Mahroug, Soumaya El Assri, Abderrahim Firaouni, Mohamed Alouani and Rachid Bouharroud**
CA113	Evaluation of Safety and Antibiotic Resistance Profiles of Lactic Acid Bacteria for Biocontrol Applications **Haitam Lahmamsi, Samir Ananou, Abdessalem Tahiri**
CA114	The influence of the BG11 culture medium on the growth rate of Scenedesmus and Chlorella under the same culture conditions for bioenergy, industrial, and environmental valorization **BOUMALIK DOHA**
CA115	Artificial Intelligence and Water Resource Management: A Synthesis of Recent Work **ELKADI Meryem, CHAFI Abdelhafid, KERKOUR ELMIAD Aissa**
CA116	Health risks associated with heavy metals in Sardina pilchardus from Betoya Bay, Morocco **Rihab BEN-TAHAR, Oualid BOUKICH, Nour-elhouda BASRAOUI, Bouchra EL GUERROUJ, Youssef SMIRI**
CA117	Effet du stress salin sur la germination et la croissance in vitro des variétés de *Cannabis sativa L.* : Beldia et Khardala **TAHTAH Meryem, IBRAHIM Toufik, SAMIR Karima, NORDINE Aicha**
CA118	Calibration of an Artificial Nose Designed for Food Quality Control **LECHAEL Dhoha, BENABDELLAH Nihad, TAIBI Mohamed, MEHANE Lamyae, BELLAOUCHI Reda,ASEHRAOU Abdeslam**

Session II: Transformations post récolte : lutte contre les altérations et les pertes :

(1) défis des fermentations, (2) voies de valorisation des protéines alternatives, (3) antimicrobiens, (4) emballages (actifs, biosourcés, intelligents), (5) approches innovantes dans le nettoyage et désinfection, (6) métabolites secondaires des plantes aromatiques et médicinales, (7) stratégies innovantes pour la biopréservation des aliments …

CA21	Optimized Formulation of a Three-Component Extract Mixture from *Crocus sativus L.* (Stigmas, Leaves, and Tepals) for Enhanced Antioxidant Activity **Abdellah Baraich, Amine Elbouzidi, Mohamed Taibi, Mounir Haddou, Samira Mamri, Reda Bellaouchi, Ramzi A. Mothana, Mohamed Addi, Redouane Benabbes, Mohammed Choukri, Abdeslam Asehraou, Bassem Jaouadi, Ennouamane Saalaoui**
CA22	Phytochemistry and Pharmacological properties of *Portulaca oleracea* L **Ayoub Farihi, Noufel Hachimi, Mohammed Roubi, Youness Mahdi, Bruno Eto and Nadia Gseyra**
CA23	Microbial lipases: A promising tool for dermatological applications **Ibrahim Sadougui, Bouchra El Guerrouj, Alexandre Noiriel, Mohamed Taibi, Noureddine Bentouami, Mohamed Amine Meziane, Lamyae Mehane, Amine Elbouzidi[4*], Reda Bellaouchi, Abdelkarim Abousalham, Bassem Jaouadi, Adem Gharsallaoui, Ennouamane Saalaoui, Abdeslam Asehraou**
CA24	Smart packaging based on bioactive molecules for sustainable food preservation **Lamyae Mehane, Ibrahim Sadougui, Mohamed Amine Meziane, Meryem Idrissi Yahyaoui, Mohamed Taibi, Reda Bellaouchi, Rachid Sabbahi, Mounir Haddou, Amine Elbouzidi, Aleksandar Széchenyi, Bouchra El Guerrouj, Abdeslam Asehraou**
CA25	Flash chromatography-guided valorization of *Rosmarinus tournefortii* By-products for circular economy and bioactive applications **Imane Ziani, Hamza Bouakline, Mohammed Merzouki, Nour Eddine Bentouhami, Oumayma Sayah, Soumia Taibi, Abdeslam Asehraou, Ali El Bachiri**
CA26	Post-Harvest Quality Assessment and Loss Reduction in Exported Clementines: Case of Fina Berkane and Bruno Varieties in Morocco **Houmy Nadia, M'harzi AbdelHakim, El Fazazi Kaoutar, Touzani Rachid, Noutfia Youness**
CA27	Microbial Biofilms in Table Olive Fermentation: Role and Optimization **Hamza NIDBRKA, Yahya ROKNI, Hafida ZAHIR, Mostafa ELLOUALI and Hassan LATRACHE**
CA28	Valorization of Moroccan Brown Seaweeds through Optimized Alginate Extraction, Structural Characterization, Development of Biofilms, and Evaluation of Antimicrobial Activities **Souad El Quoul, Meryem Idrissi Yahyaoui, Mohamed Amine Meziane, Ibrahim Sadougui, Lamyae Mehane, Mohamed Taibi, Reda Bellaouchi, Bouchra El Guerrouj, Bouaiadi El Bachir, Brahim Sabour, Ennouamane Saalaoui and Abdeslam Asehraou**
CA29	Improving the Fermentation of Unsalted Moroccan Picholine Green Olives Using Heat-Shock Treatment. **Meryem Idrissi Yahyaoui, Sara Moumnassi, Nour eddine Bentouhami, Reda Bellaouchi, Mohamed Taibi, Mounir Haddou, Amine El Bouzidi, Lamyae Mehane, Ibrahim Sadougui, Mohamed Amine Meziane, Bouchra El Guerrouj, Abousalham Abdelkarim, Saalaoui Ennouamane, Bassem Jaouadi and Abdeslam Asehraou**
CA210	Antibiofilm effect of Zataria multiflora Boiss. essential oil against *Streptococcus pneumoniae* and *Pseudomonas aeruginosa* **Viktória Lilla Balázs, Barbara Vörös-Horváth, Bence Bordás, Edit Ormai, Aleksandar Széchenyi, Györgyi Horváth**
CA211	Sustainable Valorization of *Ulva sp.* from the Marchica Lagoon: Towards the Optimization of Bioactive Compound Extraction **Sara AZHAF, Said BELLAHCEN, Mourad BAGHOUR**

CA212	Impact of Antibiotic and Pesticide Residues on the Sanitary Quality of Animal-Derived Foods **Wiame Ezzarouali, Khalid El Bekkaye, Rachid Benkaddour, Chaouki Belbachir**
CA213	Biotechnological Stimulation of Phenolic Biosynthesis in Geranium (*Pelargonium graveolens* Hort.): Elicitor Strategies, LC-MS/MS Phytochemical Profiling, and Bioactivity Exploration **Amine Elbouzidi, Mohamed Taibi, Abdellah Baraich, Mounir Haddou, Yousra Hammouti, Francois Mesnard, Mohamed Addi**
CA214	Phytochemical Characterization and Evaluation of the Biological Properties of Sargassum spp. By-products: Biotechnological Potential of Crude Extracts and Fermented Products **Safia Labed, Meryem Idrissi Yahyaoui, Lamyae Mehane, Ibrahim Sadougui, Mohamed Amine Meziane, Bouchra El Guerrouj, Reda Bellaouchi, Abdeslam Asehraou**
CA215	Étude biochimique de *Alsidium corallinium*, une algue rouge de la lagune de Marchica **Srhiri Zainab, Ramdani Mohammed**
CA216	*Serenoa repens Extracts: Evaluation of Antimicrobial Effects and Chemical Characterization* **Meryem Raoudi, Meryem Idrissi Yahyaoui, Imane Ziani, Abdeslam Asehraou, Ali Elbachiri, Smaail Radi, Nawel Khalef, Abdelaziz Bakri**
CA217	Optimisation d'une formulation antifongique à base d'eucalyptol, β-pinène et α-terpinène contre *Candida albicans* et *Candida glabrata* : étude par plan de mélanges **Saad Bougrine, Amine Elbouzidi, Mohamed Taibi, Meryem Idrissi Yahyaoui, Mounir Haddou, Bouchra El Guerrouj, Reda Bellaouchi, Abdeslam Asehraou.**
CA218	Phytochemical Profile, Genotoxicity and In Silico Toxicity Assessment, Antioxidant, and Neuroprotective Effects of *Clinopodium nepeta* Essential Oil: Inhibition of Acetylcholinesterase, Butyrylcholinesterase, and Monoamine Oxidase **Mohamed Taibi, Amine Elbouzidi, Abdellah Baraich, Mounir Haddou, El Hassania Loukili, Reda Bellaouchi, Ramzi A. Mothana, Abdullah R. Alanzi, Ennouaamane Saalaoui, Loubna Firdaous, Abdeslam Asehraou, Mohamed Addi, Bouchra El Guerrouj, and Khalid Chaabane.**

Session III : Qualité, Sécurité, Nutrition, et Santé : un engagement pour l'avenir

(pathogènes, xénobiotiques, antimicrobiens, probiotiques, nutraceutiques, …)

CA31	Antioxidant and antimicrobial effects of microalgae **Abderrahmane Belkasmi, Soukaina Terroufi, Reda Bellaouchi, Abdeslam Asehraou, Khalida Mokhtari.**
CA32	Optimization of Anticandidal, Antibacterial and Antioxidant Activities of Citrus Essential Oils Using a Simplex–Centroid Mixture Design **Amine Elbouzidi, Mohammed Taibi, Soumia Barraki, Abdellah Baraich, Meryem Idrissi Yahyaoui, Reda Bellaouchi, Abdeslam Asehraou, Bouchra Elguerrouj**
CA33	Évaluation des paramètres physico-chimiques et bactériologiques de la nappe phréatique des Béni Amir, région de Béni Mellal-Khénifra, Maroc : Perspectives pour une gestion durable de l'eau souterraine **Noura Lmoudn, Noura Ait Said, Radouane Al Amri**
CA34	Sustainable Bioproduction of Industrially Relevant Enzymes and Biosurfactants from Food Waste **Slaoui Chaymae, Manni Laila, Zaazoui Nouhaila, Bouraqqadi Meryem, Ananou Samir Et Bahafid Wifak**
CA35	Acceptability of Three Mediterranean-Inspired Snacks with Health Benefits **Nadia Houmy, Kaoutar Elfazazi, Younes Noutfia, Flavio Cioffi, Sami Fattouch, Nives Ogrinc.**

CA36	Novel clean label approach: Assessment of antimicrobial potential of combined use of aromatic and medicinal plants and bacteriocin *against Salmonella enterica, Bacillus cereus* and *Staphylococcus aureus* in model sausages **MERYEM BOURAQQADI, ABDELJALIL AIT ARBAIN, LAILA MANNI, SAMIR ANANOU**
CA37	Valorization of *Crocus sativus* Stamen By-Products: Antibacterial Potential of Glycosylated and Aglycone Flavonoids against MDR Pathogens **SAMIRA MAMRI, SANAE BADDAOUI, MOHAMMED ROUBI, SAID EZRARI, ADIL MALEB, MOHAMMED CHOUKRI, ABDESLAM ASEHRAOU, AND ENNOUAMANE SAALAOUI**
CA38	Impact of Storage on the Phytochemical Composition and Bioactivity of Saffron Corms **SANAE BADDAOUI, ENNOUAMANE SAALAOUI, SAMIRA MAMRI, SABIR OUAHHOUD, DIEGO SALAGRE, ANAS ZIANI, ABDELLAH BARAICH, AMINE KHOULATI, ABDELKRIM ABOUSALHAM6, BASSEM JAOUADI, ABDESLAM ASEHRAOU, AHMAD AGIL**
CA39	The Dual Therapeutic Potential of *Lactobacillus plantarum* Supernatant: Antifungal and Anticancer Perspectives **MOUMNASSI SARA, GHARSALLAOUI ADEM, BRAHMI MOHAMED, BENTOUHAMI NOUR EDDINE, IDRISSI YAHYAOUI MERYEM, BELLAOUCHI REDA, DUMAS EMILIE, SAALAOUI ENNOUAMANE, ASEHRAOU ABDESLAM**
CA310	Impact of Surface Properties on *Pseudomonas savastanoi* Adhesion: A Comparative Study of the Moroccan Picholine and Spanish Arbequina Olive Cultivars **SOUKAINA MITRO, MOSTAFA EL LOUALI, HASSAN LATRACHE, HAFIDA ZAHIR.**
CA311	Biochemical composition, antioxidant and antimicrobial activities of carob pulp (*Ceratonia siliqua* L.) from Khenifra province (Morocco). **Fatima-Ezzahra Eddabbeh, Sabir Ouahhoud, Sara Moumnassi, Ayoub Ainane, Meryam Idrissi Yahyaoui, Salma Kadda, Anas Ziani, Sanae Baddaoui, Reda Bellaouchi, Bouchra El Guerrouj, Ennouamane Saalaoui, Abdeslam Asehraou, Tarik Ainane.**
CA312	The Role of Artificial Intelligence and the Dietary Microbiota in Colorectal Cancer Pathogenesis. **MESSAOUDI Maryam, BENNANI AMAL**
CA313	Machine Learning Applications in Biofilm Research: A Bibliographic Review **Yasser Chouhari, Iman Meftah, Fadoua Louglali, Soukaina Mitro, Chaima Oujaba, Hassan Latrache, Hafida Zahir.**
CA314	Physicochemical investigation of human gallstones from Beni-Mellal region, Morocco **Fadoua Louglali, Abdeslam Jaafari, Souad Lekchiri, Iman Meftah, Hafida Zahir, Mostafa El Louali and Hassan Latrache**
CA315	Anti-biofilm potential of clove essential oil for continuous glucose monitoring medical devices: toward an innovative strategy for preventing healthcare-associated infections **Markaoui Ikram, Idrissi Yahyaoui Meryem, Asehraou Abdeslam, Daoudi Abdelkrim, Housni Brahim.**

Session IV : Coproduits et économie circulaire : vers une gestion responsable des bioressources

(dessalement, traitement et réutilisation des eaux usées, bioremédiation, biotransformation, bioénergie,…)

CA41	Production biologique de biogaz à partir des déchets organiques via des procédés de fermentation anaérobie **Maryam Fathi, Karima Amghar, Meryem Idrissi Yahyaoui, Mohamed Taibi, Lamyae Mehane, Amine Elbouzidi, Ibrahim Sadougui, Mohamed Amine Meziane, Abdellah Baraich, Mounir Haddou, Bouchra El Guerrouj, Abdeslam Asehraou, Reda Bellaouchi**
CA42	Biotransformation of Tomatoes and Their By-Products by Lactic Acid Bacteria: An Innovative Path to Healthier Tomato-Based Foods **Abdelmoumen Mokhtari, Mohamed Amine Meziane, Meryem Idrissi Yahyaoui, Ibrahim Sadougui, Lamyae Mehane, Mohamed Taibi, Amine Elbouzidi, Sanae Baddaoui, Abdellah Baraich, Reda Bellaouchi, Bouchra El Guerrouj, Abdeslam Asehraou**

CA43	Biotechnological Valorization of Carob (*Ceratonia siliqua* L.) Seed Powder via Microbial Fermentation **Essamhi Aymane, Fatima-Ezzahra Eddabbeh, Meryem Idrissi Yahyaoui, Abdellah Baraich, Mohamed Taibi, Lamyae Mehane, Ibrahim Sadougui, Mohamed Amine Meziane, Nour Eddine Bentouhami, Sara moumnassi, Bellaouchi Reda, Ali berraaouan, El Guerrouj Bouchra, Ennouamane Saalaoui, Asehraou Abdeslam**
CA44	The valorization of flavedo's biological properties through bioconversion via lactic acid bacteria. **Rihab Benmeryeme, Meryem Idrissi Yahyaoui, Mohamed Taibi, Lamyae Mehane, Ibrahim Sadougui, Mohamed Amine Meziane, Amine Elbouzidi, Reda Bellaouchi, Abdeslam Asehraou, Bouchra El Guerrouj**
CA45	Characterization of immobilized *endo*-polygalacturonase PGC-AN64 forms from *Aspergillus niger* HO32 with potential biotechnological interest **Nour Eddine Bentouhami, Sara Moumnassi, Meryem Idrissi Yahyaoui, Reda Bellaouchi, Houssam Abouloifa; Nabil Ghabbour, Abdelkarim Abousalham, Ennouamane Saalaoui, Loubna Firdaous, Bassem Jaouadi, Abdeslam Asehraou,**
CA46	The Valorization of Low-Quality Date Fruits for Microbial Enzyme Production **Kaoutar Eljari, Reda Bellaouchi, Mohammed Taibi, Meryem Idrissi Yahyaoui, Ibrahim Sadougui Mohammed Amine Meziane, Bouchra El Guerrouj, Abdeslam Asehraou, Khadija Chakroune.**
CA47	Isolement, identification et criblage de souches bactériennes productrices de bioplastiques biodégradables : Cas des polyhydroxyalcanoates (PHA) **Karima AMGHAR, Maryam Fathi, Meryem Idrissi Yahyaoui, Mohamed TAIBI, Lamyae Mehane, Amine ELBOUZIDI, Ibrahim Sadougui, Mohamed Amine Meziane, Abdellah BARAICH, Mounir HADDOU, Bouchra EL GUERROUJ, Abdeslam ASEHRAOU, Reda BELLAOUCHI**
CA48	Biomedical potential of nanoparticles produced by sustainable biosynthesis methods **Nada Al Moudani, Ibtissam Ouahidi, Lotfi Aarab**
CA49	Exploring microbial mechanisms for sustainable remediation of heavy metal pollution **Mohamed Amine Meziane, Jean-François Deliège, Ibrahim Sadougui, Meryem Idrissi Yahyaoui, Lamyae Mehane, Mohamed Taibi, Amine Elbouzidi, Reda Bellaouchi, Bouchra El Guerrouj, Ennouamane Saalaoui, Abdeslam Asehraou**
CA410	Assessment of the Phytotoxicity of Dairy Wastewater Using the Lettuce Plant (*Lactuca sativa*) and Duckweed Plant (*Lemna minor*) as Bioindicators **Oulaya Zoui And Mohamed Bourioug**
CA411	Impact of submerged fermentation on the bioconversion of *Crocus sativus* corms **Rofaida Bouhalga, Sanae Baddaoui, Abdellah Baraich, Samira Mamri, Meryem Idrissi Yahyaoui, Anas Ziani, Reda Bellaouchi, Bouchra El Guerrouj, Abdeslam Asehraou, Ennouamane Saalaoui.**
CA412	Potentiel agro-industriel de quatre algues marines du littoral méditerranéen marocain : approche biochimique et biotransformation **Latifa Anjouda, Meryem Idrissi Yahyaoui, Noureddine Bentouhami, Mohamed Taibi, Reda Bellaouchi, Bouaiadi El Bachir, Brahim Sabour, Mustapha Meziane, Abdeslam Asehraou**
CA413	Valorisation des Métabolites Secondaires de l'Arganier (*Argania spinosa* L.): Analyse du Taux de Polyphénols et de l'Activité Antioxydante **Hachimi Fatehellah, Ibrahim Toufik, Oudija Fatiha, Ilham Belkoura.**
CA414	Bioleaching of metallic pollutants in mining residues by an indigenous strain: ***Aspergillus niger*.** **Tarik Moubchir, Jihan Faouzi, Noureddine Eloutassi, Amal Lahkimi And Ilham Zahir**

Plenary Sessions

Prof. Cinzia CAGGIA, Università degli Studi di Catania: Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), via Santa Sofia, 98, 95124 Catania (CT), I piano.
http://www.di3a.unict.it/docenti/cinzia.caggia;
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Since 2018, she has been a full professor in Agricultural Microbiology and group leader at the Department of Agriculture, Food and Environment (Di3A) of the University of Catania (UNICT). Since April 2023, she has served as President of the CORFILAC "Consorzio per la Ricerca nel Settore della Filiera Lattiero-Casearia e dell'Agroalimentare" in Ragusa (Italy). Since 2001, she has been involved in academic and research activities in the field of Food Microbiology. She served as Vice-President (2018-2021) of the Scientific Italian Society of Agri-Food and Environmental Microbiology (SIMTREA) and was a member of the Board of Directors. She also held the position of Secretary of the Italian Joint Coordination of Studies in Food Sciences and Technologies (COSTAL). Since 2021, she has been a lecturer at the INTERDEPARTEMENTAL CENTER FOR RESEARCH IN NUTRACEUTICS AND HEALTH PRODUCTS, within the Department of Pharmaceutical and Health Sciences at the University of Catania.
2022-2023-2024 Winner of a scholarship as a visiting professor within the CAPES-PRINT program (PRINT - PROGRAMA INSTITUCIONAL DE INTERNACIONALIZAÇÃO) at the Department of CIÊNCIA E TECNOLOGIA DE ALIMENTOS of the Federal University of Viçosa (Brazil).

International research projects recently funded as PI

PRIMA SEZIONE 2 MULTITOPICS 2022. Progetto: "Risorse microbiche per un sistema olivicolo sostenibile e un'alimentazione mediterranea più sana: dai sottoprodotti al cibo funzionale. Oli4food" 2023-2027. Principal Investigator per la parte italiana. # PRIMA22_00153.

ITALY – POLAND- CALL FOR JOINT PROJECT PROPOSALS- PROGRAMME CANALETTO - BILATERAL EXCHANGE OF SCIENTISTS, within the Scientific and Technological Cooperation Agreement between the Government of the Republic of Italy and the Government of the Republic of Poland, - Office IX - of the Italian Ministry of Foreign Affairs and International Cooperation and the Polish National Agency for Academic Exchange – NAWA.

Patents

Co-inventor of the industrial patent, in collaboration with the company MisterBioFood srl, "New formulation based on fermented germinated brown rice, suitable for use in food products, dermocosmetics and/or pharmaceutical formulations" (patent application no. 102020000011776 of 05/20/2020);

Co-inventor of the industrial patent, in collaboration with the company Uriach Italia srl, "New strain of the species Lacticaseibacillus rhamnosus, its compositions and their use in the treatment of genitourinary diseases" (application no. 102020000016666 of 07/09/2020);

Co-inventor of the industrial patent, Lacticaseibacillus rhamnosus DSM 33960, and its use for the prevention and treatment of conditions of dysbiosis of the female urogenital system, and vaginal dysbiosis (application no. 102022000016542 of 03/08/2022).

The scientific activity is carried out in the field of food microbiology; in particular, on the microbiology of fermented foods. The most recent research activities focus on the validation of technological processes at laboratory and pilot plant scale; the selection of yeast strains with oenological characteristics; the study of antibiotic resistance in waste water, and food matrices; Improvement of the microbiological quality and shelf-life of minimally processed vegetables.

Microbial biotechnology for food chain sustainability: beyond the limits of fermentation

Cinzia Caggia, Cinzia L. Randazzo
[1]*Department of Agriculture, Food and Environment, University of Catania (Catania, Italy)*

Abstract

Fermentation is an ancient method for preserving foods related to microbial communities' growth in the raw matrix. Over thousands of years, humans have optimized the conditions that promote the development of specific microbial communities. The metabolic activity of these communities generates end-products, such as acids, alcohol, and carbon dioxide, able to control the growth of food spoilage microorganisms and bioactive compounds with a role in enhancing the safety, flavor, aroma, and nutritional value of final products. All over the world a lot of fermented foods, like cheese, yogurt, salami, beer, and wine are described. Among fermented them, fermented milk products are the most popular, followed by table olives which are considered the most largely diffused fermented vegetables in the Mediterranean area. Table olive consumption is expanding worldwide thanks to the nutritional value related to the presence of polyphenols, vitamins, minerals, and fatty acids. . Numerous table olive processing methods are known, the choice of which mainly depends on olive variety, degree of ripeness, and on available process technology. Up to now, the application of starter cultures in table olive fermentation at industrial level is still limited. The fermentation of table olives is hard to control because the raw material cannot be thermally treated and abnormal phenomena could occur. For this reason, salt is added to reduce the water activity, prevent the growth of spoilage microorganisms, and improve taste and textures of the final product. Furthermore, according to World Health Organization (WHO, 2012) which recommends to reduce the daily salt intake (5 g salt per day), several authors have proposed the partial substitution of NaCl. Nevertheless, the replacement affected the microbiota of table olives modifying the sensorial quality of the final product The majority (64%) of the studies reported in was focused on the characterization of the metabolite produced during the fermentation process; others (28%) revealed table olives microbial composition; only few available studies (8%) have explored the proteomic profile of indigenous lactic acid bacteria. The metagenetic studies allowed to gain a comprehensive view of table olives microbiota, revealing the presence of unexpected bacteria involved in table olives fermentation. Table olives flavor develops by the combined metabolic activity of microbial community on drupes, and carbohydrates, accompanied by further enzymatic and chemical conversions during fermentation. The identification of active VOCs compounds, using metabolomics, has led to create a library that can be used to associate desirable flavor or defects to specific molecules.

During the last twenty years, food microbiologists have introduced considerable changes in the study of table olives microbial ecosystem, which traditionally relied on cultivation, isolation and phenotypic and (or) genotypic characterization of the microbial isolates. In particular, the advent of the DNA-based approaches has enabled a clear picture of the microbiota of table olives, revealing microbial taxa previously overlooked. Here an overview of the microbial composition and the metabolic processes that drive the table olives fermentation, affecting both sensorial profile and safety properties of the final product are presented.

Prof. Brahim SABOUR
University Chouaïb Doukkali in El Jadida, Morocco

Brahim Sabour is a Full Professor of Phycology and Marine Biology at the University Chouaïb Doukkali in El Jadida, Morocco. He heads the Laboratory of Biotechnology, Ecology, and Ecosystem Valorization, an accredited research unit recognized by the CNRST (National Centre for Scientific and Technical Research), and leads the Research Team on Phycology, and Blue Biodiversity and Biotechnology. He also serves as a Scientific Expert Evaluator for the CNRST and for the European Commission under the Biodiversa+ program. Professor Sabour's research focuses on algal biodiversity and blue biotechnology. He has supervised numerous PhD theses on topics ranging from algal ecology, invasive macroalgae and marine microbial diversity to the impacts of climate change on coastal species and algal biorefinery innovations. He has coordinated several national and international research projects (e.g., AFRIMED, RESTORESEAS, EMERTOX, VPMA, CNRST/FCT). He has actively organized and participated in various high-level scientific events, including international conferences and workshops on seaweeds, algal forest restoration, and biodiversity conservation. At the institutional level, he has held key academic leadership roles, notably serving as Director of the Doctoral Studies Pole and the Doctoral Center of the University Chouaïb Doukkali. He is also an elected member of the University and Faculty Councils, and a member of various research, scientific, and administrative committees, as well as recruitment boards for academic and technical positions in Moroccan universities.

Marine Algae and Seaweed Farming: An Emerging Sector Meeting the Objectives of a Sustainable Blue Economy in Morocco

Prof. Brahim Sabour

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Abstract

The global seaweed market is experiencing remarkable growth, with current annual production exceeding 39 million tonnes, more than 95% of which comes from algoculture of a few species of *Eucheuma*, *Kappaphycus*, *Saccharina*, *Porphyra,* and *Gracilaria*. This biomass generates an estimated market value of $24.65 billion, primarily serving human food and the extraction of phycocolloids (e.g. agar, carrageenan, alginate…) with emerging applications in pharmaceutical, cosmetic, agricultural, energy, and biomaterials sectors. Seaweed populations provide also a wide range of ecosystem services including habitat and food source for marine life, sequestering carbon, releasing oxygen, mitigating nutrient pollution, and protecting coastlines from wave energy.

At the national scale, Morocco with its Atlantic and Mediterranean coastlines is considered a regional hotspot for both species-specific and genetic diversity of marine macroalgae, hosting over 600 recorded species, dozens of which have demonstrated commercial value. Despite this rich biodiversity, the country's contribution to global algal production remains marginal, mainly based on the harvesting of wild populations of *Gelidium corneum* which accounts for over 90% of national production, mostly concentrated in the El Jadida region, which alone represents about 80% of the national's volume. In addition to this agarophyte, other macroalgae are also authorized for harvesting such as the carrageenophytes *Gigartina* / *Chondracanthus* (300 t) and the alginophyte *Laminaria* (50 t). The annual authorized wild seaweed harvested quota reached 19 100 t in 2024 while in terms of locally produced agar, the quota authorized to a single industrial operator was about 1 450 t of agar. Currently, seaweed exploitation relies exclusively on natural populations, although southern Moroccan Atlantic coast, mainly Dakhla bay, and some appropriate sites on the Mediterranean coast are now the focus of ambitious seaweed farming projects. This development potential aligns fully with the goals of a sustainable blue economy, addressing industrial, climate, and ecosystem challenges. Despite this promising wind in terms of production of algal biomass from cultivation, concerns remain concerning, the sector suffers from insufficient regulatory oversight. Existing legislation does not ensure effective conservation of seaweed habitats nor protection of overexploited or threatened species. Additionally, scientific knowledge about the status of local populations and their resilience to anthropogenic pressures (pollution, climate change, invasive species...) remains limited. The implementation of an integrated national strategy including effective environmental governance, creation of marine protected areas, support for specific scientific research, training of local expertise, and the development of sustainable aquaculture value chains, is now essential to establish a national seaweed farming as a key driver of sustainable coastal development in Morocco.

Keywords: *Morocco, Seaweed farming, biodiversity, sustainable development, blue economy.*

Noureddine ELMTLI
Université Abdelmalek Essaadi, Maroc

Noureddine Elmtli, 63 ans, est professeur-chercheur en biologie végétale, titulaire de deux doctorats : un doctorat d'État obtenu en 1995 à l'Université Mohammed Premier d'Oujda, et un doctorat de l'Université Paris XI (Orsay) en 1990. Il est également diplômé d'un DEA en génétique et amélioration des plantes, d'une licence en biologie végétale et d'un DEUG en biologie-géologie. Sa carrière universitaire s'est déroulée principalement à la Faculté des sciences de Tétouan (Université Abdelmalek Essaâdi), où il a enseigné et mené des recherches de 2000 à 2025, après avoir été chercheur à l'Université Paris XI (1990–1992) puis enseignant à l'Université Mohammed Premier (1992–2000). Il a dirigé une dizaine de thèses de doctorat et en encadre actuellement autant, avec plus de 50 publications scientifiques à son actif. Il a également exercé plusieurs responsabilités scientifiques, notamment en tant que responsable de l'équipe « Sciences de l'Alimentation et de la Santé » (UAE/U06FS), directeur du laboratoire de génétique et biotechnologie végétale à Oujda, et directeur de publication de plusieurs revues scientifiques telles que *Moroccan Journal of Biology*, *Cahiers de recherche de l'Université Abdelmalek Essaâdi* et *Biomatec magazine*.

A la recherche des gènes cachés pour contrer l'érosion génétique

Noureddine EL MTILI

Abstract

Récemment, le Maroc a connu une destruction presque totale de ses surfaces cultivées par la figue de barbarie (*Opuntia ficus-Indica* L.). Environ 120 000 à 150 000 hectares ont été dévastées par la cochenille. Ce phénomène est lié le plus souvent, au système de production agricole dit : monoculture qui consiste à cultiver une variété, connue pour ses performances agronomiques ; notamment la productivité ; sur des surfaces qui s'étendent à perte de vue. Cette monoculture nécessite plus d'engrais, plus de produits phytosanitaires pour contrer et l'appauvrissement des sols et les attaques par les différents pathogènes. Outre l 'impact bénéfique sur notre sécurité alimentaire, ce mode d'agriculture s'avère, de plus en plus, catastrophique. Les impacts sont souvent énormes, notamment l'«érosion génétique», définie comme étant la perte de gènes et des combinaisons génétiques constituées au cours du temps, au niveau des variétés traditionnelles bien adaptées aux conditions environnementales locales. Le remplacement des cultivars locales par des variétés commerciales dans les systèmes agricoles traditionnels aboutit dans bien des cas à une réduction du nombre des variétés cultivées, et donc à une réduction de la variabilité génétique.

Parmi les autres causes d'érosion génétique figurent l'apparition de nouveaux ravageurs, de nouvelles plantes adventices, de nouvelles maladies et la dégradation du sol. En effet, la surexploitation du sol, qu'on l'adapte aux exigences nutritionnelles spécifiques d'une même variété pendant longtemps, rend le sol plus facilement fragilisé et érodé, et affecte en parallèle l'écosystème naturel composé de micro-organismes et menace, en outre, la diversité génétique des insectes considérés comme étant des agents pollinisateurs essentiels pour la réussite de nombreuses productions agricoles.

Devant cette situation, il est temps d'établir une stratégie nationale sérieuse et structurée pour maintenir la biodiversité agricole et préserver nos ressources phytogénétiques *in situ*, notamment dans les régions marginalisées où les pratiques agricoles traditionnelles utilisent encore une panoplie de cultivars locaux. En parallèle, une conservation *ex situ* devrait être établie et gérée par des instituts spécialisés.

Ramzi KHIARI
Higher Institute of Technological Studies of Ksar Hellal, Tunisia

Ramzi Khiari est professeur agrégé spécialisé en science et ingénierie des matériaux polymères, avec une expertise reconnue en polymères, biomatériaux, nanomatériaux et science des polymères. Il compte à son actif plus de 140 publications, près de 3 700 citations et plus de 56 000 lectures sur ResearchGate, un indice h de 32 selon AD Scientific Index.
Ramzi Khiari est maître de conférences à l'ISET de Ksar Hellal, spécialisé dans la valorisation de la biomasse végétale, les matériaux à base de cellulose et les procédés textiles durables. Titulaire d'une habilitation à diriger des recherches (HDR) obtenue à l'Université Grenoble Alpes, il cumule une solide expérience dans la recherche appliquée, notamment à travers plusieurs projets collaboratifs franco-tunisiens. Ses travaux portent sur la fonctionnalisation de la cellulose, la formulation de matériaux composites, les procédés d'enduction et d'impression, ainsi que la recyclabilité dans une approche d'économie circulaire. Il a encadré plusieurs thèses de doctorat, publié plus d'une centaine d'articles scientifiques, et collabore activement avec des institutions académiques et industrielles à l'échelle internationale.
Son parcours académique, notamment comme professeur associé à l'ISET Ksar Hellal en Tunisie (janvier 2011 – avril 2016), l'a mené à diriger des recherches sur les polymères issus de déchets agricoles (palmiers-dattiers, oliviers, amandiers) pour la production de nanocellulose, d'hydrogels, et de matériaux composites innovants. Ses travaux récents incluent des sujets comme les nanocristaux de cellulose issus de biomasse bactérienne (mai 2025) ainsi que la valorisation des déchets de tournesol, de soja et de dattes (2024–2025). Ses compétences couvrent la synthèse de polymères, leur caractérisation (nanocellulose, fibres, composites), ainsi que l'ingénierie des matériaux durables et la valorisation des déchets biomasse. Fort de collaborations internationales, Ramzi Khiari contribue activement aux enjeux de l'environnement et de l'économie circulaire dans le domaine des matériaux avancés.

Polysaccharide Nanomaterials

Ramzi KHIARI

Higher Institute of Technological Studies of Ksar Hellal, Department of Textile, Tunisia Univ. Grenoble Alpes, CNRS, Grenoble INP, LGP2, 38000 Grenoble, France.*

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Abstract

The potential of nanotechnology in various research and application fields is promising and attracting more and more application. When the size of materials is reduced to the nanoscale, unexpected and fascinating properties can be observed. Cellulose and other polysaccharides (starch, chitin) are no exception. Moreover, its abundance, reproducibility, high strength and stiffness, non-toxicity, light weight, and biodegradability enhance the highly reactive surface of polysaccharides arising from the high density of hydroxyl groups at the nanoscale. Although cellulose is the most readily available natural polymer on earth, it has only recently gained interest as a nanostructured material due to its hierarchical structure. Cellulosic nanomaterials are commonly in the form of cellulose nanofibrils (CNF) or cellulose nanocrystals (CNC). Microcrystalline cellulose's mechanical modulus is the basis for many potential applications. In addition, the low coefficient of thermal expansion caused by the high crystallinity of cellulose nanomaterials and the high transparency in the absence of polymers are very beneficial for flexible display panels and electronic devices. In papermaking, it improves tensile strength, burst strength, tear strength, density, smoothness, and air permeability, as well as filler retention capacity and dye adsorption by nanoparticles. In addition, due to the high reactivity inherent in cellulose, ubiquitous surface hydroxyl groups associated with nanoscale dimensions of cellulose nanomaterials open up possibilities for the development of new functional nanomaterials.

Prof.in Dr. habil. Tuba ESATBEYOGLU
Institut für Food und One Health, Leibniz Universität Hannover (LUH), Germany

Since 2023 W3 Professor of Molecular Food Chemistry and Development at the Institute of Food Science and Human Nutrition, Head of the Institute of Food Science and Human Nutrition at Leibniz Universität Hannover.

07/2022 – 08/2022: Visiting professor at The University of Queensland, Institute for Molecular Bioscience, Brisbane/Australia.
2019 - 2023: Professor for Food Development and Food Quality, Head of Institute of Food science and human Nutrition at the Leibniz University Hannover.
2018-2016: Research associate at the Institute of Safety and Quality of Fruits and Vegetables of the Max Rubner Institute in Karlsruhe, Germany.
2017-2010: Habilitation; awarded the teaching qualification for the subject "Food Science" by the Faculty of Agricultural and Nutritional Sciences of the Christian-Albrechts-Universität zu Kiel; title of the habilitation thesis: "Analytics, radical scavenging properties and gene regulatory activity of dyes and secondary plant compounds from roots".
2015: Research stay in the Netherlands; Wageningen UR (University & Research Centre) at the Institute of Food Safety (RIKILT) in the field of Analytical Chemistry in cooperation with "Swiss Federal Institute of Technology Zurich (ETH Zurich)" Department of Environmental Systems Science.
2010-2006: PhD (Dr. rer. nat.) at the Institute of Food Chemistry of the Technical University Carolo-Wilhelmina zu Braunschweig, Germany; title of the PhD thesis: "Analysis of value-added constituents of Aronia melanocarpa and characterization and isolation of proanthocyanidins" (ISBN-10: 3-86955-642-0 [Titel anhand dieser ISBN in Citavi-Projekt übernehmen]); Grade: "with distinction (summa cum laude)".
2006-2005: Practical training at the Lower Saxony State Office for Consumer Protection and Food Safety (LAVES) to become a "state-certified food chemist"
2005-2000: Studies of Food Chemistry at the Technical University Carolo-Wilhelmina zu Braunschweig

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JOVE (submit until July 2025):
https://app.jove.com/methods-collections/3839/phytochemical-analysis-methods
Food Chemistry(Q1; Guest Editor): https://www.sciencedirect.com/special-issue/10893N73L63
Frontiers in Food Science and Technology and Frontiers in Nutrition(Q1; Guest Editor):
https://www.frontiersin.org/research-topics/42881/advancing-quality-characterization-methods-for-plant-based-food-alternatives

Influence of fruit juices on Antioxidant activity and Bioavailability

Tuba Esatbeyoglu

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Abstract

In recent years, consumer interest in fruit juice extracts as nutraceuticals has increased. Fruits, especially red berries, contain valuable bioactive compounds such as polyphenols, which are often associated with anti-inflammatory, anti-diabetic, anti-cancer, cardioprotective and gastroprotective properties. However, the effects of fruit juice extracts on the permeability of the intestinal barrier and their influence on glucose transport across the intestinal membrane have not yet been sufficiently investigated. In the present study, anthocyanins and copigments were isolated from 11 fruit extracts using XAD7 column chromatography and the health-promoting effects and their influence on the intestinal membrane were characterized. Extracts of chokeberry, pomegranate and blueberry showed the highest antioxidant activity, but incomplete regeneration of the intestinal membrane with induced higher permeability, possibly due to their high anthocyanin content. Extracts of goji berries, elderberry and the copigment fraction of apple led to a better regeneration of the intestinal barrier.

In addition, the effects of sweeteners such as saccharin, cyclamate, acesulfame K, aspartame and sucralose in combination with apple and chokeberry extracts on intestinal permeability and glucose transport were investigated. In vitro, it was shown that saccharin in combination with apple polyphenols in particular significantly increased glucose transport across the intestinal membrane. However, no influence of the sweeteners on the expression of glucose transporters such as SGLT1, GLUT1 and GLUT2 was observed. Interestingly, the combination of chokeberry extracts with aspartame increased intestinal permeability, which could be beneficial in certain contexts such as drug intake.

In summary, fruit juice extracts have a high antioxidant potential and can reduce the expression of antioxidants and glucose transporters. Depending on the composition of the extracts and the combination with sweeteners, they may also influence glucose transport and intestinal permeability. Further studies are needed to identify the health-promoting substances in fruit extracts in more detail and to investigate their role in the development of healthier beverage alternatives.

Pr. Riadh BEN SALAH
Centre de Biotechnologie de Sfax, Tunisie

Pr. Riadh BEN SALAH is a permanent professor and holds a first class engineer degree in Biotechnology; a Master's degree in biological engineering; and a doctorate and habilitation to dirige researcher from National School of Engineer of Sfax University. He has over twenty four-years' experience of Biochemistry, microbiological research and food formulation. This includes experience of designing, validating and operating a range of microbiological tests including sterility testing, bacterial exopolysaccharide testing, microbial enumeration, extraction and purification of exopolysaccharide, probiotic characterization and formulation in agro feed and food. In addition, he is experienced in testing antioxidant, antimicrobial and anti inflammatory activities. He is a tutor with the Faculty of Sciences of Sfax and Gabès, University for technology of food M.Sc course. In addition, he is member of several national committees relating to purchasing material. He is a committee member of the Biotechnology Interest Group (ATSB); and is a member of several editorials boards for scientific journals. He acted as consultant, expert witness and technical advisor for lactic acid bacteria in food formulation. He has also undertaken several technical writing and review projects. He has written over 75 publications, peer reviewed papers and technical articles relating to food and feed biotechnology. Pr. Riadh BEN SALAH has also twenty five years of teaching in university and 60 Projects of End of Studies (licence and engineers), 20 Masters + 3 PhD theses.

Exploring the probiotic properties of Lactic Acid Bacteria: New advances in encapsulation and biological applications

Prof. Riadh Ben Salah[1], Sirine Ben Slima[1], Imen Trabelsi [1]

Naourez Ktari [1,2]

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Abstract

Lactic acid bacteria represent a group of micro-organisms with well-established benefits for animal and human health. These bacteria have different morphological, physiological and metabolic properties. They are widely recognized as safe (GRAS) in food products, gaining in popularity due to their probiotic properties. The most commonly used strains belong to the genera *Lactiplantibacillu*s (formerly *Lactobacillus*) and *Bifidobacterium*.

However, it is crucial to ensure the survival of probiotics, particularly through the gastrointestinal tract. To this end, encapsulation is an effective method for protecting probiotics, enhancing their bioavailability and increasing their survival rate as they pass through the body. This conference aims to present recent advances in the probiotic properties of lactic acid bacteria, encapsulation techniques and their various fields of application, based on research carried out by our team. A selection of 100 newly-isolated lactic acid bacteria (LABs) from the Laboratory of Microbial Biotechnology, Enzymes and Biomolecules(LBMEB-CBS) was subjected to a subtractive screening method, combining in vitro and *in vivo* tests. From these 100 LABs, 19 strains were selected for their strong antibacterial activity against pathogenic bacteria. Of these 19 strains, only two (TN8 and TN9) showed good growth at acidic pHs and high bovine bile concentrations, were sensitive to a wide range of antibiotics, had no undesirable enzymatic activities, and possessed good adhesion to intestinal cells. A study of the anti-inflammatory activity of these 2 strains showed that the TN8 strain possesses greater immunomodulatory activity than the TN9 strain. This strain was identified as Lactiplantibacillus plantarum TN8. To test and study its effect on complications linked to chronic inflammatory bowel disease (colitis), strain TN8 was administered to rats induced by Trinitrobenzene Sulfonic Acid (TNBS). This study showed that administration of strain TN8 reduced and slowed TNBS-induced weight loss. Treatment of diseased rats with strain TN8 also led to partial correction of total cholesterol, triglycerides, HDL-cholesterol and urea levels, protection of liver and kidney organs from cysts, and a reduction in the presence of mucosal necrosis and inflammatory infiltrates in the intestines of diseased rats. In addition, using 11 factors and experimental design methodology, we optimized immobilization conditions for strain TN8. A good yield of 80% was achieved using a biomass concentration of 10^{10} CFU/mL, 0.45 M $CaCl_2$ and a solidification time of 30 min. These conditions enabled the immobilized TN8 strain to ensure good viability following exposure to unfavorable conditions (high and low temperature gastrointestinal transit). The addition of immobilized strain TN8 to broiler feed had a positive effect on the chicken's zootechnical performance.

The biochemical study also showed that a diet based on the immobilized TN8 strain reduced cholesterol and triglyceride levels in the chicken's blood. We also studied the effect of immobilizing another *Lactiplantibacillus plantarum* TN9 strain in alginate-chitosan and

alginate-gelatin polymers on its viability and antibacterial potential. All the results obtained in this study show an improvement in the viability and antibacterial activity of the TN9 strain immobilized in alginate-chitosan. In addition, another strain of lactobacilli from the same collection, with the highest exopolysaccharide production (2.4g/L), was selected. Acid hydrolysis and analysis by TLC and HPLC showed that the polymer (EPS) produced by this strain is of the glucan (dextran) type. FTIR structural characterization of this homoexopolysaccharide confirmed these results. This strain was identified as *Lactobacillus* sp. Ca6. The extracted EPS was valorized and applied as a healing gel in the treatment of acute wounds in rat models. Indeed, treatment of wounds with this biopolymer ensured complete and rapid wound healing, as well as advanced tissue regeneration compared with control rats. In summary, our research has shed light on the remarkable potential of certain strains of Lactic Acid Bacteria in the food industry as well as in wound healing, thus paving the way for promising new therapeutic applications.

Key words: *Probiotics, Encapsulation, Lactic acid bacteria, Exopolysaccharide, broiler feed, wound healing*

Dr. Aleksandar SZÉCHENYI
University of Pécs, Hungary

Dr. Aleksandar Széchenyi, a senior scientific associate at the Institute of Pharmaceutical Technology and Biopharmacy, Faculty of Pharmacy at the University of Pécs, Hungary. He holds a PhD in Chemistry from the University of Szeged, with a specialization in heterogeneous catalysis, surface chemistry, and nanoscience. His current research interests lie at the intersection of nanochemistry and pharmaceutical technology, with a particular focus on nanostructured drug delivery systems, pharmaceutical crystallization, and the development of optical and electrochemical sensors based on the application of carbon-based conductive nanomaterials. Dr. Széchenyi's involvement in various interdisciplinary projects, including the design of chemical sensors, the development of nanomaterials for drug delivery, and the rational design of crystalline drugs, showcases his ability to work across different fields.

Dr. Széchenyi's innovative contributions to the field are highlighted by his patent for the development of a wide-range optical sensor for pH measurement. He has also contributed to several scientific projects funded by European funds (Horizon 2020, Eurostars), national funds (OTKA, GINOP, EFOP), and other international organizations, particularly in the fields of healthcare, environmental applications, and sensor technologies. His membership in the Hungarian Chemical Society, the Hungarian Society for Pharmaceutical Sciences, and the American Chemical Society, he is a member of further underscores his active involvement in the scientific community.

Dr. Széchenyi is fluent in English, Hungarian, and Croatian and has published over 50 scientific papers.

Targeted Delivery of Natural Antimicrobials

Aleksandar Széchenyi

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Abstract

The pharmaceutical use of essential oils (EOs) encounters challenges due to low water solubility and hydrophobicity. Traditionally, surfactants or solvents, ethanol or DMSO are frequently used to improve EOs viability in drug formulations. However, with the advent of nanotechnology, more novel strategies are being implemented for their solubilization and targeted delivery. Our research outlines alternative pharmaceutical uses of EOs, with specific emphasis on targets such as nail infection, oral care, and antimicrobial effect. Pickering nanoemulsions with EOs were formulated, with classification based on physicochemical properties and optimization of droplet size and surface characteristics of stabilizing nanoparticles for the respective applications. Antimicrobial studies were carried out in vitro, and a toxicology profile was done to assess safety. The results indicated that nanotechnology-based formulations deliver drugs effectively targeting specific sites and that Pickering emulsions are more potent than conventional formulations. The amount and type of nanoparticles used was not toxic since the toxic threshold was determined to be much higher, which emphasizes the potential of Pickering nanoemulsions to deliver EOs for various fields in clinical practice for an enhanced therapeutic effect with safety.

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Keywords *Pickering nanoemulsions*; targeted delivery; essential oil; antibiofilm activity; antibacterial effect; antifungal effect

Prof. Bassem JAOUADI
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Dr. Bassem Jaouadi is a full professor of Biochemistry and Molecular Biology at the Centre of Biotechnology of Sfax (CBS), University of Sfax (USF), Tunisia. His research in the Laboratory of Microbial and Enzymatic Biotechnology and Biomolecules (LMEBB) focuses on screening, cloning, expression, protein engineering, and industrial applications of extremozymes, including proteases, keratinases, lipases, phospholipases, chitinases, amylases, and peroxidases. Dr. Jaouadi is the co-founder of the biotech start-up Biotech-ECOZYM and the spin-off ENZYin, both incubated at the CBS Business Incubator and LMEBB. He also provides technical assistance for setting up biotech companies. He holds an HDR in Biological Engineering (2014) and a Ph.D. in Biological Sciences (2009) from the University of Sfax (USF), Tunisia. His doctoral research, conducted in collaboration with the Laboratory of Biocrystallography at the University Claude Bernard Lyon 1 (UCBL), France, focused on the biochemical and molecular characterization of a novel glycosylated alkaline protease from *Bacillus pumilus* strain CBS. Dr. Jaouadi has led multiple industrial, national, and international R&D biotechnology projects, collaborating with industry partners in Tunisia, Algeria, Morocco, South Africa, France, Italy, Germany, Finland, Malaysia, India, and South Korea. He serves as the Principal Investigator (PI) for the multilateral PHC-Maghreb project “FranMaghZYM” (2020–2024) in partnership with France, Morocco, and Algeria. Additionally, he is a member of the PHC-Maghreb project “NGS-ENZYin” (2025–2027) involving France and Morocco. Since 2022, Dr. Jaouadi has been the Work Package 1 (WP1) Leader in the Horizon Europe CSA-Twinning project “NGS-4-ECOPROD” (2022–2026), focusing on bioprospecting extreme Tunisian biotopes for novel extremozymes through metagenomic and genomic approaches. He is also an active participant in the ENI Cross-Border Cooperation Programme Italy-Tunisia project “ARIBiotech” (2022–2023) and the newly accepted EU Interreg NEXT Italy-Tunisia project “CercleBleu” (2025–2026). Dr. Jaouadi has supervised nearly 50 graduate and post-graduate students, guiding them in their projects, master’s theses, and doctoral research on industrial microbial enzymes. Under his mentorship, 30 students have obtained their Ph.D. degrees, with five currently pursuing their doctorates. His contributions to scientific research include more than 105 publications in peer-reviewed journals, 45 national patents, and 70 invited book chapters. According to the ISI Web of Knowledge database, Dr. Jaouadi has accumulated more than 3,410 citations in scientific publications, with a Hirsch index of 36.

Advancing Extremozymes Discovery: Exploiting Next-Generation Sequencing for Sustainable Industrial Innovation through Genomic and Metagenomic Approaches

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Abstract

Enzymes are the key components of industrial biotechnology, with the global market projected to grow from €5.6 million in 2021 to €7.6 million by 2026, at a compound annual growth rate (CAGR) of 6.3% (https://www.bccresearch.com/). Despite their industrial significance, comprehensive studies on the genomic adaptations of extremophiles and their enzymes are lacking. Next-generation sequencing (NGS) methods are essential for quantifying the functionality and dynamics of microorganisms in their natural habitats. The vast amount of data generated by NGS necessitates a deep understanding of structural and functional genomics through omics techniques. As part of the Horizon Europe (HE)-Coordination and Support Action (CSA)-Twinning Project, NGS-4-ECOPROD, titled "FROM NEXT GENERATION SEQUENCING MICROORGANISMS TOWARDS ECOFRIENDLY BIOTECH BASED PRODUCTS" (https://cordis.europa.eu/project/id/101079425), coordinated by Prof. Slim TOUNSI (CBS, TUNISIA), in collaboration with Université Claude Bernard Lyon 1 (UCBL1, FRANCE) (Prof. Joel LACHUER) and Georg-August-Universität Göttingen Stiftung Öffentlichen Rechts (UGOE, GERMANY) (Dr. Heiko LIESEGANG), we aim to address the networking gaps in NGS for the development of eco-friendly biotech products, particularly extremozymes. Fifty original species of fungi (35), yeast (6), and bacteria (9) were isolated from various extreme biotopes in Tunisia, including hot springs, mountain peaks, forest soils, saline lake sediments, and oil reservoirs. The goal is to explore these extreme biotopes to bio-prospect extremozymes using NGS genomic and metagenomic approaches with NextSeq™ 500 Illumina (short-reads) and PromethION™ 2 Solo Oxford Nanopore (long-reads) sequencing technologies. Whole-genome sequencing (WGS) of thirty five fungi (27), yeast (4), and actinomycetota (4) strains has been completed. The NGS data are assembled, annotated, and analyzed, with one bacterial strain (CTM50504) fully processed and others in progress. The complete sequences are used to identify genes encoding potentially useful extremozymes, with a particular focus on phospholipases. *Streptomyces cyaneofuscatus* strain CTM50504, isolated from a terrestrial hot spring in Korbous (Nabeul, Tunisia), is a promising extracellular hydrolase producer. This strain can grow at 50°C and a pH range of 6-9. Its genome, assembled into 1,252 contigs with an average G+C content of 71% and a total length of 8,591,922 bp, revealed 770 protein-coding enzymes, including 323 open reading frames (ORFs) encoding hydrolases, such as 10 phospholipases (A2, C, lyso, and D), 20 TG-lipases, 179 proteases, 5 amylases, and 5 chitinases. The WGS assembly was deposited in the DDBJ/ENA/GenBank databases under the sequence read archive accession number PRJNA1065629. A novel phospholipase D (*ScplD*) gene from strain CTM50504, encoding a polypeptide of 416 residues, was synthesized, cloned, and successfully expressed in *E. coli* BL21 (DE3)pLysS. The purified recombinant enzyme (rScPLD) has a monomeric structure of 50 kDa, with activity and thermostability significantly dependent on Ca^{2+}. These findings represent a crucial first step towards creating new efficient extremozymes with enhanced catalytic properties and high potential for biotechnological and industrial applications.

Keywords: *Extremophiles; Extermozymes; Whole-Genome Sequence; Illumina; Nanopore, Genome Assembly; Genome Annotation.*

Prof. Abdelkarim ABOUSALHAM
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Abdelkarim ABOUSALHAM is Professor of Biochemistry at the University Claude Bernard Lyon 1, France and Team leader of Molecular and Interfacial Mechanisms of Lipolytic Enzymes in the Institute for Molecular and Supramolecular Chemistry and Biochemistry (ICBMS UMR5246CNRS). From 1991 to 1995, he prepared his PhD thesis in the laboratory of Dr. Robert Verger, on Purification, biochemical, immunological and structural characterization of plant phospholipases D (PLD). From 1995 to 1997, he was researcher at Signal Transduction Laboratories, Lipid and Lipoprotein Research Group, University of Alberta, Edmonton, Canada, where he worked on the “Cross talk” between the bioactive glycerolipids and sphingolipids in the regulation of mammalian PLD. From 1997 to 2004, he was researcher at the Laboratory of Enzymology at Interfaces and Physiology of Lipolysis, CNRS, France. From 2005 to 2007, He was a Scientific Director of the cooperative laboratory at Research Group in Microbiology and Environment, Marseille, France Abdelkarim ABOUSALHAM has 30 years of expertise in the field of lipids and lipolytic enzymes and 84 publications (h-Index = 25) dealing with the structure-function relationships of (phospho)lipases. At the molecular level, his work aims at understanding the mechanism of action of lipases and phospholipases and monitoring their catalytic activity. These lipolytic enzymes have many industrial (biotransformation of oils and fats) and medical (obesity and cancer) applications.

Caractérisation biochimique des (phospho)lipases de microorganismes isolés de biotopes extrêmes pour une application industrielle

Abdelkarim ABOUSALHAM

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Résumé

Les microorganismes extrêmophiles vivant dans des écosystèmes extrêmes présentent un répertoire d'enzymes originales aux propriétés singulières leur permettant de survivre dans ces conditions et présentent des caractéristiques innovantes et novatrices pour des applications industrielles. Dans ce contexte, nouvelles (phospho)lipases extracellulaires, FAL de *Fusarium annulatum* Bugnicourt CBS et PCrL de *Penicillium crustosum* Thom ont été isolées de biotopes extrêmes tunisiens et marocains. La PCrL a été purifiée 63 fois jusqu'à homogénéité avec un rendement de 34% et une activité spécifique de 5000 U/mg sur une émulsion d'huile d'olive à pH 9 et 37°C. L'immobilisation de la PCrL améliore considérablement sa stabilité thermique et ses performances catalytiques dans les solvants organiques non miscibles à l'eau. La (phospho)lipase FAL a été purifié environ 62 fois avec un rendement de 21 % et une activité spécifique de 3500 U/mg à pH 9 et 40°C et de 5000 U/mg à pH 11 et 45°C, respectivement sur des émulsions de triocanoïne et de lécithine de jaune d'œuf. Ces nouvelles lipases fongiques ont montré une tolérance extrême à la présence de solvants organiques, de tensioactifs non ioniques et anioniques, ainsi que d'oxydants, et une compatibilité considérable avec les lessives commerciales. Ces propriétés biochimiques en font des candidats potentiels prometteurs pour les formulations détergentes commerciales, en tant que bio-additifs.

Mots clés *: biotopes extrêmes, Fusarium annulatum, Penicillium crustosum, (phospho)lipase, immobilization, bio-additif, détergents.*

Prof. Noure-Eddine CHIHIB
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Professor CHIHIB is a researcher in the fields of microbiology, with a particular focus on bacterial biofilms, lactic acid bacteria, antimicrobial resistance, and surface decontamination. He is known for his work on developing innovative strategies to combat bacterial contamination, especially in food production environments. His research often explores the use of biosourced antimicrobials, surface treatments, and microbial ecology to address the growing issue of pathogen resistance and ensure public health safety. His work has resulted in high-quality scientific output (more than 100 articles and 4 Books Chapters). Scientific leader of many PhD thesis and Post-doctoral position (24). Member of the scientific and organizational committees of several international conferences. Guest lecturer several times in many countries.

Enzymatic and Microencapsulated Terpenes-Based Hurdle Approach to Target pathogenic bacterial Biofilms

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Abstract

Biofilms, microbial communities enclosed in an extracellular matrix, pose a significant problem in various fields due to their resistance to stress and impeded antimicrobial penetration. They are particularly problematic in medical, food, marine, oil reservoirs, and petroleum distribution industries due to their complex structure and potential economic and health issues. Biofilm resistance to current control strategies highlights the need for new alternatives. Hurdle technology, combining two or more methods, offers an effective method for controlling biofilms effectively. In this perspective, the use of functional enzymes combined with biosourced antimicrobial such as essential oil (EO) is a promising alternative anti-biofilm approach. However, these natural antibiofilm agents can be damaged by severe environmental conditions and lose their activity. Microencapsulation of enzymes and EOs is a promising new technology that enhances their stability and biological activity. This work focuses the problems related to biofilm in various fields, and the use of Hurdle technology based on encapsulated enzymes with essential oils as antibiofilm agents.

Prof. Adem GHARSALLAOUI
Université Claude Bernard Lyon 1 – France

Adem Gharsallaoui is a Full Professor (PhD) at Claude Bernard University Lyon 1, where he is a member of the Laboratoire d'automatique et de génie des procédés et génie pharmaceutique (LAGEPP) in Bourg-en-Bresse, France. He holds a doctorate in Food Science and has accumulated over two decades of academic research in the food sector, with a research focus on microencapsulation, emulsion engineering and biopolymer-based delivery systems.

With 139 peer-reviewed publications, more than 70 000 reads and over 6 400 citations, Prof. Gharsallaoui is internationally recognized for his work on biopolymers, rheology, biomaterials and antimicrobial delivery. He has guest-edited special issues on microencapsulation and active packaging, contributed to numerous European-funded research projects, and supervised several doctoral theses on advanced nano- and microstructured formulations for food and biomedical applications.

His research advances the fundamental understanding and practical application of encapsulation technologies, employing techniques such as coacervation, spray-, freeze- and electrospray-drying to produce micro- and nanoparticles from proteins, polysaccharides, lipids and hybrid materials. He has developed stimuli-responsive carriers for the controlled release of antioxidants, vitamins and essential oils in food matrices, as well as probiotic delivery systems with enhanced stability and bioavailability. Prof. Gharsallaoui integrates rheological modeling, interfacial analysis and process scale-up methodologies to optimize encapsulation efficiency and release kinetics. Collaborative projects with industry partners have led to patented processes and technology transfers aimed at sustainable food preservation and targeted drug delivery

Microencapsulation of natural bioactive molecules and microorganisms: an innovative approach for food preservation

Adem GHARSALLAOUI

Université Lyon 1, France

Abstract

Microencapsulation is a process that consists of enclosing, trapping or coating an active substance in a microsized capsule in order to immobilize it, protect it or control its release. This technique has undergone various improvements and has been adapted to many applications in the pharmaceutical, biotechnological, environmental, cosmetic and food fields. This technique allows to incorporate bioactive molecules into the hosting matrix without altering their qualities. In addition, it allows to protect these molecules against physical or chemical degradation, to control their release at their site of action as well as to increase their bioavailability. Other applications of this technique target the masking of tastes, flavors and odors of certain food ingredients or only the transformation of liquid substances into solid substances. Microencapsulation of microorganisms is also a widely used technique to trap them and preserve their viability. Several studies have demonstrated the effectiveness of this approach in protecting bacteria against various adverse conditions to which they may be exposed. Indeed, some microorganisms need to be protected against different deleterious conditions encountered during the product processing such as heat, prolonged exposure to ambient temperatures as well as variations in pH and oxygen concentration, drying, storage, and gastrointestinal transit such as the acidic pH of the stomach and the presence of bile salts in the small intestine (case of probiotics).

The aim of this contribution is to present the latest innovations concerning the encapsulation of active molecules and microorganisms by focusing on the techniques used and the targeted applications.

Keywords: *Microencapsulation; Bioactive molecules; Microorganisms; Controlled release; Stability.*

Prof. Mohamed CHIKHAOUI
IAV Hassan II, Rabat, Maroc

Professeur Mohamed CHIKHAOUI a obtenu son doctorat de l'Université de Sherbrooke - Canada en 2005, après avoir obtenu un diplôme d'ingénieur agronome spécialisé en sciences du sol à l'IAV Hassan II en 1998. De 2006 à 2010, il a enrichi son parcours académique en occupant les fonctions de chercheur postdoctoral et de chercheur associé à l'Université McGill, au Canada. Durant cette période, il s'est impliqué dans des projets multidisciplinaires et multi-institutionnels, ce qui lui a permis de renforcer ses compétences en recherche appliquée et de développer des aptitudes remarquables en supervision d'étudiants ainsi qu'un esprit collaboratif exemplaire.

Professeur CHIKHAOUI a dirigé plusieurs projets de recherche d'envergure internationale et nationale, principalement axés sur la gestion des ressources hydriques et la conservation des eaux et des sols dans le contexte du changement climatique et le développement des mesures d'adaptation.

En plus de son rôle à l'Institut Agronomique et Vétérinaire Hassan II, où il est depuis 2011 Directeur Adjoint de la Recherche Scientifique et de la Formation Doctorale, Pr CHIKHAOUI est également professeur associé à l'Université Laval au Canada. Il est reconnu comme expert par des organisations internationales de premier plan telles que la FAO et la Banque Mondiale, ce qui lui confère une influence et une expertise reconnues à l'échelle mondiale. Son engagement continu dans la recherche a généré de nombreuses publications scientifiques et lui a valu une participation active à d'innombrables symposiums, conférences et séminaires, confirmant son statut de leader dans son domaine tant au niveau national qu'international.

Intelligence Artificielle au service de la gestion durable des ressources naturelles

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Abstract

La gestion durable des ressources naturelles s'impose aujourd'hui comme un défi stratégique à l'échelle mondiale, sous l'effet conjugué du changement climatique, de l'urbanisation accélérée et de l'intensification de l'agriculture. Face aux limites des approches traditionnelles, souvent fondées sur des modèles empiriques ou linéaires peu adaptés à la complexité des systèmes socio-écologiques, l'intelligence artificielle (IA) se positionne comme un levier technologique majeur pour renouveler les paradigmes de modélisation, de prévision et de gestion.

Cette communication, appuyée sur une sélection rigoureuse d'études de cas représentatives, met en lumière le rôle transversal et stratégique de l'IA dans l'amélioration de la précision, de la résilience et de l'efficience des dispositifs de gestion durable. À travers une analyse critique enrichie d'exemples concrets d'applications, elle démontre comment l'intégration intelligente de l'IA dans les processus de modélisation biophysique et de soutien à la décision peut contribuer de manière significative à anticiper les risques, optimiser l'usage des ressources, et renforcer la capacité d'adaptation des territoires face aux pressions environnementales croissantes et à la variabilité climatique.

Ing. Jabir CHAOUI

Entreprise Global Diagnostic Distribution (GDD), Témara, Maroc

Global Diagnostic Distribution (GDD) est une entreprise spécialisée dans la distribution et le support de solutions innovantes dans les domaines des sciences de la vie, du diagnostic médical et de la biotechnologie. Basée au Maroc, GDD représente des marques internationales de référence telles que QIAGEN, et collabore étroitement avec des laboratoires, des cliniques, des centres de recherche et des institutions académiques.

Grâce à une expertise technique solide et une approche orientée client, GDD contribue activement à l'évolution du diagnostic moléculaire et de la recherche en sciences de la vie au niveau national et régional.

Parmi ses collaborateurs, Jabir Chaoui occupe le poste de Life Science Specialist. Il assure le support scientifique et technique des solutions QIAGEN au Maroc, en accompagnant les chercheurs, cliniciens et laboratoires dans l'implémentation et l'optimisation de leurs protocoles en biologie moléculaire. Son rôle allie conseil, formation, démonstration et veille technologique, afin de garantir une utilisation optimale des outils de pointe distribués par GDD.

Sur la trace des gènes : la PCR digitale QIAcuity vers une nouvelle ère de précision en biotechnologie

Jabir CHAOUI
Entreprise GLOBAL DIAGNOSTIC DISTRIBUTION (GDD), Témara

Résumé

La PCR digitale (dPCR) marque une révolution dans le domaine de la biologie moléculaire, en apportant une précision absolue dans la quantification des acides nucléiques. Dans cette présentation, nous mettons en lumière la technologie QIAcuity dPCR développée par QIAGEN, un système innovant basé sur la partition numérique sans gouttelettes, combinant la microfluidique et la lecture optique haute résolution.

Nous explorerons ses applications avancées dans le domaine de la valorisation des bioressources (micro-organismes, biomarqueurs environnementaux) ainsi que son potentiel dans la lutte contre l'antibiorésistance, grâce à la détection ultra-sensible des gènes de résistance.

Nous discuterons également des outils de bio-informatique intégrés dans l'interprétation des données dPCR, ouvrant la voie à une biotechnologie de précision, prédictive et durable.

Mots clés *: biologie moléculaire, QIAcuity dPCR, antibiorésistance, valorisation, bioressources*

Dr. Mohammed BOUDCHICHE

University Center for Prototyping and Innovation (CUPI) Mohammed First University, Oujda, Morocco

Since 2022 Director of the University Center for Prototyping and Innovation (CUPI) Mohammed First University, Oujda Development and coordination of training programs in 3D printing, robotics, digital manufacturing, and rapid prototyping. Oversight of innovation labs and support for student entrepreneurship, industrial prototyping, and applied research projects.
Since 2019 PhD Student in Hydrogeology and Civil Engineering Faculty of Sciences, Mohammed First University, Oujda Thesis title: *Hydrochemical characterization and sustainable management of water resources in arid zones – Application to the Tendrara aquifer (Eastern Morocco)*. Research includes GIS mapping, hydrological modeling, and risk assessment of water quality.
2018 – Present Founder and President of BerBot (Berkane Robotics) Design and fabrication of educational robotics platforms, 6-axis robotic arms, CNC machines, and 3D printers. Project-based innovation and technology transfer within the university ecosystem.
2017 – 2018 Laboratory Engineer – LECI (Laboratoire d'Essais et de Contrôle Industriel) Faculty of Sciences, Mohammed First University, Oujda Responsibility for mechanical and material testing, coordination of research projects, and student mentoring in civil engineering practices.
2015 – 2016 Web Developer – Faculty of Sciences, UMP Oujda Design and maintenance of academic web applications, including student results systems and research tools.
2014 – 2015 General Director and Founder of TCHOR Startup company focused on architectural visualization, urban planning tools, and prototyping services using AutoCAD, SketchUp, and 3D rendering software.
2013 – 2014 Engineering Intern – Multiple Technical Offices (GH-Project, CCET, AL OMRANE, ZINE WORKS) Tasks included environmental remediation studies, road design, reinforced concrete analysis, and energy audits for residential buildings.
2012 – 2010 Organizer and Media Lead – Academic and Technical Events – Renewable Energy Forum, Marrakech (2011) – Civil Engineering Day & FPEGC Forum, UMP Oujda (2012) – International Building Expo (SIB), Casablanca (2010)
Academic Background

Since 2021 PhD Candidate in Civil Engineering – Shenzhen University, China Research on 3D printing technologies and the development of composite concrete for digital construction.
Since 2019 PhD Candidate in Hydrogeology and Civil Engineering – UMP Oujda Focus on hydrological modeling, groundwater quality, and sustainable water management in semi-arid environments.
2020 Research Internship – University of Zagreb, Croatia Faculty of Mechanical Engineering and Naval Architecture. Topics: renewable energy and sustainable civil engineering materials.
2016 Specialized Master's Degree – Civil Engineering and Environment – UMP Oujda
2015 DALF C1 – French Language Proficiency – 76/100
2014 Professional License – Civil Engineering and Geo-Environment – UMP Oujda
2013 University Technical Degree – Civil Engineering and Geo-Environment – UMP Oujda
2011 Bachelor of Science – Computer Science and Mathematics (SMI track)
2010 Diplomas in Web Security and 3D Design
2009 – 2008 High School Diplomas – Experimental Sciences and Math Baccalaureates

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Intelligent Aeroponic System BERBOT / BranchGrow

Dr. Mohammed BOUDCHICHE

The BERBOT / BranchGrow system is a high-performance aeroponic farming solution designed to maximize productivity on minimal surface area through fully automated management powered by artificial intelligence (AI).
Comprising 120 vertical towers that can host up to 10,200 plants within just 100 m², it features intelligent control of climate conditions, irrigation, and nutrition via IoT sensors and predictive algorithms. This setup enables intensive cultivation with a growth cycle reduced by 40% and yields up to five times higher compared to traditional hydroponics.
The system saves 98% of water and eliminates nutrient waste through a closed-loop, optimized system. It supports a wide variety of crops including leafy greens, delicate fruits, and medicinal plants.
Easy to maintain thanks to automatic cleaning, it also comes with intelligent reporting services and remote software updates. The estimated return on investment is between 18 and 24 months, with labor requirements reduced by 90%.

Keywords: *Aeroponics – AI – Productivity – Automation – Sensors – Water Efficiency – Vertical Farming – Smart System – Sustainability*

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Prof. Mohamed Addi is a Full Professor at Mohammed First University (UMP) in Oujda, Morocco, with more than fifteen years of experience in higher education and scientific research. He is affiliated with the *Laboratory for the Improvement of Agricultural Production, Biotechnology, and Environment*, where his research focuses on **plant biotechnology**, **plant breeding**, and the **valorization of agricultural and medicinal plant products**, especially those related to native and locally cultivated species.

He holds a PhD in Plant Biotechnology from the University of Science and Technology of Lille (France) and a Master's degree in Biotechnology from the University of Picardie Jules Verne (Amiens, France). In addition to his academic career, he has gained experience in both public and private sectors, notably as a research engineer at Al Akhawayn University in collaboration with the industry.

His scientific interests extend across multiple disciplines, including **cell biology**, **biotechnology**, **phytochemistry**, and **pharmacology**, with a particular emphasis on exploring bioactive compounds from medicinal plants for therapeutic applications. Prof. Addi has authored over 120 peer-reviewed articles published in international scientific journals. He is also a recognized **academic editor** for several journals, including *Journal of Food Quality*, *Advances in Pharmacological and Pharmaceutical Sciences*, *Scientifica*, and *International Journal of Agronomy*. Additionally, he serves as Guest Editor for the *International Journal of Plant Biology* (MDPI).

Prof. Addi is actively involved in coordinating and participating in national and international research projects, including:

- The **PRIMA project "Switch to Healthy" (2022–2025)**, which aims to promote healthier dietary habits among children and adolescents across the Mediterranean region.
- A national project on the **valorization of *Cannabis sativa* seeds through biochemical characterization and their use in poultry diets** (2020–2023).
- A project under the Applied Research Support Program (PARA-1) focused on the **characterization and post-harvest valorization of local almond ecotypes** in the Oriental region of Morocco (2019).

Beyond his research activities, Prof. Addi is committed to fostering scientific dialogue and capacity-building. He has helped organize several international and national conferences and workshops, such as:

- The **Fifth International American Moroccan Agricultural, Health, and Life Sciences Conference (AMAHLS V, 2022, Tangier)**,
- Two **Humboldt Kolleg meetings** in Marrakech (2018) and Fès (2015),
- And a national workshop on student entrepreneurship and agro-industrial innovation (2017).

With a strong commitment to scientific innovation, local resource development, and academic excellence, Prof. Addi continues to play a key role in advancing plant science and biotechnology research in Morocco and the wider Mediterranean region.

Smart Cultivation of Medicinal Plants: Hydroponics, Aeroponics, and Plant Advanced Technologies for Sustainable Cosmetic Ingredients

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Abstract

This presentation explores smart agriculture innovations—specifically hydroponics and aeroponics—as advanced soilless cultivation methods for growing medicinal and aromatic plants under tightly controlled conditions. These techniques allow for precise management of environmental factors and nutrient supply, resulting in increased biomass and enhanced production of valuable bioactive compounds widely used in the cosmetic industry, such as antioxidants, polyphenols, and essential oils.

By integrating data-driven technologies like sensors, artificial intelligence (AI), and the Internet of Things (IoT), cultivation processes become more efficient, reliable, and consistent. Additionally, the use of **Plant Advanced Technologies (PAT)**, including innovative approaches like **Plant Milking®**, enables sustainable, non-destructive extraction of active molecules directly from living plants, maximizing yield without harming the crop.

Case studies and experimental data demonstrate that these smart systems reduce water consumption, decrease land use, and eliminate the need for pesticides, while enabling year-round production. The presentation will conclude with an outlook on the industrial scalability of these technologies and their potential to transform the production of natural cosmetic ingredients in a sustainable and eco-friendly manner.

Keywords *: Smart agriculture, hydroponics, bioactive compounds, cosmetics, Plant Advanced Technologies (PAT).*

Oral Presentations
Theme 1

Session I: Innovative and Sustainable Primary Production Integrating Life Cycle Assessment (LCA):
(Water resource conservation, biological control and biopesticides, plant biostimulants...)

Sub-session T1-A: Biotechnologies and Innovative Practices for Sustainable Agriculture
(Biocontrol, biofertilization, biochar, valorization of agricultural residues, improvement of plant productivity)

CO11: Advancing Sustainable Agriculture: Biocontrol of Tomato Root Rot Caused by *Rhizoctonia solani* Using Antagonistic Microorganisms

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Abstract

Root rot caused by *Rhizoctonia solani* poses a significant threat to tomato cultivation, leading to substantial yield losses worldwide. To address this challenge, our study investigates the use of antagonistic microorganisms as a biocontrol strategy. The research evaluates the efficacy of microbial consortia, including bacterial strains such as Bacillus spp. and fungal species like Trichoderma spp. Initially, individual isolates were assessed for their antagonistic potential against *R. solani* through in vitro and in vivo assays. Subsequent trials combined these isolates to enhance their biocontrol efficacy. Key physiological and biochemical parameters such as chlorophyll content, phenolic compounds, flavonoids, proline, and malondialdehyde (MDA) were analyzed in treated plants to elucidate their roles in induced systemic resistance (ISR). Enzymatic activities, including catalase, peroxidase, ascorbate peroxidase, polyphenol oxidase, and superoxide dismutase, were also monitored to evaluate plant defense responses. Furthermore, bio-priming of tomato seeds with selected isolates was tested to enhance germination, seedling vigor, and resistance to *R. solani.* Preliminary findings demonstrate that treatments with Bacillus and Trichoderma isolates significantly enhance tomato plant resilience, achieving up to a 50% reduction in disease severity. Additionally, improvements in plant growth parameters including protein content, soluble sugars, and chlorophyll exceeded 40%, while oxidative stress markers, such as malondialdehyde (MDA), decreased by 35%. These results highlight the potential of these
biocontrol agents to reduce reliance on chemical fungicides and promote sustainable agriculture, paving the way for eco-friendly and effective disease management strategies.

Keywords: *Rhizoctonia solani - Root rot - Biocontrol - Antagonistic microorganisms - Induced systemic resistance.*

CO12: Evaluation of seaweed biostimulatory effects on Durum Wheat (*Triticum durum L.*) growth, physiology, and antioxidant System

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Abstract

To meet international food demand and reduce dependence on chemical fertilizers that have harmful effects on both the environment and human health, the demand for sustainable and ecological agricultural tools has increased significantly in recent years. Macroalgae-based biostimulants offer an innovative and eco-friendly approach for enhancing crop growth and yield, as well as stimulating plant defense systems against biotic and abiotic stresses, due to their diverse metabolic profiles. In this study, the durum wheat plant (*Triticum durum*) was used as a model plant to evaluate the biostimulant potential of *Codium tomentosum* (Ulvophyceae) aqueous extract on the growth, physiology, and antioxidant defense system of durum wheat. The plants were exposed to three different concentrations (1, 3, and 6%) for 42 days. Results showed that the seaweed extract at 3 and 6% induced a significant increase in biomass, plant height, relative water content, and leaf area in durum wheat plants. Moreover, all tested concentrations increased photosynthetic pigments, soluble sugars, and protein content of durum wheat plants. The antioxidant systems, including superoxide dismutase (SOD), catalase (CAT), and polyphenols, were significantly enhanced in seaweed extract-treated *T. durum* plants. The obtained results demonstrate the potential of macroalgae-based aqueous extracts as eco-friendly biostimulants and their promising application for sustainable agriculture.

Keywords: *Seaweeds, Codium tomentosum, Triticum durum L., Plant growth, Biostimulation, Antioxidant System.*

CO13: Impact of Biochar on the Physico-Chemical Properties of Soils Under Water Stress: A Comparative Study

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Abstract:

Over the last few decades, the importance of biochar has sparked growing academic interest. This material serves as an effective solution for valorizing agricultural and organic waste while improving soil quality. This study aims to evaluate the effects of two types of biochar, referred to as B and P, on the physico-chemical properties of soils under different irrigation levels: 80%, 60%, and 40%, the latter representing a state of water stress, applied to a selected crop.
The results show that samples enriched with biochar, particularly at concentrations of 4% (P 4%) and 6% (P 6%), exhibit higher nutrient levels compared to the controls (CN and CP) at 80% and 60% irrigation. This indicates that the addition of biochar can enhance the bioavailability of nutrients, thereby improving soil fertility.
The controls, CP and CN, show relatively stable levels of iron and manganese at 60% irrigation. However, these levels remain lower than those observed in the biochar-enriched samples, highlighting the positive effect of biochar on the availability of micronutrients in the soil.
Regarding the variations observed among the different types of biochar (e.g., B 2%, B 3%, Mix 4%), some samples, such as B 2%, reveal particularly high levels of manganese at 60%, which could benefit the crop by promoting optimal allocation of this micronutrient.

Keywords: *Biochar, Physico-chemical properties, Water stress, Irrigation, Soil fertility.*

CO14: Isolation and Characterization of Actinobacteria from Moroccan Arid Zones and Their Role in Seed Germination

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Abstract

Global crop productivity is significantly impacted by climate change, which intensifies drought stress. This study investigates the potential of actinobacteria isolated from three arid regions of Morocco to enhance seed germination under drought-prone conditions. Out of 28 isolates, six *Streptomyces* strains (OS0, SO4, SO5, SO6, SO6a, OM10) exhibited remarkable resistance to water stress (40% PEG-6000) and demonstrated notable plant growth-promoting rhizobacteria (PGPR) traits, including auxin synthesis (up to 89 µg/mL IAA); siderophore production), phosphate solubilization (up to 19.50 mg P/mL), and Potassium and Zinc solubilization. Some isolates showed also Gibberellic acid production. *In vitro* germination assays showed that tomato seeds treated with these actinobacteria had significantly higher final germination percentages FGP (66% at 20% PEG compared to 4% in non-inoculated control), improved seed germination speed SGS (2.3 seed/day at 15% PEG compared to 0.5 in non-inoculated control), enhanced mean daily germination MDG and reduced mean time to germination MTG. The strains also induced enhancement in seed vigor (germination vigor index GVI of 57.93 at 5% PEG compared to 0 in control). Strain OS0 showed the highest FGP at 20% PEG of 60%. At higher PEG concentration of 25%, only 16% FGP was reached with strain SO4. SEM observations and molecular identification, by 16S rDNA sequencing confirmed their assignment as *Streptomyces* species. These findings indicate that actinobacteria from Moroccan arid areas are promising bioinoculants able to enhance germination by alleviating drought stress and multiple PGPR mechanisms, offering sustainable agricultural solutions in water-limited environments.

Key words: *Actinobacteria, Streptomyces, drought tolerance, seed germination, PGPR, osmotic stress.*

CO15: Biofertilizing potential of *Sargassum muticum* for improving *Capsicum annuum L.* plant growth

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Abstract

Macroalgae are marine resources widely used for sustainable and organic crop production due to their richness in biologically active substances. This study explores the use of *Sargassum muticum* as a biofertilizer for *Capsicum annuum* L. plants. Biochemical and mineralogical characterization of *S. muticum* confirmed its richness in protein (0.66 ± 0.10 mg·g^{-1} DW), sugars (0.52 ± 0.07 mg·g^{-1} DW), nitrogen (18.1 ± 3.1 mg·g^{-1} DW), as well as macro and microelements including P, K, Ca, Mg, S, Fe, Mn, and Zn. HPLC analysis revealed that *S. muticium* contains indole butyric acid (IBA) at a concentration of 0.14 mg·g^{-1}. *C. annuum* plants were exposed to different concentrations of *S. muticum* (5, 20, and 30 g·kg^{-1}) and compared to negative and positive (NPK fertilizer) controls. Results showed that *S. muticum* increased shoot elongation, number of leaves, flowers, and internodes, dry weights of shoot, root, and fruit, as well as photosynthetic activity, mineral elements, protein, and total sugar content, with greater efficacy for the 20 g·kg^{-1} treatment. The nutritional yield of the fruits was significantly improved, with protein and sugar contents were 0.19 and 10.22 mg·g^{-1} fresh weight (FW), respectively. Nitrogen, phosphorus, and potassium contents were 95.2, 136.8, and 639.2 mg·g^{-1} dry weight (DW), respectively. The obtained results encourage the application of *S. muticum* seaweed as a low-cost and environmentally friendly biofertilizer for promoting sustainable crops.

Keywords: *Biofertilization, Growth, Sargassum muticum. Capsicum annuum L., Nutrients*

CO16: Agricultural Waste-Based Biochar: Enhancing Sandy Soil Properties and Tomato Growth Under Water Stress

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Abstract

Soil degradation and water scarcity are major challenges in arid regions like Souss-Massa. This study evaluates the effects of three biochars—BC-R, BC-T, and BC-B—derived from the pyrolysis of agricultural waste, on the physicochemical properties of sandy soil and tomato growth under water stress. Biochars were applied at concentrations of 2%, 4%, and 6%, and tomato plants were cultivated under three irrigation regimes: normal (100% ETc), moderate (60% ETc), and severe (40% ETc) stress in a controlled greenhouse environment. The results showed that biochar application increased soil pH and slightly raised electrical conductivity (EC), indicating improved nutrient availability. Trace element analysis revealed a significant increase in nitrogen (N), phosphorus (P), and potassium (K) levels, particularly at 4% and 6% biochar concentrations. A comparison between biochar-amended soil before and after tomato cultivation under different water stress conditions demonstrated enhanced water retention and plant resilience. Tomato plants grown in biochar-treated soils exhibited more vigorous growth and improved tolerance to water deficit, with notable differences among biochar types. This study highlights the potential of biochar as a sustainable soil amendment to improve sandy soil fertility and mitigate water stress impacts on crops in arid environments.

Keywords: *Biochar, Sandy Soil, Water Stress, Tomato Cultivation, Sustainable Agriculture.*

CO17: Alternative de lutte contre les ennemis des cultures : Contribution à l'étude des potentialités des bio pesticides à base d'extraits d'algues pour une valorisation en protection des plantes

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Résumé

La présente étude a pour objectif de contribuer à améliorer l'état sanitaire et la croissance des plantes par des éventuels biopesticides issus d'extraits algaux appartenant aux groupes vert, rouge et brune, et ce dans l'objectif de minimiser les effets indésirables des produits phytosanitaires. Des essais ont été réalisés aux laboratoires de la FSO et sous abris serre, par trois concentrations d'extraits d'algues et d'un biopesticide de référence, sur des semences, des fruits et des plants de de diverses cultures, selon des dispositifs expérimentaux aléatoires. Les résultats de cette étude montrent que, pour la phase de germination, les traitements (extrait *d'U. lactuca, G. gracilis*, biopesticide et eau distillée) ont donné des taux de germination équivalents pour les cultures de tomate et de basilic.Pour le melon, le biopesticide s'est révélé être le traitement le plus efficace pour obtenir un taux de germination élevé, suivi par les traitements par les deux types d'algues. L'essai avec ces deux espèces d'algues, en plus de *U. rigida, G. dura* et *Cystosiera sp*, a été réalisé en vue d'évaluer leur activité antifongique et antibactérienne au moyen des extraits aqueux et méthanoliques. Les résultats montrent que les extraits aqueux d'U. lactuca et *G. gracilis* présentent principalement un pouvoir antifongique contre *Penicillium digitatum*, et l'extraits méthanolique de *G. dura* contre *Rhodotorula glutinis* et ceux *d'U. rigida* et *G. dura* ont une activité antibacterienne contre *Micrococcus luteus*. La fermentation des algues, notamment *U. rigida*, *G. dura* et *Cystosiera sp*., par la bactérie *Lactiplantibacillus plantarum S61*, montre que les algues sont considérées comme des stimulateurs pour le développement de la bactérie plutôt que comme une source de carbone. Cette étude a été finalisée par l'évaluation de l'activité antifongique et antibactérienne de ces matières après fermentation dans des milieux MRS normal et modifié. Dans le premier milieu, une zone d'inhibition significative a été observée pour la souche *Rhodotorula glutinis* pour les trois algues, et également dans l'autre milieu, à l'exception de *G. dura*. Pour l'usage de ces traitements sur les fruits contre les contaminations fongiques en post-récolte, les résultats montrent que le biopesticide possède un fort pouvoir protecteur contre les maladies post-récolte, suivi par l'extrait de *G. gracilis* pour certaines espèces.

Mots-clés: *algues marines, Ulva lactuca, Gracilaria graclis, Gracilaria dura, biopesticide, germination*

CO18: Valorization of essential oil waste of two medicinal and aromatic plants as bioactive compounds

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Abstract

This study aims to evaluate the antifungal activity of plant extracts obtained from the essential oil extraction waste against *Pythium spp*. After extracting essential oils of *Artemisia sp* and *Cymbopogon citratus* powders using hydro distillation, the plant materials were reused for the preparation of plant extracts. The aqueous extracts were prepared by maceration. Five concentrations (1%, 2%, 5%, 10%, and 20%) of stock solution were tested for their antifungal activity against *Pythium spp.* using poisoned food technique. The determination of flavonoids and total phenol contents was performed using the spectrophotometric methods with aluminum chloride ($AlCl_3$) and the Folin-Ciocalteu respectively. For both plant extracts, the inhibition of mycelial growth was significantly different among the tested concentrations ($P<0.001$). A concentration of 20% of the stock solution showed 100% and 76.42 ± 9.14 % inhibition of *Pythium spp.* for lemongrass and Artemisia extracts respectively. However, the concentration of 1% exhibited the lowest mycelial growth inhibition with a value of 28.21 ± 6.75 for Artemisia extracts and 34.96 ± 6.22 % for *C. citratus* extracts. On the other hand, regarding phytochemical analysis, the results showed that the flavonoids contents were 6.97 ± 0.05 µg QE/mg DE for Artemisia extracts and 10.59 ± 0.29 µg QE/mg DE for *C. citratus* extracts. Furthermore, the highest total phenol was recorded for Artemisia extracts with a value of 92.28 ± 2.31 µg GAE/mg while *C. citratus* extracts showed a content of 67.5 ± 5.55 µg GAE/mg. These bioactive compounds can be used as an active ingredient of a biopesticide for the management of this fungus.

Keywords: *Antifungal activity, Artemisia sp, C. citratus, plant extracts and Pythium spp.*

CO19: Endemic Bacillus from the Souss region: biopesticides and PGPR against fungal diseases of tomato (Botrytis, mildew, Oidium and Alternaria)

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Abstract

Effect of Bacillus Strain Against Phytopathogenic Fungi Plants constantly face biotic stress in their environment, which affects their growth, limits agricultural production, and causes significant economic losses. Chemical control has been the primary method for managing disease; however, these products have created numerous problems. They have led to the development of resistance in phytopathogenic agents and pose health and environmental risks. These concerns are driving a shift toward biological control strategies that align with sustainable agriculture and natural resource conservation. Our research aims to evaluate the activity of Bacillus strains isolated from rhizosphere soil in the Souss-Massa region of Morocco against the major fungal diseases of tomato plants (Botrytis, mildew, Oidium, and Alternaria). The results indicate that the bacterial isolates exhibit significant inhibition of these diseases. This effect is associated with the production of antimicrobial compounds (lytic enzymes, HCN, NH_3), the induction of systemic resistance, and siderophore production. Molecular identification of these isolates shows their classification within the Bacillus genus. Consequently, these findings highlight the efficacy of Bacillus genus bacteria as biopesticides, suggesting their potential in integrated disease management programs to reduce reliance on chemical pesticides.

Keywords: *Tomato fungal diseases, Souss region, Biological control, Bacillus, Biopesticides,*

Oral Presentations
Theme 1

Session I: Innovative and Sustainable Primary Production Integrating Life Cycle Assessment (LCA):
(Water resource conservation, biological control and biopesticides, plant biostimulants...)

Sub-session T1-B: Sustainable Management of Natural Resources and Aquatic Environments
(Water quality, contamination, aquatic biodiversity, valorization of marine ecosystems)

CO110: Potentially Toxic Elements Contamination in Surface Water of Moulouya Estuary (Northeastern, Morocco)

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Abstract

Metallic pollution in aquatic ecosystems represents a significant environmental issue, posing considerable risks to both aquatic life and human health. This study focuses on assessing the levels, distribution, sources, and human health risks of potentially toxic elements (PTEs) in the surface waters of the Moulouya River. Water samples were analyzed using inductively coupled plasma–optical emission spectrometry (ICP-OES). The highest concentrations were recorded at sites influenced by anthropogenic discharges such as urban wastewater and agricultural runoff. The Pollution Index (PI) indicates that the water of Moulouya Estuary is affected by Zn, followed by Pb, and As. Moreover, the Heavy Metal Evaluation Index (HEI) reveals that the water is strongly contaminated, indicating a significant environmental risk. Furthermore, the Metal Pollution Index (MPI) values were recorded in the following order: S2>S3>S4>S1. The human health risk assessment was determined by US-EPA models, including HQ and CR. For oral exposure, the HQ of the studied PTE suggests an unacceptable risk for both adults and children. However, the Cr represents an intolerable risk for dermal exposure for both age groups. The results of the Cancer Risk (CR) values for the studied metals via water intake and dermal contact for both children and adults were greater than 10^{-4}, which indicates a high cancer risk. The findings highlight the need for regular monitoring and management strategies to reduce ecotoxicological risks from human activities in the Moulouya River, essential for protecting biodiversity, water quality, and public health.

***Keywords**: Metallic pollution; Quality; PET; Health risks; Moulouya*

CO111: Impact des caractéristiques sédimentaires sur la répartition de la faune associée aux herbiers marins de la lagune de Nador

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Résumé

La lagune de Nador (Marchica) constitue un écosystème riche en biodiversité, où les herbiers marins jouent un rôle écologique fondamental en abritant une faune benthique diversifiée. Cette étude vise à évaluer l'impact des caractéristiques sédimentaires sur la répartition de cette faune associée. Des prélèvements de sédiments et des échantillonnages de la macrofaune ont été réalisés dans plusieurs stations représentatives au sein des herbiers. Les résultats montrent que les variations de la granulométrie et de la teneur en matière organique influencent de manière significative la structure des peuplements benthiques, mettant en évidence l'importance des caractéristiques du substrat dans la dynamique de ces communautés.

Mots-clés : *Lagune de Nador (Marchica), herbiers marins, faune benthique, sédiments, biodiversité.*

CO112: Biologie des populations du merlu européen (*Merluccius merluccius*, Linnaeus, 1758) dans la mer Méditerranée marocaine.

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Résumé

Le merlu européen (*Merluccius merluccius*) est l'une des espèces démersales les plus importantes de la mer Méditerranée. Afin de mieux comprendre sa biologie et la dynamique de sa pêche, la croissance, la reproduction et le régime alimentaire de *M. merluccius* dans la Méditerranée marocaine ont été minutieusement analysés. Un total de 6 223 individus a été collecté à l'aide de chaluts de fond commerciaux entre mars 2015 et avril 2019 dans la Méditerranée marocaine (Méditerranée occidentale). Les relations taille-poids ont révélé une croissance allométrique négative chez les mâles (b = 2,89) et une croissance isométrique chez les femelles (b = 3,02). Le cycle reproducteur de *M. merluccius* indique que l'espèce est sexuellement active tout au long de l'année. La taille à la première maturité sexuelle a été estimée à 24,8 cm. Le spectre alimentaire du merlu est relativement diversifié, comprenant plus de 24 taxons de proies identifiés. L'analyse des préférences alimentaires a montré que les Ostéichthyens (poissons osseux) dominent le régime alimentaire, suivis des crustacés. Les préférences alimentaires varient selon les stades ontogénétiques : les spécimens plus petits consomment principalement des proies zooplanctoniques, tandis que les adultes ciblent des proies plus grandes, telles que les Ostéichthyens et les crustacés, pour répondre à leurs besoins énergétiques accrus. Un niveau trophique de 4,1 a été calculé, classant l'espèce comme un prédateur de haut niveau. Cette étude apporte des connaissances scientifiques précieuses sur *M. merluccius*, fournissant des données essentielles pour soutenir le développement de stratégies de gestion optimales et durables pour cette ressource halieutique clé.

Mots-clés *: Mer Méditerranée,* Merluccius merluccius*, mortalité, dynamique des populations, évaluation des stocks.*

CO113: Desalination Brine: Characterization, Management Strategies, and Environmental Impact

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Abstract

Seawater desalination is a process that generates a highly concentrated discharge of salts and chemicals, known as concentrate or brine. When released into the environment, this residue disrupts the marine ecosystem and alters water quality. It is therefore essential to study the composition of this concentrate and its impact on the natural environment. Several solutions can help mitigate its negative effects, including dilution techniques, treatment, or the recovery of specific components.

This study examines the characteristics of desalination brine and the strategies to minimize its environmental impact. The composition of the brine was analyzed by determining key parameters such as boron, sulfate, calcium, and total dissolved solids (TDS). The results reveal high concentrations of boron (2.53 ppm), sulfate (3,995 mg/L), calcium (812 mg/L), and TDS (63,662 mg/L). These values exceed regulatory limits, emphasizing the need for rigorous discharge management.

The dilution effect resulting from mixing brine with seawater and other desalination effluents significantly reduces these concentrations, ensuring compliance with current environmental standards.

In conclusion, although the initial concentrations in desalination brine are high, dilution serves as an effective mitigation measure to limit negative impacts on marine ecosystems, thereby ensuring discharge in accordance with environmental regulations.

Keywords: *Brine, Dilution, Characterization, Discharges, Marine Ecosystem.*

CO114: Assessment of Pyrethroid Resistance in a Moroccan field population of *Cydia pomonella* (Lepidoptera: Tortricidae)

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Abstract

The codling moth (*Cydia pomonella*), a key pest of pome fruits worldwide, causes significant challenges to apple producers due to its capacity to develop resistance to insecticides. This study evaluated the resistance status of *C. pomonella* to three commonly used pyrethroid insecticides, deltamethrin, lambda-cyhalothrin, and cypermethrin, in a field population collected from one of Morocco's largest apple orchards over two consecutive years (2023 and 2024). Toxicological bioassays were conducted using discriminating doses to assess resistance levels and temporal variations in susceptibility. The presence of the knockdown resistance (kdr) mutation, a key mechanism underlying pyrethroid resistance, was also investigated. The results revealed significant resistance to all tested pyrethroids, with a marked decline in insecticide efficacy from 2023 to 2024. Molecular analysis detected the kdr mutation in all tested individuals. These findings highlight the inefficacy of pyrethroids against Moroccan *C. pomonella* strains and stress the urgent need to revise pest management strategies. By elucidating resistance mechanisms and tracking susceptibility trends, this research provides essential insights for the development of sustainable IPM programs to manage *C. pomonella* populations in Morocco.

Keywords : *Cydia Pomonella*, Pyrethroid Resistance, *kdr* Mutation, Pest Management.

CO115: Investigation study of physicochemical properties of Schiff bases (SF) complexes and their innovative applications in heterogeneous catalysis

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Abstract

Heterogeneous catalysis, a cornerstone of modern industry, relies on efficient and selective catalysts. Hybrid materials combining the unique properties of organic and inorganic components have emerged as promising candidates to address this need. Mesoporous silica, known for its well-defined pore structure and high surface area, provides an ideal platform for anchoring active catalytic sites. Schiff bases, versatile ligands, offer tunable electronic and steric properties, allowing for the design of catalysts with tailored selectivity and activity. By combining these two components, hybrid materials can be engineered to catalyze a variety of processes, including as C-C bond formation, oxidation, and reduction.

This review provides a comprehensive overview of the latest research, offering insights into the synthesis, characterization, and application of hybrid materials in various catalytic processes. In contrast to conventional homogeneous or heterogeneous catalysts, special attention will be paid to the synergistic effects of the inorganic and organic components, which might result in improved catalytic performance.

Keywords : *Heterogenous Catalysis, Mesoporous Materials, Complexes, Schiff Bases.*

CO116: Assessment of Mineral Oils, Black Soap, and Essential Oils for Controlling *Dactylopius opuntiae* (Cockerell. 1929) (Hemiptera: Dactylopiidae)

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Abstract

The cactus pear is extensively cultivated in Morocco, but its evolution as a high-value crop has been disrupted since the introduction of *Datylopius opuntiae*, in 2014. The objective of this study was to test, in laboratory, greenhouse, and field, the efficacy of mineral oils, black soap, and essential oils from three plants: *Origanum vulgare*, *Artemisia herba-alba*, and *Brassica alba* against this insect, and to evaluate their phytotoxic effects on one-year-old cladodes in the field. The results showed significant efficacy of the five tested products. In the laboratory, the essential oil of *O. vulgare* and black soap emerged as the most effective treatments, achieving a maximum mortality rate of 100% against adult females 96 hours after application. The same level of mortality was observed in nymphs at 24 hours and 48 hours after treatment by *O. vulgare* essential oil and black soap, respectively. This efficacy was confirmed in greenhouse with percentages of 100% (144 hours after treatment) and 99.44±0.95% (168 hours after treatment) respectively, for black soap and *O. vulgare* essential oil. In the field, the essential oils of *O. vulgare* and *A. herba-alba* showed the highest efficacy with a mortality rate of 100%, 48 hours after treatment. The phytotoxicity evaluation showed a significant phytotoxic effect of *O. vulgare* essential oil applied at a 5% dose.

Keywords *Dactylopius opuntiae*, control, *Origanum vulgare*, *Artemisia herba alba*, *Brassica alb*

CO117: Seasonal Dynamics and Stocking Density: Key Factors Influencing the Growth of *Gracilaria gracilis* in the Nador Lagoon, Morocco

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Abstract

Seaweed aquaculture, a rapidly growing segment of global food production, offers numerous strategies for mitigating and adapting to the challenges of developed-world conditions. In Morocco, the expansion of seaweed cultivation holds promise for increasing incomes in fishing villages. This study evaluated the effects of stocking density (1.3, 1.6, and 2.3 kg/m²) and season on the cultivation of the red seaweed *Gracilaria gracilis* using the suspended method in the Nador Lagoon from February 2024 to February 2025. Statistical analysis using ANOVA revealed that both season and stocking density significantly influenced seaweed growth ($p < 0.05$). The highest daily growth rate (DGR) and biomass were observed in summer (2.90% per day) while the lowest were recorded in winter (0.62% per day). The maximum biomass yield and DGR were achieved at a stocking density of 2.3 kg/m² after 45 days of culture; however, no significant difference ($p > 0.05$) was found between the 1.3 and 1.6 kg/m² densities. Additionally, hydrological parameters (temperature, salinity, dissolved oxygen, pH, and turbidity) were monitored and their influences on growth were discussed. Based on these findings, cultivating *G. gracilis* at a stocking density of 2.3 kg/m² during the warm season may enhance biomass production, thereby providing monetary benefits to small-scale farmers in Morocco's Marchica Lagoon.

Keywords: *Seaweed aquaculture ; Gracilaria gracilis ; Stocking density ; Seasonal growth ; Biomass yield ; Nador Lagoon*

CO118: Analyse et simulation du transfert des éléments traces métalliques issu des activités minières vers les eaux superficielles

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Abstract

Few studies have quantified the complex flux of trace metals from mine tailings to rivers through water erosion, especially in the semi-arid region of North Morocco (Zaida mine) where soil erosion is a severe issue. This study applies (i) methods to understand and estimate the complex flux of trace metals from mine tailings to rivers, using the RUSLE model combined with the concentration of trace metals in the soil and additionally (ii) pollution indices and statistical analyses to assess the sediment contamination by Cd, Cu, Pb, and Zn. Our study revealed that the basin has a low erosion rate, with an average of 9.1 t/ha/yr. Moreover, the soil contamination is particularly high at the north of the mine tailings, as prevailing winds disperse particles across the basin. The assessment of the sediments indicated that Pb is the main contaminant, with concentrations exceeding 200 mg/kg specifically downstream of the tailings. This study also identified high a concentration of trace elements 14 km away from the tailings alongside the Moulouya river, due to the specific hydrological transport patterns in the area. This research contributes to a better understanding of the transport and fate of the trace metals in mining areas. It proposes a replicable method that can be applied in other regions to assess the contamination flows and thereby assist water resource management.

Keywords: *soil erosion; sediment contamination; trace metals flux; RUSLE model; remote sensing; GIS*

Oral Presentations
Theme 1

Session I: Innovative and Sustainable Primary Production Integrating Life Cycle Assessment (LCA):
(Water resource conservation, biological control and biopesticides, plant biostimulants...)

Sub-session T1-C: Agroecology, Integrated Systems, and Climate Resilience
(Aquaponics, desertification, abiotic stress, soil–plant interactions, biological control, circular economy)

CO119: Rhizobia-soybean (*Glycine max*) varietal interaction and substrate preferences under controlled condition

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Abstract

Understanding the interactions between the triple substrate-root-plant definitely will boost the efficiency of inoculated strains in the open field. Here, we evaluated under controlled conditions the response of three soybean varieties (V1: Afatok, V3: Soung Pungun and V10: TGX-1987-62F) to inoculation and substrate property using three rhizobial strains (B1: *B. elkanii*; B2: *B. japonicum* and B3: *R. phaseoli*) and four different substrates (peat; sandy soil; vermiculite; and bentonite). The substrate analysis was performed to reveal the key traits impacting the symbiosis. In parallel, we monitored the overall growth and physiological parameters of plants cultivated in every substrate. Likewise, we measured the nitrogen and phosphorus content in shoots, roots and nodules after harvesting. Results revealed increased biomass, nodulation and improved nutrient content for different used varieties grown in peat and vermiculite. Negative correlations were detected between the measured parameters especially for plants cultivated in sandy soil. For instance, shoot nitrogen content reached 74.40 mg/g DW in V3B3 grown in vermiculite, compared to 54.40 mg/g DW in peat. The root/shoot ratio reached 2.16 in V10B2 in soil and 1.46 in V3B2 in bentonite. A strong regression of nodulation efficiency was also detected for inoculated plants in soil, it varies according to varieties but generally still increased for peat and vermiculate. These were strongly correlated to substrate properties especially oxygen and silicon contents, pH and porosity. The study provides insights into the reasons affecting the success of inoculation technology that clearly depend on the overall interaction of these parameters in field.

Keywords: *plant variety, pH, substrate propriety, porosity, oxygen, silicon.*

CO120: Introduction of Aquaponic systems in the Oriental region in the face of desertification challenges

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Abstract

In Morocco, the Oriental region, particularly in its southern part, is facing advanced desertification, resulting from the continuous degradation of local ecosystems. This phenomenon is exacerbated by both natural and anthropogenic factors, affecting hydraulic infrastructures and vegetation cover. Although a lot of projects to combat desertification have been implemented, their results have not met expectations. In light of this situation, it has become necessary to explore more suitable, effective, and sustainable solutions to mitigate the effects and preserve the natural resources of the region.

Aquaponics appears as an innovative solution, based on the aquaculture project recently introduced in the province of Jerada, aimed at the production of fish suitable for desert areas. Indeed, this aquaculture station inaugurated by the National Agency for Water and Forests will provide an opportunity to integrate this sustainable technique and combine fish farming with plant cultivation in the region's agricultural farms, as well as the idea of establishing a forest nursery of suitable species, which would be irrigated by the water coming from this station.

Aquaponics optimizes water resources while multiplying the essential plant production needed to combat desertification. An experiment conducted in the Larache region as part of a final project demonstrated promising results in terms of plant production and water conservation, without the use of fertilizers, pesticides, or chemical inputs. The waste from the fish is metabolized by bacteria and assimilated by the plants to produce a better plant mass. The fish farming water, laden with ammonia, is sent to the cultivation beds, where ammonia is converted into nitrites, then into nitrates, and finally the water filtered by the plants can return to the reservoirs, and the cycle begins again. This initiative represents a unique opportunity and a sustainable solution that contributes to the responsible management of natural resources while enhancing the resilience of ecosystems in the face of climate challenges.

Keywords: *Oriental region, Desertification, Aquaculture, Reforestation, Sustainable agriculture, Aquaponics.*

CO121: Antifungal potential of *Warionia saharae* essential oil against *Botrytis cinerea*

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Abstract

Warionia saharae Benth. & Coss is a rare and an endemic species to North Africa, particularly found in the arid regions of Morocco. This medicinal plant belongs to the Asteraceae family and is known for its significant biological properties, including antimicrobial and antioxidant activities. However, studies investigating the potential of this species in agricultural application remain limited, suggesting a knowledge gap in this field that warrants further exploration. This study aims to assess the antifungal activity of essential oil (EO) of *W. saharae* against *Botrytis cinerea*, a major phytopathogenic fungus responsible for substantial crop losses worldwide. The EO was extracted from the leaves of *W. saharae* via hydro-distillation. The antifungal activity was assessed using the food poisoning technique, where radial mycelial growth was measured after four days of incubation. Results showed that a concentration of 0.15 ml/100ml led to complete inhibition (100%) of *B. cinerea* growth. These findings highlight the potential of *W. saharae* EO as a natural fungicide, offering a promising alternative for sustainable crop protection and integrated pest management. Further studies should focus on identifying the bioactive compounds responsible for this antifungal effect, understanding their mechanisms of action, and optimizing formulations for agricultural applications.

Keywords: *Warionia saharae; Essential oil; Antifungal activity; Botrytis cinerea; Phytopathogenic fungi.*

CO122: Assessment of Nitrogen Fertilizer Strategies for Wheat Cropping Systems Under Semi-Arid and Sub-Humid Climatic Zones in Morocco

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Abstract

Optimizing nitrogen (N) fertilization is critical for sustainable wheat production, yet its use efficiency remains context dependent. This study aims to evaluate the sustainability of the current fertilizer management and to optimize N application rate under two contrasting environments in Morocco. A two-year field study was implemented in Larache (Sub-humid climate) and Settat (semi-arid climate). In the first season, the farm practices fertilizer management was evaluated against a control treatment without fertilizer. In the second season, four N rates were investigated to optimize the N rate. Our results indicate that nitrogen fertilizer had a significant effect on wheat yield in both locations at both years. However, the yield response to nitrogen fertilizer was significantly different at the spatiotemporal scale. Proving the importance of environmental conditions as a determinant of crop response to fertilizer. Overall, the results highlight the need for site-specific and seasonally informed fertilizer recommendations rather than a one-size-fits-all approach. In addition, integrated management approaches that combine supplementary irrigation with fertilizer application are necessary to achieve the best crop response.

Keywords: *Site-specific fertilization, nitrogen use efficiency, nitrogen optimization, nitrogen uptake.*

CO123: Influence de la composition du milieu de culture sur la multiplication *in vitro* de deux variétés de *Cannabis sativa* L. cultivées au Maroc

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Résumé

Cannabis sativa L. est largement reconnu pour ses propriétés pharmacologiques et thérapeutiques, mais sa culture à partir de graines présente des défis, notamment en raison de sa nature allogame. Cela rend difficile la préservation de sa stabilité génétique. Dans ce contexte, la biotechnologie apparaît comme une solution efficace pour surmonter ces obstacles. Cette étude a pour objectif d'optimiser le protocole de micropropagation de deux variétés de *Cannabis sativa* cultivées au Maroc, à savoir Beldia et Khardala. Plusieurs concentrations de milieu ont été testées en association avec différentes concentrations de saccharose (1,5 %, 3 % et 4,5 %) et différentes substances de croissance (la zéatine, l'acide gibbérellique et le thidiazuron). Les résultats indiquent que l'utilisation du milieu MS favorise la croissance des pousses et l'induction des cals. L'ajout de sucrose à 1,5 % et 3 % permet d'obtenir des taux de régénération élevés, de 67,71 % à 77,43 %, tandis qu'une concentration de 4,5 % induit un stress osmotique et inhibe la croissance. L'ajout de régulateurs de croissance montre des effets significatifs, notamment la zéatine, qui offre les meilleurs résultats de régénération, atteignant 73,61 % pour la variété Khardala et 89,58 % pour Beldia, avec une augmentation du nombre de feuilles et de pousses. L'acide gibbérellique (GA_3) génère des résultats similaires mais avec des taux de régénération légèrement inférieurs (72,92 % et 74,31 %). En revanche, l'utilisation de thidiazuron donne des résultats plus au moins faibles. Ces résultats soulignent l'importance des régulateurs de croissance pour optimiser la micropropagation de *Cannabis sativa*.

Mots-clés: *Micropropagation, Saccharose, Zéatine, Acide gibbérellique, Thidiazuron.*

CO124: Drought- and Salinity-Tolerant PGPR Actinomycetes : Effects on Date Palm Seed Germination and Antagonism of Date Palm Bayoud Disease Agent

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Abstract

The objective of this study was to select salinity and drought tolerant PGPR actinomycetes isolates, with antagonistic properties against *Fusarium oxysporum* f.sp. *albedinis* (*Foa),* causal agent of Bayoud disease. Results showed that 10 isolates were drought, heat and salinity tolerant. Selected isolates showed *in vitro* PGP abilities. Strain S129 showed the highest ability to solubilize phosphates. The isolate S113 showed highest solubilization of potassium and zinc. All the isolates produced the phytohormone IAA, antifungal metabolites and volatile compounds, but not HCN. Six isolates (Z25, K809, Z27, S113, K810, and S129) inhibited *Foa* mycelium growth by more than 50%. Treatment with Z27 and Z25 resulted in a decrease in conidia number, by 98.15% and 99%, in conidia germination by 99% and 98.67% and in germ tube elongation by 71.25% and 99.4% respectively. In addition, most strains induced increase in electrolyte leakage from *Foa* mycelia. In addition, in drought and salinity conditions (respectively induced by 30% of PEG 6000 and NaCl at 7%), strain Z27 showed a high germination rate of 66% compared to only 13% in control. It also induced enhancement in radicles length compared to control under the same conditions. The selected isolates were therefore identified at species level by 16S rDNA sequencing.
This study highlights the importance of selecting actinomycetes tolerating stress conditions, with PGPR traits and beneficial effects on seed germination, for biofertilization of date palm trees as antagonists of Bayoud disease agent.

Keywords*: Actinomycetes, Antagonism, Bayoud disease, Drought, Germination, Fusarium oxysporum f.sp. albedinis, PGPR, Salinity.*

CO125: Bacteriological Quality Assessment of Drinking Water in the Rural Region of Ouichane

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Abstract

This study assesses the bacteriological quality of water intended for human consumption in the rural region of Ouichane in a context where access to safe drinking water remains a significant public health challenge. Fifteen water samples (12 wells and three springs) were analyzed according to Moroccan standards and WHO guidelines, focusing on total mesophilic flora, total and fecal coliforms, Escherichia coli, and fecal streptococci. Environmental factors such as the distance from dwellings, the water points' protection status, and the water's intended use were also considered. The results reveal widespread contamination of the water sources, rendering almost all samples unfit for human consumption. The analysis of the fecal coliform/fecal streptococci ratio indicates a predominantly human origin of pollution, closely associated with the proximity of wells to dwellings and the frequent use of rudimentary septic tanks. Principal Component Analysis (PCA) confirmed the influence of distance from habitation on the deterioration of microbiological water quality, and statistical classification distinguished three groups of stations according to their level of contamination. These findings highlight the urgent need to strengthen the protection of water points, improve rural sanitation, and raise community awareness of the risks associated with contaminated water to safeguard public health in these vulnerable areas.

Keywords: *Fecal Coliforms, Drinking Water, Water Quality, Fecal Streptococci, Escherichia*

CO126: Diversité des champignons endomycorhiziens et ectomycorhiziens dans la rhizosphère d'*Helianthemum ledifolium* dans la zone de Bni Guil (Maroc oriental)

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Résumé

L'objectif de ce travail est d'étudier la diversité des champignons mycorhiziens arbusculaires (CMA) et les champignons ectomycorhiziens (ECM), présents dans la rhizosphère *d'Helianthemum ledifolium* de la zone de Bni Guil (Province de Figuig, Maroc), connue par son climat aride et par sa production des truffes du désert. Les résultats de cette étude ont montré que la densité des spores extraites par tamisage humide est de 165 spores/50g du sol. L'identification de ces spores a révélé la présence de 37 espèces, appartenant à trois familles des CMA (Glomeraceae, Acaulosporaceae et Claroideoglomeraceae) et une famille des ECM (Cistaceae). Les genres *Glomus* et *Acaulospora* sont les plus dominants par la présence de 17 et 14 espèces respectivement par comparaison aux autres genres. En outre, la fréquence d'occurrence du genre *Glomus* est plus importante (50%) par comparaison avec les fréquences d'occurrence des autres genres de champignons présents surtout le genre *Terfezia* ce qui traduit la rareté des truffes du desert ces dernières décennies. Les résultats des observations racinaires ont montré la présence d'une ectomycorhization avec un réseau de Hartig typique et sans manteau fongique, malgré la dominance des champignons CMA, ce qui indique qu'il y a une certaine spécificité de l'hôte vis-à-vis des champignons ECM.

Mots-clés *: Rhizosphère, Helianthemum ledifolium, Champignons ectomycorhiziens, Champignons endomycorhiziens, Fréquence d'occurrence, Maroc oriental.*

CO127: Molecular and morphological identification of indigenous arbuscular mycorrhizal fungi (AMF) associated with *phoenix dactylifera* L. in the Figuig Oasis, Morocco

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Abstract

This study presents the first molecular characterization of arbuscular mycorrhizal fungi (AMF) isolated from single-spore cultures in Morocco, specifically from the rhizosphere of date palm (*Phoenix dactylifera* L.) in the Figuig oasis. Nine indigenous AMF isolates were established and identified through an integrative approach combining spore morphology with ribosomal DNA region sequencing (SSU–ITS–LSU). Morphological and phylogenetic analyses revealed that isolates belonging to the genera *Rhizophagus* and *Glomus* were the most frequently represented. Molecular data confirmed most morphological identifications, but also highlighted mismatches, underscoring the limitations of morphology alone—especially for genera with overlapping traits such as in *Glomus* sp.. Our findings refine the current understanding of AMF diversity in arid Moroccan ecosystems and offer a robust foundation for their future application in sustainable agriculture and soil restoration under challenging environmental conditions.

Keywords: *Arbuscular mycorrhizal fungi, Phoenix dactylifera L., Rhizosphere, Molecular identification, Figuig oasis, Arid ecosystems.*

Oral Presentations
Theme 2

Session II: Post-Harvest Processing – Tackling Spoilage and Losses:
(1) Challenges in fermentation, (2) valorization pathways for alternative proteins, (3) antimicrobials, (4) packaging (active, bio-based, smart), (5) innovative approaches to cleaning and disinfection, (6) secondary metabolites from aromatic and medicinal plants, (7) innovative strategies for food biopreservation...

Sub-session T2-A: Valorization of Agricultural By-products and Bioactive Extracts:
Utilization of crop residues, leaves, seeds, roots, etc., for food, pharmaceutical, or agricultural applications…

CO21: Anticancer activity of macroalgal proteins treated with cold plasma and ultraviolet radiation applications

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Abtract

Non-thermal, environmentally friendly techniques such as cold plasma and ultraviolet radiation application can increase the usage possibilities of proteins as food additives in food industry by improving their functional properties and bioactive properties such as antioxidant and anticancer activity. In this study, to modify *Caulerpa prolifera* protein extracts in terms of antioxidant and anticancer activity, cold plasma and ultraviolet radiation as nonthermal processing techniques were applied. Cytotoxic activity on a cancer cell line Caco-2 was be determined by the MTT (3-(4,5-dimethylthiazol-2-yl)-2,3-diphenyl-tetrazolium) assay in concentration of 10, 15, 20, 25, 30, 35 and 40 mg/mL at 24 h treatment time. Moreover, CUPRAC and DPPH assays were performed for antioxidant activity of the protein extracts. The conditions of cold plasma application were as follows: power of 87.50 W, application duration of 6.63 min and pressure of 0.90 mbar. On the other hand, ultraviolet radiation (60 W/m²) was applied under 20 min application duration and 25 cm distance (between electrode and the samples). According to the results, antioxidant activity of the modified protein extracts with cold plasma and ultraviolet radiation was determined as 6.56±0.72 mg Trolox equivalent (TE)/g and 11.77±0.52 mg TE/g in dry weight (dw) by CUPRAC method, respectively. Untreated sample's antioxidant activity was found as 4.41±0.05 mg TE/g dw. According to the results of MTT assay, the modified with cold plasma and ultraviolet radiation protein extracts show cytotoxic effect on Caco2 cells in concentration of >35 mg/mL whereas the unmodified protein extracts had a cytotoxic effect above 30 mg/mL concentration.

Keywords: *Macroalgae, proteins, anticancer activity, cold plasma, ultraviolet radiation.*

CO22: Biotechnological strategy for functional table olives production

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Abtract

In recent years, increased demand for low-sodium foods has driven innovative fermentation strategies for traditional products like table olives, essential in the Mediterranean Diet due to their richness in bioactive compounds (polyphenols, vitamins, minerals, monounsaturated fatty acids) and probiotic potential. This study optimized a multistep fermentation protocol to produce functional Sicilian olives with reduced salt, using indigenous cultivars Nocellara Etnea and Tonda Iblea. The sequential approach involved an initial Lactiplantibacillus plantarum starter, followed by probiotic Lacticaseibacillus rhamnosus with bile salt hydrolase (BSH) enzyme activity, known for cholesterol-lowering properties. Microbiological and chemical-physical parameters were monitored monthly during fermentation. The use of the starter significantly reduced spoilage microorganisms, improving the microbiological safety of the final product. After 150 days, the probiotic was added, the survival of which was confirmed by qPCR. A significant increase in total phenolic content (TPC) and antioxidant activity (DPPH assay) was observed in Tonda Iblea cultivar. Additionally, the analysis of volatile compounds (VOCs) by GC-MS and sensory analyses were performed at 240 days. Data on VOCs showed a more complex aromatic profile, characterized by fruity and floral notes (benzaldehyde, α-farnesene), compared to the spontaneously fermented samples, in which compounds responsible for aromatic defects prevailed (guaiacol, 4-ethylphenol). Finally, sensory analysis confirmed the high consumer acceptability of olives treated with the probiotic. In conclusion, this study confirms the validity of the sequential fermentation approach to produce functional and low-sodium table olives, enhancing the value of native Sicilian cultivars and effectively responding to the demand for healthy and innovative foods.

Keywords: *functional foods; low-sodium table olives; probiotic fermentation; volatile organic compounds; antioxidant activity; Sicilian olive cultivars*

CO23: Biotechnological Enhancement of Phenolic Compound Production in *Pelargonium graveolens* Hort.: Elicitor-Based Approaches, LC-MS/MS Metabolite Profiling, and Evaluation of Biological Activities

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Abstract

To support sustainable approaches in plant biotechnology, this study explores the use of chitosan (CHT) and salicylic acid (SA) as elicitors to stimulate the biosynthesis of phenolic and flavonoid compounds in Pelargonium graveolens callus cultures. Cultures grown on solid media were exposed to different concentrations of these elicitors, and metabolite changes were characterized using LC-MS/MS. The elicitor treatments markedly enhanced the accumulation of key secondary metabolites, particularly total phenolics and flavonoids. Among the detected compounds, kaempferol and rutin showed notable increases under specific treatments. This phytochemical enrichment was associated with improved biological activities, including enhanced antioxidant potential and significant inhibition of enzymes linked to skin aging. These results underscore the efficacy of elicitation strategies in optimizing the bioactive profile of plant cell cultures and support their application in the development of natural, plant-based cosmeceutical products.

Keywords: *Elicitation, Pelargonium graveolens, Phenolic compounds, LC-MS/MS profiling, anti-ageing activities, Plant biotechnology.*

CO24 : Valorisation des sous-produits du safran (*Crocus sativus* L.) : l'application foliaire d'extraits aqueux de tépales stimule la croissance et améliore les propriétés antioxydantes des plants d'aubergine en conditions sous serre.

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Résumer

La valorisation des sous-produits de *Crocus sativus* L. a pris de l'importance en raison de leur teneur intéressante en molécules bioactives. Les effets des extraits aqueux de tépales (EAT) ont été étudiés sur la croissance et la physiologie des plants d'aubergine en conditions sous serre. L'EAT a été appliqué par pulvérisation foliaire à trois reprises, à raison d'une application toutes les deux semaines, avec trois répétitions pour chaque concentration (1 mg/mL, 2 mg/mL, 3 mg/mL) dans un dispositif en blocs aléatoires complets, ainsi qu'un traitement combiné contenant 2 mg/mL de tépales et 0,6 mg/mL de stigmates (T+S).
La concentration de 2 mg/mL d'EAT a significativement ($p \leq 0,05$) augmenté la hauteur des plants et la teneur en chlorophylle, tout en réduisant l'activité antioxydante et le taux de MDA (malondialdéhyde). En revanche, la concentration de 3 mg/mL a inhibé la croissance des plants, augmenté la teneur en acide ascorbique et en polyphénols, et induit une peroxydation lipidique ainsi qu'une augmentation des activités antioxydantes, indiquant un stress oxydatif ($p \leq 0,05$). Par ailleurs, le traitement T+S a significativement influencé certains des paramètres analysés.
Ces résultats démontrent que l'EAT, à une concentration de 2 mg/mL, peut agir comme un biostimulant pour améliorer la croissance des plants et être utilisé dans des situations de stress.

Mots clés *: Crocus sativus L. ; Biostimulants ; Activité antioxydante ; Stress oxydatif ; Solanacées.*

CO25: Involvement of Characterized Polysaccharides Extracted from ginger in Food Applications

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Abstract

This study investigates the structural characteristics of a polysaccharide extracted from Zingiber officinale (ZOP) and its in vitro antioxidant activities, as well as its role in improving the shelf life of whipped cream. Thin layer chromatography (TLC) and high-performance liquid chromatography (HPLC) analyses revealed that ZOP is a heteropolysaccharide composed of glucose and galactose. Fourier transform infrared spectroscopy (FT-IR) identified key polysaccharide bands, confirming the presence of specific functional groups and structural components. Furthermore, ZOP demonstrated significant water holding capacity (WHC) and oil holding capacity (OHC), with values of 1.82±0.10 g/g and 2.42±0.02 g/g, respectively, and exhibited excellent emulsifying properties, achieving 54.54%. The in vitro antioxidant activity showed strong radical scavenging effects, particularly against DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS (2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid)) radicals, alongside notable reducing power. Additionally, the incorporation of ZOP into whipped cream enhanced its antioxidant capacity and rheological properties, effectively extending its shelf life. The findings indicated a reduction in conjugated dienes and trienes in the fat content of the cream. Overall, ZOP improved the oxidation stability and quality of the whipped cream.

Keywords: *Zingiber ofcinale · Polysaccharides · Antioxidant activity · Whipped cream*

CO26 : Composition phénolique et activité antibactérienne de trois variétés d'avocats "*Persea americana*" cultivées au Maroc

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Abstract

Persea americana, est un arbre de la famille des Lauraceae qui est originaire du Mexique et d'Amérique Centrale. Il pousse dans un climat tropical à sous-tropical, et le Maroc est parmi les pays qui cultivent cet arbre. Il est populaire pour ces fruits (avocats) riches en nutriments notamment sa teneur élevée en matière grasse. Les écorces des fruits de *Persea americana* (*Hass, Zutano, Fuérté*) ont été étudiées de manière comparative pour leurs teneurs en polyphénols totaux, en flavonoïdes et en tanins condensés, ainsi que pour leur activité antibactérienne dans des extraits méthanoliques. Les teneurs en polyphénols totaux, flavonoïdes et tanins ont été déterminées respectivement par les méthodes du Folin-Ciocalteu, du réactif de chlorure d'aluminium et de vanilline. L'évaluation de l'activité antimicrobienne des extraits a été déterminé par la technique de diffusion des disques vis-à vis de quatre souches microbiennes. Les résultats de cette étude ont démontré que l'extrait de la variété *Hass* présentent les concentrations les plus élevées en polyphénols totaux, en flavonoïdes et en tanins, ainsi qu'un effet inhibiteur sur deux souches à Gram positif tel que *Staphylococcus epidermidis* et *staphylococcus aureus*.

keywords *: Persea americana ; polyphénols ; flavonoïdes ; activité antibactérienne ; Maroc*

CO27: Assessing the Volatile Composition by GC/MS-MS and Biological Efficacy of *Rosa damascena* Essential Oil: Examining its Antimicrobial and Antioxidant Capabilities

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Abstract

Rosa damascena essential oil of Kelaat M'gouna region was investigated for volatile composition, antioxidant activity, and antibacterial activity in this study. The essential oil yield was 0.05%, and GC/MS-MS identified 57 compounds that represented over 99.95% of the total essential oil composition. Antioxidant activity was determined by DPPH, ABTS, and FRAP assays, showing good free radical scavenging activity as evidenced by an IC50 value of 454.68±10 µg/ml. Antibacterial activity was assessed through agar diffusion test, measurement of inhibition zone, and testing of minimum bactericidal concentration (MBC) and minimum inhibitory concentration (MIC). Gram-negative bacteria were less sensitive, with an inhibition zone of 9.83 to 11.67 mm, while Gram-positive bacteria were more sensitive, with an inhibition zone of 15.67 to 15.83 mm. The oil was found to possess antibacterial activity against *Staphylococcus aureus*, *Micrococcus luteus*, and *Bacillus subtilis* with MBC values of 400, 600, and 1000 µg/ml, and MIC values of 65, 62.5, and 125 µg/ml, respectively. These findings indicate the potential of *Rosa damascena* essential oil as a natural antimicrobial and antioxidant agent for application in the cosmetic and food industries. The results further suggest that incorporation of this oil with antibiotics could reduce the amount needed to treat nosocomial infections, perhaps limiting toxicity and treatment cost. Further studies are needed to comprehensively determine its therapeutic application.

Keyswords: *Essential oil, Rosa damascena, GC/MS-MS, Antioxidant activity, Antimicrobial activity.*

CO28: Antioxidant and Antimicrobial Activities of *Olea europaea* Leaf Extracts: A Study on Food Preservation

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Abstract

Olea europaea L. leaves serve as a source of bioactive compounds that offer significant benefits for health and technological benefits. This study aims to evaluate the total phenolic content (TPC), total flavonoid content (TFC), antioxidant activity, and antimicrobial properties of olive leaves. TPC and TFC were assessed using the Folin-Ciocalteu and aluminum chloride methods, respectively. Antioxidant activity was evaluated through the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, and the antimicrobial activity of the extracts was assessed against the *Staphylococcus aureus* and *Escherichia coli* strains using a well diffusion method. Furthermore, the effect of incorporation of olive leaves extract (OLE) in minced beef (OLE) was assessed by microbiological analysis. The TPC and TFC values ranged from 12.30 to 17.63 mg GAE/g and 0.04 to 0.11 mg QE/g, respectively. The extracts demonstrated an ability to scavenge DPPH free radicals, with an IC50 value of 1.85 mg/ml, and exhibited significant antibacterial activity against *Staphylococcus aureus* and *Escherichia coli* strains. The results of microbiological quality of minced beef revealed that the addition of OLE reduced microbial growth successfully. These findings suggest that olive leaves extracts have potential applications as natural preservatives and cost-effective sources of valuable antioxidants across various industries.

Keywords: Olive *leaves, antioxidant activity, antimicrobial activity, phenolic compounds, microbiological quality, minced beef*

CO29: Optimized Formulation of a Three-Component Extract Mixture from *Crocus sativus* L. (Stigmas, Leaves, and Tepals) for Enhanced Antioxidant Activity

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Abstract

This study explores the antioxidant potential of a three-component mixture derived from *Crocus sativus* L. stigmas, leaves, and tepals, with the goal of valorizing these underutilized by-products. Hydroethanolic extracts were chemically profiled using High-Performance Liquid Chromatography with Diode-Array Detection (HPLC-DAD), identifying significant bioactive compounds such as crocin (11.04%), rutin (22.32%), and ellagic acid (62.47%). Antioxidant capacity was evaluated via 2,2-Diphenyl-1-Picrylhydrazyl (DPPH) and 2,2'-Azino-bis (3-ethylbenzothiazoline-6-sulfonic acid (ABTS) assays, with IC_{50} values ranging from 88.67 ± 0.83 μg/mL to 291.41 ± 0.91 μg/mL for DPPH and 116.76 ± 1.31 μg/mL to 286.87 ± 0.25 μg/mL for ABTS. A simplex-centroid design identified optimal mixtures for antioxidant activity. A blend of 43% stigmas, 35% leaves, and 22% tepals yielded a DPPH IC_{50} of 97.36 ± 1.23 μg/mL, aligning closely with the predicted value of 95.96 μg/mL. Similarly, a mixture of 45% stigmas, 35% leaves, and 20% tepals achieved an ABTS IC_{50} of 110.59 ± 6.82 μg/mL, matching the predicted value of 106.31 μg/mL. Both combinations demonstrated superior antioxidant efficiency compared to standard antioxidants like butylated hydroxytoluene (BHT) and ascorbic acid. This study highlights the synergistic potential of saffron stigmas, leaves, and tepals, presenting an eco-friendly and cost-effective approach to enhancing antioxidant activity. The findings suggest potential applications in food preservation, nutraceuticals, and biopharmaceuticals. By promoting the utilization of saffron by-products, this research contributes to sustainability, agricultural waste reduction, and a circular economy.

Keywords: *Crocus sativus L., By-products, Experimental mixture design, Antioxidant activity, DPPH, ABTS.*

CO210: Antioxidant and Antimicrobial Activities of Argan Leaf Extracts: A Study on Food Preservation

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Abstract

Argania spinosa, commonly known as the argan tree, is endemic to southwestern Morocco and has been utilized for nutritional, cosmetic, and medicinal purposes since ancient times. This study aims to characterize the total phenolic content (TPC) and total flavonoid content (TFC) in crude extracts of argan leaves and assess their antioxidant and antimicrobial activities and their potential for food preservation. The TPC was quantified using the Folin-Ciocalteu assay, while the TFC was evaluated through aluminum chloride colorimetry. Antioxidant activity was assessed using the DPPH assay, and the antimicrobial potential against *Staphylococcus aureus, Escherichia coli* and *Salmonella enterica* was investigated using the agar well diffusion method. Additionally, a microbiological analysis of beef samples incorporated with Argan leaf extract was conducted every three days. The TPC values ranged from 8 to 32.9 mg GAE/g, while the TFC values ranged from 0.05 to 0.01 mg QE/g. The antioxidant activity demonstrated a moderate antiradical capacity with an IC50 of 9.11 mg/mL. The pathogenic bacterial strains exhibited sensitivity to various concentrations of the argan leaf extract. Microbiological evaluation of bovine meat revealed that the crude extract significantly inhibited bacterial colony growth compared to the control. The findings indicate that argan leaves possess substantial antioxidant and antibacterial properties, supporting their potential application as a natural preservative in foods. Further research is recommended to explore the mechanisms underlying these effects.

Keywords: *Argania Spinosa, Argan leaves, Total phenolic, Antioxidant activity, Antibacterial activity, Microbiological analysis, Food preservation.*

CO211: Antioxidant and Antimicrobial Properties of *Ramalina canariensis*: HPLC-UV Identification of Usnic and Divaricatic Acids

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Abstract

This study reports for the first time the identification of bioactive compounds in the lichen *Ramalina canariensis*. Extracts were obtained using ultrasound bath extraction with solvents of different polarities. Antioxidant potential was evaluated using DPPH and FRAP assays, and total phenolic and flavonoid contents were quantified. HPLC-UV analysis revealed several phenolic compounds, including divaricatic acid, a marker of the Ramalinaceae family, and usnic acid, detected in high concentrations in all extracts except the methanol-water extract (CFB). Additionally, orsellinic acid (ORS), nordivaricatic acid (NOR), 2-O-methylnordivaricatic acid (MND), and thiophanic acid (THI) were identified for the first time in this species. The aqueous extract (CWB) exhibited the strongest antioxidant activity with an IC_{50} of (0.12 ± 0.53 mg/mL) (DPPH assay) and high reducing power (FRAP). The hexane extract (CHB) showed the highest phenolic content (26.8 ± 1.92 mg GAE/g) and the most potent antimocrobial activity, with minimum inhibitory concentrations (MIC) reaching as low as 0.087 mg/mL. These results highlight *Ramalina canariensis* as a promising source of natural antioxidant and antimicrobial agents for potential pharmaceutical or cosmetic applications.

Keywords: *Ramalina canariensis, Lichen acids, Usnic acid, Divaricatic acid, Antioxidant activity, antimicrobial activity*

CO212: Dermatoprotective Potential of *Clinopodium nepeta* and *Thymus vulgaris* Essential Oils: Phytochemical Profiling, Anti-Elastase and Anti-Tyrosinase Activities, Photoprotection, and Antimicrobial Effects Against Dermatopathogens

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Abstract: The growing demand on natural ingredients in cosmetics has immensely contributed to a renewed interest in cosmetic industry in plant derivatives, especially essential oils. The aim of this study is to examine the dermatoprotective and antifungal properties of *Clinopodium nepeta* (CNEO) and *Thymus vulgaris* (TVEO) essential oils. Gas chromatography-mass spectrometry (GC-MS) analysis was performed to identify the chemical composition of the essential oils. Anti-elastase and anti-tyrosinase activities were evaluated using standard enzymatic inhibition assays, and IC_{50} values were calculated. Photoprotective properties were determined using in vitro sun protection factor (SPF) calculations. Antifungal and antibacterial activities were assessed using the disc diffusion method and minimum inhibitory concentration (MIC) determination against *Candida albicans*, *Candida glabrata, Micrococcus luteus*, and *Staphylococcus aureus*. GC-MS analysis revealed the presence of 13 compounds in CNEO, mainly oxygenated monoterpenes (91.9%) with pulegone (42.3%) as the main component, and 25 compounds in TVEO, with α-terpineol (19.8%) and carvacrol (13.5%) as the dominant compounds. CNEO showed superior anti-elastase activity (IC_{50} = 13.55 ± 0.81 µg/mL) compared with TVEO (IC_{50} = 28.40 ± 2.64 µg/mL). Both oils demonstrated significant anti-tyrosinase effects, with CNEO showing greater efficacy in inhibiting monophenolase (IC_{50} = 36.71 ± 4.09 µg/mL) and diphenolase (IC_{50} = 22.77 ± 0.97 µg/mL) than TVEO. Sun protection factor (SPF) calculations revealed notable photoprotective properties for both oils, with CNEO (SPF = 6.472) slightly outperforming TVEO (SPF = 5.640). Antifungal tests against *Candida albicans* and *Candida glabrata* and antibacterial tests against *Micrococcus luteus* and *Staphylococcus aureus* showed that both oils possess strong antifungal and antibacterial activities, with CNEO demonstrating superior efficacy (MIC = 0.50 ± 0.00% *v/v* for both *Candida* strains) compared with TVEO (MIC = 0.011 ± 0.00% *v/v* for both *Candida* strains). This study provides the first comprehensive assessment of the dermatoprotective, antifungal and antibacterial activities of CNEO and confirms the potential of TVEO in cosmetic, antifungal and antibacterial applications. The results suggest that these essential oils could serve as promising natural ingredients in dermatoprotective, antifungal and antibacterial formulations.

Keywords: *Clinopodium nepeta; Thymus vulgaris; anti-elastase; anti-tyrosinase; photoprotection; antifungal; antibacterial.*

CO213: Evaluation of Key Quality Parameters in Honey from Different Moroccan Regions

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Abstract

This study investigates the physicochemical properties of honey samples collected from various regions of Morocco. Key parameters analyzed include moisture content, pH, refractive index, acidity, HMF (hydroxymethylfurfural) levels, and Brix degree. The results reveal noticeable variability among the samples. Moisture content ranged from $16.8 \pm 0.3\%$ (AG.CE) to $19.5 \pm 0.3\%$ (BE.POL), while HMF concentrations varied from 8.5 ± 0.8 mg/kg (RA.POL) to 15.5 ± 0.7 mg/kg (BE.CA). A particularly high HMF value of 81.0 ± 0.5 mg/kg was observed in sample T.RO, possibly due to heat exposure or extended storage. These findings underscore the necessity of monitoring physicochemical parameters to ensure the quality and authenticity of honey.

Keywords: *Honey quality; Physicochemical properties; Hydroxymethylfurfural (HMF)*

Oral Presentations
Theme 2

Session II: Post-Harvest Processing – Tackling Spoilage and Losses:
(1) Fermentation challenges, (2) valorization pathways for alternative proteins, (3) antimicrobials, (4) packaging (active, bio-based, smart), (5) innovative cleaning and disinfection approaches, (6) secondary metabolites from aromatic and medicinal plants, (7) innovative strategies for food biopreservation...

Sub-session T2-B: Green Extraction, Metabolic Stimulation, and Medicinal Valorization:
(Sustainable approaches to enrich plant extracts, phytotherapy, stimulation of secondary compounds…)

CO213: Antimicrobial Potential of the lichen *Pseudevernia furfuracea* (L.) Zopf Volatile Compounds from Morocco: Chemical Composition and Activity against Human Pathogens

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Abstract

Lichens are interesting organisms with a unique secondary metabolism. Volatile compounds from Pseudevernia furfuracea (L.) Zopf, from two different locations in Morocco were extracted by hydrodistillation. The chemical composition of the extracts was determined qualitatively using gas chromatography coupled to mass spectrometry (GC-MS). The major compounds in the two extracts were identified as atraric acid and chloroatranol. The two extracts exhibited interesting potential against multidrug-resistant bacteria (Klebsiella pneumoniae, Escherichia coli, Acinetobacter baumanii and Staphylococcus aureus) and culture collection strains (Salmonella typhimurium, Staphylococcus aureus, Escherichia coli, Bacillus subtilis and Candida albicans), with minimum inhibitory concentrations (MIC) ranging from 1 mg/ml against K. pneumoniae. and 31.25 µg/ml against C. albicans. These results highlight an interesting antimicrobial potential of the volatile compounds from P. furfuracea.

Keywords: *Volatile compounds, Pseudevernia furfuracea, GC-MS, multidrug-resistant bacteria, minimum inhibitory concentration.*

CO214: Phytochemical profiling and bioactivity of *Petroselinum crispum* hydroethanolic extract

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Abstract

Medicinal plants are valuable reservoirs of bioactive compounds with wide-ranging biological activities. This study explores the phytochemical composition and evaluates the antioxidant and antimicrobial properties of the hydroethanolic extract of *Petroselinum crispum* (parsley), a widely used aromatic and medicinal plant. High-performance liquid chromatography (HPLC) was employed to identify major phenolic constituents contributing to its bioactivity.The antioxidant potential of the extract was assessed using two complementary assays: DPPH radical scavenging and ferric reducing antioxidant power (FRAP). Results revealed strong antioxidant activity, highlighting the extract's capacity to neutralize free radicals and reduce oxidative stress.The antimicrobial activity was evaluated against three pathogenic bacterial strains: *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*. The extract demonstrated a notable inhibitory effect, particularly against S. aureus, suggesting the presence of active compounds capable of interfering with bacterial growth or metabolism.These findings confirm the richness of *P. crispum* in phenolic compounds with dual antioxidant and antimicrobial functions. The study supports its potential as a natural source of bioactive molecules, offering promising alternatives to synthetic preservatives and antibiotics. The biological activities observed reinforce the importance of plant-based extracts in the development of new therapeutic and biotechnological applications.

Keywords: *P. crispum; phytochemicals; antioxidants; antimicrobial activity; HPLC.*

CO215: Phytochemical, antioxidant, and antimicrobial insights into *Cuminum cyminum L.* essential oils

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Abstract

This study aims to compare the phytochemical profile, antioxidant activity, and antimicrobial efficacy of essential oils (EOs) extracted from the leaves and seeds of *Cuminum cyminum L.* The EOs were obtained through hydrodistillation and analyzed using gas chromatography-mass spectrometry (GC-MS), revealing distinct chemical compositions. p-Cumic aldehyde and 2-Caren-10-al were identified as the major components in both EOs, with significant differences in their relative abundance. Antioxidant activity was assessed using DPPH and total antioxidant capacity (TAC) assays, showing stronger antioxidant effects for the seed EO compared to the leaf EO. In addition, the antimicrobial activity of both EOs was tested against various bacterial strains (*Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, and Micrococcus luteus*) as well as fungal strains (*Aspergillus niger, Penicillium crustosum, Candida glabrata, and Rhodotorula glutinis*) using the disk diffusion method, minimum inhibitory concentration (MIC), and minimum bactericidal concentration (MBC). The seed EO exhibited stronger antimicrobial activity, particularly against S. aureus and E. coli. The results highlight the potential of *Cuminum cyminum L.* essential oils, especially the seed EO, as natural antimicrobial and antioxidant agents, suggesting their possible application in various industries.

Keywords: *Cuminum cyminum L., essential oils, antioxidant activity, antimicrobial activity, GC-MS analysis, natural preservatives.*

CO216: Exploring the multifaceted bioactivities of *Lavandula pinnata L.* essential oil: promising pharmacological activities.

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Abstract

This study assessed the biological activity of *Lavandula pinnata* essential oil (LPEO), collected from the eastern region of Morocco. The chemical composition of LPEO was determined through gas chromatography-mass spectrometry (GC-MS), and the antioxidant, antibacterial, antifungal, anti-gout, antidiabetic, antityrosinase, and cytotoxic activities of LPEO were estimated through in vitro methods. LPEO exhibited high antiradical activity (IC50 = 148.33 ± 2.48 µg/mL) and significant antioxidant capacity. It demonstrated notable antibacterial activity against four strains with inhibition zones ranging from 18.70 to 29.20 mm, and relatively low MIC and MBC values. LPEO displayed significant antifungal activity against four strains with a remarkable fungicidal effect, surpassing the positive control at 1 mg/mL. The oil showed substantial inhibition of xanthine oxidase enzyme (IC50 = 26.48 ± 0.90 µg/mL), comparable to allopurinol, as well as marked inhibitory effects on α-amylase (IC50 = 31.56 ± 0.46 µg/mL) and α-glucosidase (IC50 = 58.47 ± 2.35 µg/mL) enzymes, suggesting potential in regulating postprandial glucose release and as an anti-gout agent. LPEO inhibited tyrosinase (IC50 = 29.11 ± 0.08 mg/mL) and showed moderate cytotoxic activity against breast, liver, and colon cancer cells, with low toxicity towards normal cells, exhibiting greater selectivity than cisplatin for certain cancer cell lines.

Keywords: *antibacterial; antifungal; anti-diabetic; anti-gout; anti-cancer.*

CO217: Impact of Xylooligosaccharides on the Metabolic Activity of *Lactiplantibacillus plantarum* S61: Generation of Bioactive Metabolites with Antioxidant and Antimicrobial Activities.

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Abstract

This study investigates the fermentation of commercial xylooligosaccharides (XOS) by *Lactiplantibacillus plantarum* S61 in a modified MRS medium (MRSm) at concentrations of 1%, 2%, 4%, and 6%. The results show that 6% XOS was the optimal condition, enhancing bacterial growth, total phenolic content (6.70 ± 0.01 mg GAE/g), and antioxidant activity compared to glucose. XOS fermentation led to the production of diverse organic acids (lactic, malic, oxalic), improving antimicrobial activity. Strong antibacterial effects were observed, particularly against *Salmonella enterica* (20.25 mm inhibition zone) and *Staphylococcus aureus* (20.01 mm). The antifungal activity was highest against *Rhodotorula glutinis* (26.00 mm). These findings highlight the potential of XOS fermentation in developing natural preservatives and antimicrobial agents. Moreover, the broad spectrum of bioactive metabolites produced suggests its potential use in food preservation and pharmaceutical applications targeting pathogenic and spoilage microorganisms.

Keywords: *xylooligosaccharide; prebiotics; probiotics; L. plantarum; fermentation*

CO218: Enhanced production of secondary metabolites in medicinal plant cell cultures: effects of melatonin and salicylic acid on bioactive compounds

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Abstract

The valorization of plant cell cultures for the production of secondary metabolites, in particular phenolic compounds and flavonoids, relies on the use of suitable external stimuli. This study investigated the effects of two elicitors, salicylic acid (SA) and melatonin (MEL), on various biological and biochemical parameters of a *Salvia officinalis* cell culture. Results showed that the application of these compounds significantly influenced callus formation, morphology (color, consistency), and biomass accumulation. Liquid chromatography-mass spectrometry (LC-MS) analysis identified several phenolic compounds whose production varied according to the treatment. In parallel, enzymatic tests revealed a modulation of antioxidant enzyme activity (SOD and POD), while DPPH and TAC tests confirmed an improvement in the antioxidant properties of the extracts. The study also assessed the effect of the treatments on tyrosinase inhibition, underlining their potential in cosmetics. This work highlights the interest of SA and MEL in inducing physiological responses favorable to the production of bioactive compounds in *S. officinalis*, with prospects for applications in the pharmaceutical, cosmetics, and agri-food fields.

Keywords: *Salvia officinalis, Plant cell cultures, Secondary metabolites, Salicylic acid, Melatonin, Antioxidant capacity.*

CO219: Valorization of polysaccharide from Laurus nobilis leaves: Structural analysis and in vitro and in vivo biological applications

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Abstract

The antibacterial, anti-inflammatory and antioxidant properties of *Laurus nobilis* leaves may offer processing potential for medical applications. The present study explores the structure characteristics of a novel heteropolysaccharide from *Laurus nobilis* leaves (LNSP), its *in vitro* antioxidant activities, and its *in vivo* potentiel in promoting wound healing in a diabetic rat model. The structure of LNSP was examined by different chemical analysis using instrumental analysis methods: Fourier Transform infrared spectroscopy (FT-IR), and Gas chromatography-mass spectrometry (GC-MS). The biochemical and functional properties of LNSP were also determined. LNSP is a novel heteropolysaccharide structure that consists of ribose (9.2%), glucose (31.22%), mannose (15.25), xylose (14.85), rhamnose (8.57%) and galactose (20.91) with a mean molecular weight of 105.37 kDa. Results showed that LNSP exhibited strong antioxidant activities and significant antibacterial activity against almost all tested bacteria. Physic-chemical properties of LNSP were also determined. Likewise, the cytotoxic test revealed that LNSP was not cytotoxic at concentrations lower than 100 µg/mL, for human HEK-293 cells since the cell survival is over than 85%. Furthermore, the LNSP treatment on the wound in diabetic rat, raised significantly the percentage of wound contraction (100%) after 14th days. Histological assessment demonstrated that LNSP hydrogel enhances the re-epithelization of wounds in diabetic rats as well as the epidermal regeneration compared to other groups.
Our findings showed that the application of this polysaccharide may open promising opportunities for wound healing in therapeutic medicine especially of diabetic patients.

Keywords: *Laurus nobilis,* Heteropolysaccharide, Antioxidant activities, Antibacterial proprieties, *in vivo* application.

CO220: Exploration of Moroccan medicinal plants traditionally used in the treatment of infectious diseases

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Abstract

Infectious diseases are among the most widespread health challenges globally, affecting a significant number of people. Morocco, with its rich floral diversity and traditional knowledge of medicinal plants, holds considerable potential for managing these diseases. This study aims to document the medicinal plants used to treat infectious diseases and to catalog the traditional knowledge of Moroccans on this subject. The bibliographic research is based on ethnobotanical studies conducted in Morocco since 1991. The compiled data can serve as a foundation for the discovery of potential bioactive compounds useful in the treatment of these conditions. A total of 378 species belonging to 76 families are used to treat infectious diseases. The most represented families are Lamiaceae, Asteraceae, and Fabaceae. Leaves are the most commonly used part of the plant. Infusion and decoction are the most frequent traditional preparation methods. Oral administration is identified as the main mode of use, reflecting the diversity of local traditional knowledge in phytotherapy. Furthermore, these plants are rich in active compounds, such as alkaloids, known for their effectiveness in treating infections. This study highlights the richness of traditional knowledge regarding medicinal plants as effective therapeutic alternatives for treating various infectious diseases. However, further evaluations are necessary in the future.

Keyword: *Ethnobotany; Infectious Diseases; Medicinal Plants; Morocco.*

CO221 : Prise en charge d stress et des états anxieux par phytothérapie

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Résumé

Les troubles anxieux, fréquents en psychiatrie, sont souvent pris en charge par des traitements allopathiques efficaces mais non dénués d'effets secondaires, de risques de dépendance et de rechutes. Face à ces limites, la phytothérapie et l'aromathérapie apparaissent comme des approches complémentaires intéressantes. Ce travail explore les fondements physiopathologiques du stress et de l'anxiété, et met en lumière l'efficacité de plusieurs plantes médicinales aux propriétés anxiolytiques (passiflore, valériane, mélisse), adaptogènes (rhodiola, ginseng, éleuthérocoque) et antidépressives (millepertuis), ainsi que des huiles essentielles à visée anxiolytique (petit grain bigarade, marjolaine, camomille noble, ylang-ylang). Ces solutions naturelles, lorsqu'elles sont encadrées médicalement et intégrées dans une approche globale, peuvent favoriser le sevrage des benzodiazépines, limiter les effets indésirables et améliorer l'adhésion thérapeutique. Cette prise en charge individualisée représente une piste prometteuse pour une psychiatrie moderne et plus respectueuse du patient.

Mots clés *: Phytothérapie, Anxiété, Stress, Aromathérapie, Huiles essentielles,Psychiatrie intégrative, Benzodiazépines, Approche naturelle, Adaptogènes.*

CO222 : *Effect of Moroccan Saffron By-Products Extracts Against Some Pathogenic and Multidrug-Resistant Bacteria*

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Abstract

With the increase of antibacterial resistance to conventional treatments, searching for new solutions from natural sources has become essential. Saffron (*Crocus sativus* L.) is renowned for its bioactive properties, yet its by-products remain little explored despite their potential pharmaceutical applications. In this context, our study aims to evaluate the antibacterial and antibiofilm effects of two extracts from Moroccan saffron by-products.
Phytochemical analysis of extracts from saffron by-products indicates its richness in polyphenolic compounds (flavonoids and tannins). Antibacterial tests revealed varying levels of antibacterial activity of the extract against the tested bacterial strains. Particularly, our extract exhibited the highest potency against *E. coli*. In addition, the evaluation of the antibiofilm activity showed that our extract is very effective against the biofilm of the bacterial strains used in this study. It represents a very significant percentage of inhibition at the different concentrations tested for the strains at minimum inhibitory concentration (MIC), MIC/2, MIC/4, and MIC/6, and at MIC/8,
Therefore, our findings showed that Moroccan saffron by-products could be promising candidates for natural antimicrobial development. It may be used as a functional ingredient by the food and pharmaceutical sectors.

Keywords: *Saffron, Crocus sativus L., by-products, antibacterial, antibiofilm.*

Oral Presentations
Theme 2

Session II: Post-Harvest Processing – Tackling Spoilage and Losses:
(1) Fermentation challenges, (2) valorization pathways for alternative proteins, (3) antimicrobials, (4) packaging (active, bio-based, smart), (5) innovative cleaning and disinfection approaches, (6) secondary metabolites from aromatic and medicinal plants, (7) innovative strategies for food biopreservation...

Sub-session T2-C: Bio-Based Materials, Composites, and Sustainable Processing Methods
(Post-harvest transformation into sustainable materials or ingredients, textiles, packaging, bioplastics, additives)

CO223: A Green Approach to Synthesizing Flame Retardant and Antifungal Materials by Phosphorylation of Water-Soluble Allyl Cellulose via a Radical-Mediated "Click" Reaction

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Abstract

Biopolymers have garnered increasing attention across medical, environmental, and industrial fields due to their potential for sustainable and innovative applications. Among them, cellulose stands out for its biocompatibility, renewability, and biodegradability, making it a prime candidate for the development of eco-friendly materials. Green solvents such as ionic liquids and NaOH/urea aqueous systems have been explored to dissolve cellulose and facilitate its chemical modification. In this study, we report a green and efficient phosphorylation strategy for cellulose using a radical-mediated "click" reaction in water, employing organophosphorus compounds as functional agents. Water-soluble allyl cellulose (AC), prepared in a NaOH/urea system and characterized by a low degree of substitution (DS = 0.67), was selected as the reactive substrate. Its pendant double bonds enabled selective and efficient "click" functionalization in aqueous media without the need for harsh conditions. The resulting phosphorylated cellulose derivatives, AC_1-diethyl phosphite (AC_1-DEP) and AC_1-dibutyl phosphite (AC_1-DBP), were successfully synthesized. Biological evaluation revealed that both AC1-DEP and AC1-DBP exhibited efficient antifungal activity, with inhibition zones ranging from 14 to 27 mm, indicating significant potential against fungal pathogens. Microcombustion calorimetry showed a notable decrease in flammability: the peak heat release rate (pHRR) was reduced to 112 W/g for AC_1-DEP and 97 W/g for AC_1-DBP, compared to 287 W/g for unmodified allyl cellulose, confirming the effectiveness of phosphorylation in imparting flame-retardant behavior. This work highlights the green, sustainable, and multifunctional nature of the developed materials, offering promising applications in packaging, coatings, and biomedical domains where both flame resistance and antifungal performance are critical.

Keywords: *Cellulose, Phosphorylation, Green chemistry, Click chemistry, Flame retardant, Antifungal activity*

CO224: Physicochemical Characterization of Celluloses Extracted from "Quinoa" stems of eastern Morocco.

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Abstract

Cellulose, a polysaccharide, can be extracted from various plants and raw materials, including forest and agricultural residues. Its selection as a biopolymer is based on its biodegradability and excellent mechanical properties, making it valuable in sustainable chemistry. In this study, we examined the isolation of cellulose from *"Quinoa"* stalks from Eastern Morocco, where global production continues to grow due to its high nutritional value. As a result, large quantities of stalks accumulate as unutilized by-products. Cellulose isolation was carried out using two distinct methods: the first involved extraction in an acidic medium, specifically an acetic acid solution catalyzed by nitric acid, while the second method utilized the Soxhlet extraction technique in an alkaline medium. The obtained samples were characterized by Fourier-transform infrared spectroscopy (FT-IR) and X-ray diffraction (XRD), while the morphology of the isolated fibers was examined using scanning electron microscopy (SEM). The solubility of the extracted cellulose was also studied to assess its behavior in different solvents. However, the extraction process using an alkaline solution is preferable due to the absence of acetylation reactions, the high purity, and the non-degradation of the obtained fibers. As a potential application, this cellulose, after appropriate modifications, could be used in the development of biodegradable packaging, contributing to the reduction of plastic waste and the transition toward more environmentally friendly materials.

Keywords : Quinoa, Cellulose, Isolation, Caractérisation, Soxhlet, acidic medium.

CO225: Synergistic Effects of PCL and PBS in Biodegradable Polyurethanes: Impact on Properties and Biodegradation Rate

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Abstract

In response to intensifying environmental worries caused by plastic residues, biodegradable polymers are gaining prominence. Polycaprolactone (PCL), appreciated for its pliability and non-toxic properties, nevertheless fails to meet the demands of higher mechanical and thermal performance. The present investigation addresses these limitations through the synthesis of polyurethanes using PCL diol and toluene diisocyanate (TDI), subsequently incorporating poly(butylene succinate) (PBS) to bolster both structural integrity and thermal resilience. Praised for its rigidity and thermal resilience. PBS not only improves overall robustness but also accelerates biodegradation, thanks to a chemical framework easily accessed by microorganisms. Techniques such as FTIR, NMR, SEM, DSC, and contact angle analyses were employed to detail each system's chemical makeup, morphology, and thermal and surface traits. Adding PBS to PCL markedly increases the polymer's mechanical metrics while speeding up biological decomposition. Hence, these polymeric mixtures present an eco-conscious alternative for food packaging, positioning themselves as viable substitutes for older, plastic-centric approaches. By synchronizing PCL and PBS within polyurethane formulations, this work advances the development of more durable, yet biodegradable materials in harmony with today's eco-design goals. In blending biodegradability with improved mechanical and thermal properties, the technique underscores how polymer innovations can address pressing environmental concerns. It paves the way for broader implementation in greener packaging solutions.

Keywords: *Polycaprolactone (PCL), Poly (butylene succinate) (PBS), Biodegradable films, Mechanical and thermal properties, food packaging, Ecological applications.*

CO226: Study of new composites based on cellulosic fibers

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Abstract

Cellulose is a technologically important biopolymer and sustainable raw material. It is the main skeletal component in plants and it is the primary target for developing an economically sustainable renewable fuels and bioproducts industry. Recently, the use of cellulose fibers in the composite materials has drawn much attention due to the economic and ecological advantages of the obtained composites. The ratio price/performance, the lightness and the biodegradability are the assets to valorize cellulose fibers in different industrial sectors such as packaging, textile, automobile, sport and building.
In this work, we develop a new composite materials based on Alfa cellulose fibers, collected in the east of Morocco. First we report the characterization of the extracted cellulose. In the second part, we develop the synthesis and characterization of organic polyurethane matrix based on poly (e-caprolactone). Finally, the composites of the synthesized polyurethane and Alfa cellulose fibers, with different matrix / reinforcement ratios, will be studied in order to determine the optimal composition to obtain biodegradable materials with thermal and mechanical performances.

Keywords: *Cellulose fibers, polyurethane, Composite, mechanical properties*

CO227: Isocyanate-and phosgene-free routes to polyfunctional cyclic carbonates and green polyhydroxyurethane from castor oil.

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Abstract

Non-isocyanate polyurethanes (NIPUs), also known as polyhydroxyurethanes (PHUs), are a category of polymers prepared by isocyanate free method. The formation process of hydroxyurethanes based on cyclic carbonate–amine chemistry is traditionally known, and is nowadays seen as the best possible alternative to the hazardous and toxic isocyante based polyurethane chemistry. In addition, utilization of renewable material such as castor oil (CO) can contribute to eco-friendly and green materials with applications in polymers and coatings.
In the present work, 5-membered cyclic carbonate monomers with various functionalities were synthesized from CO. Pendant cyclic carbonate groups were obtained through a two-step reaction. First, hydroxyl groups were converted into acids by the ring opening of succinic anhydride, yielding a triacid (CO3ac). Then, these acids were esterified with glycerin carbonate to obtain tricyclocarbonate (CO3c). Another cyclocarbonate was synthesized from CO3ac using a combination of thiol-ene “click” chemistry and esterification reactions. This high-performance method allowed the synthesis of a hexa-functional cyclocarbonate (CO6c).
All products were characterized using several techniques, including FTIR, ^{1}H NMR, and ^{13}C NMR analyses. The functionalized oil was then used to synthesize PHU materials in bulk via a catalyst-free polyaddition reaction, employing different types of polyamines, such as linear diaminobutane and cyclic m-xylylenediamine. The resulting crosslinked PHU materials were further characterized, and their structural, thermal, and mechanical properties were investigated.

Keywords: Polyhydroxyurethanes, cyclocarbonate, Castor oil, Green materials

CO228: Eco-Extraction of Phenolic Compounds from Moroccan Olive Fruits, Leaves, and their Potential use as Antimicrobial Agents

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Abstract

In Morocco, the olive harvest generates regenerates a lot of waste such as leaves and olive fruits. Valuation by the extraction of polyphenols from this waste could be a promising source. In our work, we have prepared an olive tree extract from this waste our extract contains 148 g/l of polyphenols, 8.4 g/l offlavonoids and 39.11 g/l of o-diphenols.
Polyphenols, major natural antioxidants play a key role in hundreds biological reactions.
The antioxidant activity test revealed great antioxidant potential of our extract with high ORAC value 3 848 100 µmol Te/kg. The present work has as objective to evaluate the antimicrobial activity. The olive tree extract showed broad-spectrum antibacterial activity against Escherichia coli, Escherichia coli TG1, Escherichia coli DH5α, Staphylococcus aureus, Bacillus cereus, Bacillus cereus MED5 and Streptococcus agalactiae. While pure phenolic compounds (caffeic acid, ascorbic acid and quercetin) showed more limited activity. The antifungal effect of the olive tree extract exceed the antibiotics at a concentration of 3 mg/disc ($p<0.05$). Industrial technology can therefore exploit this extract, rich in polyphenols, in order to use instead of a synthetic antioxidants and antibiotics that could be dangerous. This would lead Morocco to enhance the olive harvest waste as an important economic source.

Keywords: *Olive leaves; Olive fruit; Polyphenols; Antioxidants; Antibacterial; Antifungal.*

CO229: Optimization of the post-harvest process for Moroccan dates and valorization of the sorting residues

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Abstract

Peak date consumption often does not coincide with the harvest season. This requires storage in optimal conditions to preserve quality. Our investigations into refrigeration units revealed the absence of a technical Standards Handbook, the non-use of certain machines (Glucosage), and the adoption of artisanal practices. This calls for the standardization of post-harvest operations adapted to the specificity of Moroccan dates. Characterizing 11 main varieties revealed similarities and several divergences, particularly in terms of their humidity, which determines their ability to be preserved. Different varieties do not react the same way to similar storage conditions. Freezing at -18°C preserves most quality attributes and limits spontaneous dehydration. Similarly, using plastic trays minimizes this phenomenon. The treatment of dates with Glucosage (at 5 and 10%) has proven ineffective against spontaneous dehydration, and its role is limited to giving a shiny appearance. The valorization of date sorting residues with defects such as sugar crystallization and epicarp detachment helps to increase their market value by transforming them into derivative products such as paste, syrup, powder.... However, the traditional processes adopted by Moroccan cooperatives result in low-quality finished products. The date syrup extraction protocol was optimized to contribute to the labeling of the syrup produced by the oasis population under the name "*Tahlaout*". The results showed that a pulp/water ratio of 1/2 and a 2-hour extraction time at 80°C are sufficient to achieve maximum yield. Additionally, clarifying the juice by centrifugation and concentrating it under a vacuum (60°C/100mb) improves the quality of the syrup.

Keywords: *Date, Quality, Post-harvest, Valorization, Syrup, Optimization.*

CO230: Cumin and Sustainable Development: An Innovative Agroecological Model to Address Climate Challenges.

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Abstract

As part of the development of *sustainable agriculture* and innovative agriculture, I am working on a project focused on the cultivation of cumin in the northeast of Morocco. This plant, well-suited to semi-arid regions and requiring little water, offers a concrete and effective response to the challenges of *climate change*, food security, and resource preservation. Cumin's adaptability to harsh climates makes it an ideal crop to address the ongoing environmental pressures faced by many regions around the world.

The project is based on an integrated *agroecological* approach, combining traditional agricultural practices with modern technologies. By focusing on the sustainable and responsible use of natural resources, it promotes the conservation of soil fertility, water efficiency, and biodiversity. The rational use of fertilizers such as NPK and nitrogen, complemented by essential nutrients like potassium, magnesium, and amino acids, aims to optimize yields while maintaining long-term soil health and preventing degradation.

In the medium term, the project plans to integrate advanced digital tools and artificial intelligence (sensor-based monitoring, smart irrigation management) to further enhance productivity while ensuring environmental sustainability. This innovative model not only addresses the immediate challenges posed by climate change but also contributes to the broader agroecological transition. It strengthens the resilience and competitiveness of the agricultural sector, positioning it to thrive in a rapidly changing global environment.

This project aligns with the promotion of bioresources, environmental stewardship, and the strengthening of agricultural sector competitiveness, providing a sustainable model for future agricultural practices.

Keywords: *Sustainable agriculture; Agroecology; Climate resilience; cumin*

CO231: Advances in Bioplastics for Ecological Transition and Sustainable Development

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Abstract

This study examines the development of bioplastics derived from potato and rice starch, highlighting their potential as a sustainable alternative to conventional plastics. By analyzing the physicochemical properties of these materials, we demonstrate how their transformation through methods such as extrusion and thermocompression can lead to viable products for various industrial applications. Furthermore, we discuss the significant environmental benefits, including the reduction of plastic waste and carbon footprint, while identifying the challenges to be overcome for large-scale adoption. This research thus underscores the growing importance of bioplastics in the transition towards a circular economy.

Keywords: *Bioplastics, Starch-based materials, Sustainability, Extrusion and thermocompression, Circular economy*

CO232: Cosmetic valorization of acid-hydrolyzed extracts from cladodes and fruit by-products of *Opuntia* species resistant to *Dactylopius opuntiae*

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Abstract

Cactus species of the *Opuntia* genus, especially *Opuntia ficus-indica*, *Opuntia robusta*, and *Opuntia stricta*, are recognized for their richness in bioactive compounds with antioxidant, moisturizing, and skin-soothing properties. This study aims to investigate the cosmetic potential of extracts derived from cladodes and fruit by-products of *Opuntia* varieties resistant to the cochineal insect *Dactylopius opuntiae*, with a focus on the effect of citric acid hydrolysis, a biocompatible and non-toxic alternative to mineral acids. The plant materials used in this study were collected from the Oriental region of Morocco, specifically from the Jerada area, which hosts natural populations of cochineal-resistant *Opuntia* species.
Plant materials were dried, ground, and subjected to aqueous and ethanolic ex-traction followed by citric acid hydrolysis under optimized conditions. Crude and hydrolyzed extracts were analyzed using HPLC-DAD to evaluate changes in phenolic profiles, including flavonoid aglycones and phenolic acids. Antioxidant activity was determined using DPPH and phosphomolybdate assays, and mois-turizing properties were assessed through water retention tests and in vitro assays on keratinocyte models.
Preliminary findings suggest that citric acid hydrolysis promotes the release of key bioactives such as quercetin, isorhamnetin, and kaempferol, and enhances antioxidant capacity by up to 30- 40% compared to untreated extracts. Improved solubility and hydration potential of the hydrolyzed extracts further support their use in natural cosmetic formulations. This work highlights the sustainable and safe valorization of cactus biomass through green extraction methods, offering innovative ingredients for dermo-cosmetic applications while promoting pest-resistant plant varieties.

Keywords: *Opuntia genus, acid-hydrolyzed, Cosmetic valorization, resistant species, antioxidant activity.*

CO233: Synthesis and Antimicrobial Evaluation of Novel Pyrazole-Based Ligands

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Abstract

In this study, two novel pyrazole-based ligands, L1 and L2, were synthesized via a multi-step alkylation process and structurally characterized using Nuclear Magnetic Resonance (NMR) spectroscopy. Their antimicrobial activity was evaluated against selected bacterial and fungal strains in comparison with reference drugs.
The two ligands exhibited moderate antibacterial effects against Escherichia coli, Staphylococcus aureus, and Pseudomonas aeruginosa. Although their inhibition zones were lower than those of standard antibiotics, these results indicate potential interest for combinatorial use in antibacterial therapies.
More importantly, significant antifungal activity was observed, especially for ligand L2, which showed strong inhibition against Candida glabrata, with a performance comparable to the reference antifungal caspofungin. L1 also demonstrated antifungal effects, though to a lesser degree. These results suggest that pyrazole-based ligands, particularly L2, are promising candidates for the development of new antifungal agents.
This work highlights the relevance of heterocyclic scaffolds such as pyrazole in medicinal chemistry, especially in the ongoing search for effective alternatives to combat fungal infections resistant to conventional treatments.

Keywords: *Pyrazole-based ligands; Organic synthesis; NMR spectroscopy; Antimicrobial activity; Candida glabrata; Escherichia coli*

CO234: Antimicrobial Potential of Pyrazole Derivatives: Biological Evaluation, Pharmacokinetic Prediction, and Molecular Docking Insights

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Abstract

This work describes the synthesis and biological assessment of 14 pyrazole derivatives for their antifungal and antibacterial potential. Testing showed considerable activity against Candida albicans, Candida glabrata, Escherichia coli, Pseudomonas aeruginosa, and Staphylococcus aureus, with some compounds exceeding the efficacy of standard antibiotics like ampicillin. In particular, derivatives 5 and 6 exhibited robust antifungal effects on C. albicans and C. glabrata, as well as potent antibacterial activity, reaching inhibition zones of 26.27 mm and 32.17 mm, respectively. SwissADME-based pharmacokinetic predictions point to structural diversity conducive to intestinal absorption and oral bioavailability, although certain derivatives (7, 8, 9) require modifications to improve solubility and address excessive unsaturation. Molecular docking analyses with AutoDock Vina targeting bacterial AmpC β-lactamase and fungal CYP51 highlighted key stabilizing interactions, with compounds 10 and 11 showing the highest affinities (-6.3 and -7.1 kcal/mol for AmpC; -7.8 and -6.5 kcal/mol for CYP51), thereby underlining their promise for future therapeutic development. Overall, these findings emphasize the appeal of select pyrazole derivatives as candidates for advanced antimicrobial strategies and underscore the importance of integrating theoretical modeling with preliminary biological evaluations.

Keywords: *Pyrazole Derivatives, antifungal, antibacterial potential, Molecular Docking*

Oral Presentations
Theme 3

Session III: Quality, Safety, Nutrition, and Health – A Commitment to the Future
(Pathogens, xenobiotics, antimicrobials, probiotics, nutraceuticals…)

Sub-session T3-A: Disease Prevention and Treatment – New Therapeutic Approaches and Natural Alternatives
(Covers innovative strategies, natural extracts, probiotics, bioactive compounds, or synergies for human health)

CO31: A Green Weapon Against Antibiotic resistance: Silver nanoparticles to eradicate *Klebsiella* infections

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Abstract

Antibiotic resistance is a growing global threat, driving the urgent need for alternative antibacterial solutions. Silver nanoparticles (AgNPs) have shown great promise, especially when synthesized using plant extracts, as they offer a greener and more sustainable approach. This study focuses on optimizing the eco-friendly production of AgNPs and evaluating their effectiveness against five multidrug-resistant (MDR) *Klebsiella* strains. AgNPs were synthesized using a plant extract with natural reducing and stabilizing properties. Their size and stability were analyzed via UV-Vis spectroscopy and microscopy, while antibacterial activity was evaluated through minimum inhibitory concentration (MIC) assays. The results showed that *Klebsiella pneumoniae* 9 was the most susceptible strain (MIC = 64 µg/mL), followed by *Klebsiella pneumoniae* 2 and *Klebsiella pneumoniae* 4 (MIC = 128 µg/mL), while *Klebsiella pneumoniae* 5 and *Klebsiella pneumoniae* 6
exhibited the highest resistance (MIC = 256 µg/mL). These findings confirm the strong antibacterial potential of plant-derived AgNPs, though their effectiveness varies among strains. By optimizing green synthesis conditions, we can contribute to the development of environmentally friendly antimicrobial solutions—offering hope in the fight against MDR Klebsiella infections.

Keywords: *Silver nanoparticles (AgNPs), Green synthesis, Multidrug-resistant Klebsiella, Antibacterial activity, Plant extracts*

CO32: Advancing the fight against antimicrobial resistance of pathogenic bacteria : unleashing the power of alternative combinational therapies through drug repurposing approach : case of Staphylococcus aureus multidrug resistant strains

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Abstract

Antibiotic resistance has emerged as a worldwide issue, largely driven by the inappropriate use of antibiotics. Developing new antibiotics is a complex process with a risk of resistance development for these newly developed drugs. To address the issue of antibiotic resistance in Staphylococcus aureus, we propose a combinatorial drug repurposing approach, using FDA-approved drugs with conventional antibiotics. This approach aims to reduce development costs, shorten timelines, and minimize side effects. In this study, we target specific bacterial resistance mechanisms, to re-sensitize resistant bacteria and increase antibiotics efficacy. From more than 1500 FDA-approved drugs screened via molecular docking against our targets, we selected hits with the most favorable binding affinities from -7 to -10 kcal/mol. In-vitro screening through Antimicrobial Susceptibility Testing in High-Throughput Format, encompassing testing against different resistant strains has been performed to confirm the in-silico study. Bacterial susceptibility was tested first against antibiotics to determine resistant profile of *Staphylococcus aureus* strains via the microdilution assay. The antibacterial activity of the selected molecules was assessed using the same method, applying a range of concentrations below the therapeutic dose. Combining these molecules, either targeting specific resistance mechanisms or acting on different elements of the SOS response pathway, showed promising results. Indeed, binary formulation containing two compounds combined with low concentration of antibiotic (1/4 MIC) reduced bacterial viability to 16.11% compared to antibiotic and formulation alone (37.96% and 86.10%, respectively). These findings suggest that the selected molecules and their combinatorial use with antibiotics could be a promising strategy to combat multidrug-resistance *Staphylococcus aureus*.

Keywords: *Adjuvant, antibiotic resistance, combinational therapy, molecular docking, multidrug resistant bacteria.*

CO33: Study of the Cytotoxic Activity of *Pyrethrum anacyclus* Against Cancer Cells

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Abstract

Anacyclus pyrethrum is a medicinal plant widely used in traditional Moroccan medicine, known for its stimulant and analgesic properties. Recent studies have highlighted its anti-inflammatory potential, mainly due to the presence of bioactive compounds such as alkylamides, flavonoids, and polyphenols. These compounds help inhibit inflammatory mediators like prostaglandins and cytokines. Additionally, extracts from *Anacyclus pyrethrum* have demonstrated significant cytotoxic activity against certain cancer cell lines, suggesting a promising natural source for the development of anticancer agents. These findings support the pharmacological interest in this plant and pave the way for further studies on its mechanisms of action and potential clinical applications

Keywords: *Anacyclus pyrethrum*, medicinal plants, Medicinal properties, Anti-inflammatory, cytotoxic activity, cancer cells

CO34 : Synthesis, biological evaluation, and computational docking analysis of novel 1,2,3-Triazole-8-quinolinol derivatives

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Abstract

A new series of 1,2,3-triazole-8-quinolinol hybrid compounds was produced with high efficiency through a single-step process, utilizing monosubstituted acetonitriles and 5-azidomethyl-8-quinolinol as precursors. The structural composition of these hybrids was confirmed via nuclear magnetic resonance (1H and 13C NMR) spectroscopy and elemental analysis. In vitro antibacterial efficacy of the synthesized compounds was evaluated against four bacterial species: Escherichia coli (E. coli), Xanthomonas fragariae (X. fragariae), Staphylococcus aureus (S. aureus), and Bacillus subtilis (B. subtilis), employing disk diffusion and minimal inhibition concentration (MIC) methodologies. Hybrid 7 displayed remarkable antibacterial potency, exhibiting MIC values of 10 µg/mL against S. aureus and 20 µg/mL against B. subtilis, E. coli, and X. fragariae, which were comparable to the efficacy of nitroxoline, a standard antibiotic. A structure-activity relationship (SAR) investigation of the 1,2,3-triazole-8-quinolinol hybrids indicated that the presence of electron-donating substituents at the 4-position of the 1,2,3-triazole ring is essential for biological activity. To provide further insights into the antibacterial results, quantum chemical computations were executed using Gaussian software, employing B3LYP, HF, and M062X basis sets at 3-21g, 6-31g, and SDD levels. Moreover, molecular docking analyses were performed to explore the binding affinities and interactions between selected hybrids and their target proteins. An absorption, distribution, metabolism, excretion, and toxicity (ADME/T) study was conducted to evaluate the potential of these 1,2,3-triazole-8-quinolinol hybrids as prospective pharmaceutical agents.

Keywords *1,2,3-triazole-8-quinolinol hybrid, synthesis, NMR, antibacterial activity*

CO35: *Fusobacterium nucleatum* in Colorectal Cancer: Diagnostic and Therapeutic Implications

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Abstract

Colorectal cancer (CRC) represents a major global health challenge. While numerous risk factors contribute to its development, the gut microbiota, particularly *Fusobacterium nucleatum* (Fn), is increasingly recognized as a key player in colorectal carcinogenesis. This study aims to systematically evaluate the evidence linking *Fusobacterium nucleatum* to CRC and explore the underlying mechanisms.

- We conducted a comprehensive literature review using PubMed, ScienceDirect, and Web of Science databases, encompassing publications up to March 2025. Search terms included "*Fusobacterium nucleatum"* and "colorectal cancer".

The scientific literature demonstrates a strong association between *Fusobacterium nucleatum* presence and CRC tissue, implicating immunomodulatory and inflammatory mechanisms. However, direct causality remains to be elucidated and additional studies are warranted. Our research project aims to address this gap by evaluating the potential of *Fusobacterium nucleatum* as a diagnostic biomarker and innovative therapeutic target in CRC management.

Keywords : *Fusobacterium nucleatum, Colorectal cancer, Biomarker and Gut microbiota.*

CO36 : Innovative Bacteriocin OF71 based Hydrogel for Targeted Treatment of Mycobacterial Skin and Mucosal Infections

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Abstract

Cutaneous tuberculosis is a rare and often indolent form of mycobacterial infection, accounting for 1–2% of cases in endemic regions. Its treatment relies on oral polychemotherapy, identical to that used for pulmonary tuberculosis. However, the emergence of antibiotic resistance and the adverse effects of conventional therapies highlight the need for alternative treatment strategies. Bacteriocin OF71, an antibacterial peptide produced by *Lactococcus lactis OF71*, exhibits promising antimicrobial activity against *Mycobacterium smegmatis* a surrogate model for the study compounds active against *M. tuberculosis*. This study aims to develop a hydrogel formulation incorporating bacteriocin OF71 for the topical treatment of cutaneous tuberculosis. Bacteriocin OF71 was produced on a waste based medium and characterized in terms of its physicochemical properties, including thermal stability (60°C, 80°C and 100°C), and pH tolerance. A multi-step purification process involving cation exchange and reverse phase chromatography was performed. The bacteriocin was then incorporated into a hydrogel formulation. The hydrogel antibacterial efficacy and physicochemical stability were evaluated. Stability assays showed that the bacteriocin retained 100% of its activity at pH 4 and 7 and after heating at 100°C for 10min. The purified bacteriocin exhibited potent antibacterial activity against *M. smegmatis with and inhibition diameter of 19 mm,* highlighting its potential as an antimicrobial agent. The results demonstrated that the bacteriocin-loaded hydrogel retained its antimicrobial activity after 60 days, suggesting its suitability for treating infections caused by *Mycobacterium*. The development of such a formulation could provide a complementary approach to conventional treatments, improving therapeutic outcomes while minimizing systemic side effects."

Keywords: *Cutaneous tuberculosis, Mycobacterium, Bacteriocin, Lactic acid bacteria, Tuberculosis, Topical delivery.*

CO37 : Rôles des nutraceutiques dans la prévention des éfféts négatifs associés a la consommation de la viande rouge

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Résumé

La consommation excessive de viande rouge est associée à divers risques pour la santé, notamment les maladies cardiovasculaires, le cancer colorectal et l'inflammation chronique. Ces effets négatifssont en partie dus à la production de composés oxydatifs et pro-inflammatoires tels que les amines hétérocycliques, le fer héminique et le TMAO (triméthylamine-N-oxyde), un métabolite issu du microbiote intestinal et lié à un risque accru d'athérosclérose. Pour atténuer ces effets, les nutraceutiques, issus d'aliments fonctionnels, offrent des stratégies préventives efficaces.
Les polyphénols (présents dans le thé vert, les baies et le cacao) et la curcumine possèdent des propriétés antioxydantes et anti-inflammatoires, réduisant ainsi les dommages cellulaires. Les oméga-3, retrouvés dans les poissons gras, les graines de lin et les noix, participent à la régulation des lipides sanguins et limitent l'inflammation. Par ailleurs, les probiotiques et les fibres alimentaires (légumineuses, céréales complètes) modulent favorablement le microbiote intestinal, réduisant la production de TMAO. Enfin, les flavonoïdes (agrumes, légumes verts) et le calcium (produits laitiers, amandes) atténuent le stress nitrosatif et protègent contre les cancers digestifs. L'intégration de ces nutraceutiques dans l'alimentation permet ainsi de minimiser les effets néfastes de la viande rouge tout en maintenant un équilibre nutritionnel optimal.

Mots clés : *Viande rouge, nutraceutiques, TMAO, polyphenols, antioxidants, santé cardiovasculaire*

CO38 : The Role of Probiotics in the Management of Biofilm-Associated Infections : A Promising Therapeutic Strategy

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Abstract

Biofilm-associated infections pose significant challenges in clinical settings due to their resistance to conventional antimicrobial treatments and their role in persistent and recurrent infections. Probiotics—live microorganisms that confer health benefits—have emerged as promising adjuncts or alternatives in managing these infections. Various probiotic strains, particularly *Lactobacillus* and *Bifidobacterium*, exhibit anti-biofilm properties through mechanisms such as the production of antimicrobial substances (organic acids, hydrogen peroxide, bacteriocins), competition for adhesion sites, inhibition of quorum sensing, and modulation of the host immune response. Clinical applications have demonstrated the efficacy of specific strains like *Lactobacillus rhamnosus* and *L. reuteri* in restoring healthy microbiota and reducing biofilm-associated infections in the gastrointestinal and urogenital tracts. In hospital settings, probiotics have shown the potential to reduce the incidence of multidrug-resistant infections by disrupting biofilm formation and enhancing antibiotic efficacy. Despite these promising findings, challenges remain in standardizing probiotic therapies, understanding strain-specific effects, and managing complex multispecies biofilms. Future research should focus on identifying the most effective probiotic strains, optimizing their integration with conventional treatments, and validating their clinical utility through robust trials. Harnessing the anti-biofilm capabilities of probiotics could represent a sustainable and innovative approach to infection control in modern healthcare.

Keywords *: Probiotics, Biofilm-associated infections, Antimicrobial resistance, Lactobacillus*

CO39 : OPTIMIZATION OF THERAPEUTIC STRATEGIES AGAINST MULTIRESISTANT *ACINETOBACTER BAUMANNII*: NEW CHALLENGES AND FUTURE PROSPECTS

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Abstract

Antimicrobial resistance (AMR) is a growing global threat, especially in the hospital setting, where some pathogens such as *Acinetobacter baumannii* are of particular concern. This opportunistic bacillus is involved in many severe nosocomial infections, especially and frequently occurring in many immunocompromised patients or patients placed in intensive care. According to the Centers for Disease Control and Prevention, *A. baumannii* is very likely among the most critical pathogens due to its increasing resistance to carbapenems and other classes of antibiotics. This multiresistance compromises the effectiveness of conventional treatments, leading to a significant increase in morbidity and mortality. Although a significant number of new therapeutic options, such as cephyrocol, are being studied, their efficacy against certain strains, particularly in cases of severe pneumonia, remains uncertain. Furthermore, *A. baumannii* remains a major agent of many neonatal septicaemia, with an increased prevalence of multidrug-resistant strains, particularly in low- and middle-income countries. In Morocco, a study conducted in 2021 found that this pathogen accounted for 18% of the microorganisms isolated from nosocomial infections, all strains being resistant to carbapenems. This situation highlights the urgency of further strengthening microbiological surveillance, optimizing all preventive measures and developing new therapeutic strategies to control this highly resistant pathogen.

Keywords: *multidrug resistance, Acinetobacter baumannii, Antibiotic resistance, hospital-acquired infections, Nosocomial infections*

CO310 : Anti-inflammatory Potential of *Pistacia lentiscus* L. Seed Extract : A Natural Alternative with Comparable Efficacy to Indomethacin

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Abstract

Pistacia lentiscus L. (PLL), commonly known as mastic tree, is a medicinal plant traditionally used in various cultures for its therapeutic properties, particularly in the Mediterranean region. Rich in bioactive compounds such as polyphenols, flavonoids, and terpenes, PLL has been recognized for its antioxidant, antimicrobial, and anti-inflammatory effects. Given these properties, recent scientific interest has turned toward exploring its potential as a natural anti-inflammatory agent. The anti-inflammatory activity of PLL extracts, particularly the aqueous extract from the seeds (ASEE), was evaluated through a series of *in vitro* and *in vivo* tests. In the protein denaturation assay, ASEE showed an inhibition rate of 85%, which is very close to that of the reference drug indomethacin (88%). Similarly, in the membrane stabilization test, ASEE achieved 82% inhibition compared to 86% for indomethacin, confirming its protective effect on cells under inflammatory stress. These promising *in vitro* findings were supported by in vivo results using the carrageenan-induced paw edema model in rats. When administered at a dose of 200 mg/kg, ASEE reduced paw inflammation by 68% after 3 hours, while indomethacin at the same dose showed a 72% inhibition rate. This demonstrates a strong and comparable anti-inflammatory effect. Overall, these results highlight ASEE as a natural extract with significant anti-inflammatory potential, comparable to standard pharmaceutical treatments.

Keywords *: Pistacia lentiscus L; anti-inflammatory; Aqueous extract; in vitro; in vivo*

CO311 : Extraction, Purification, Characterization, and Wound Healing Effects of Novel Prickly Pear (Opuntiaficus-indica (L.) Mill.) Heteropolysaccharides

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Abstract

The present study undertakes the purification of a novel polysaccharide from Tunisian prickly pear (Opuntiaficus-indica (L.) Mill.) rackets (PPPRs) and the determination of its physicochemical properties, structure, antibacterial and antioxidant properties, as well as its in vitro and in vivo wound healing potential. The PPPR was structurally analyzed by Fourier Transform Infrared Spectroscopy (FTIR) and UV/Visible Spectroscopy, revealing characteristic bands of polysaccharides. According to thin-layer chromatography (TLC), high-performance liquid chromatography (HPLC), and Gas Chromatography–Mass Spectrometry (GC–MS) analyses. The crude PPPR is an heteropolysaccharide composed of glucose (62.4%), galactose (19.37%), mannose (10.24%), and rhamnose (7.98%), with an average molecular weight of 90.94 kDa. This novel polysaccharide exhibited notable antioxidant potential assessed by four different in vitro assays: the 2-diphenyl-1-picrylhydrazyl (DPPH) scavenging assay, ferric reducing power, ferrous chelating activity, and scavenging activity against 2,2′-azino-bis-3-ethylbenzothiazoline-6-sulphonic acid (ABTS). In addition, the PPPR displayed high antibacterial activities with a MIC of 2.5 mg/mL against Salmonella Typhimurium and Pseudomonas aeruginosa, cytocompatibility properties, and noncytotoxicity. Subsequently, the effect of the PPPR on skin wound healing was studied in a diabetic rat model induced by alloxan, revealing a significant acceleration in the wound healing process. This acceleration was evidenced by the expedited recovery of the dermis, increased formation of blood vessels, and enhanced tissue granulation. Therefore, the findings offer fresh perspectives on the creation of a potentially efficient and promising racket polysaccharide-based therapy for the treatment of persistent diabetic wounds.

Keywords: *prickly pear; monosaccharide composition; structural characteristics; antioxidant and antibacterial activity; HEK-293 cells.*

Oral Presentations
Theme 3

Session III: Quality, Safety, Nutrition, and Health – A Commitment to the Future
(Pathogens, xenobiotics, antimicrobials, probiotics, nutraceuticals…)

Sub-session T3-B: Nutrition, Antioxidants, and Functional Ingredients for Health
(Honey, oils, plant extracts, nutraceuticals, and nutritional quality analysis…)

CO312 : Polyphenol-Rich Honey from Northern Morocco : A Potential Source of Antioxidant and Antibacterial Agents

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Abstract

Honey has been widely used since ancient times for its nutritional and therapeutic properties. Their biological activities were largely attributed to its rich composition on polyphenols and flavonoids. This study aims to assess the antioxidant and antibacterial properties of honey from the northern region of Morocco. The total phenolic and flavonoid contents were determined using the Folin–Ciocalteu and aluminum trichloride methods, respectively. Antioxidant activity was assessed using the DPPH free radical scavenging assay to evaluate the honey's ability to neutralize free radicals and FRAP assay. Furthermore, the antibacterial activity was assessed against ***Escherichia coli*** and ***Staphylococcus aureus*** (ATCC strains) using the Minimum Inhibitory Concentration (MIC) method. The results revealed significant variability among the honey samples, reflecting the influence of floral origin and geographical conditions. A strong correlation was observed between polyphenol and flavonoid content and antioxidant activity, confirming the richness of Moroccan honey in bioactive compounds. Furthermore, the antibacterial tests demonstrated a notable inhibitory effect against ***Escherichia coli*** and ***Staphylococcus aureus*** (ATCC strains). These findings emphasize the potential health benefits of Moroccan honey and suggest its possible future application in wound healing, owing to its antioxidant and antimicrobial properties.

Keywords: *honey; phenolic compounds; flavonoids; DPPH assay; FRAP assay, Antibacterial activity*

CO313: *Ceratonia siliqua* L. pulp from the Middle Atlas of Morocco: biochemical composition, antioxidant and antimicrobial activities

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Abstract

The carob tree (*Ceratonia siliqua* L.), a leguminous, is an agro-silvo-pastoral plant of great socio-economic, environmental, industrial, pharmacological and nutritional importances. Its pulp is valued for its antioxidant and antimicrobial activities and high content of bioactive compounds and minerals. This study investigates the effect of soil from around carob trees basal geographic zones at different depths (A= 0 cm to 10cm, B= 10 cm to 30 cm C = superior at 30 cm) (edaphic conditions) on the biochemical composition and antioxidant and antimicrobial properties of *Ceratonia siliqua* L. pulp from different geographical areas in the Middle Atlas region of Morocco. Carob pulp extract from Sidi Hsine exhibited the highest levels of bioactive compounds (total polyphenols and flavonoids contents). These elevated values were associated with soils rich in heavy metals. In contrast, the extract from Lehri contained the highest concentration of water-soluble tannins, which coincided with lower calcium and higher iron levels in the soil. In addition, Principal Component Analysis revealed correlations between soil characteristics and the biochemical composition of carob pulp, including its content of bioactive compounds and its antioxidant and antimicrobial activities. This research provides valuable insights to guide the targeted valorization of *Ceratonia siliqua* L. pulp from each region based on its unique biochemical profile and antioxidant and antimicrobial properties.

Keywords *Ceratonia siliqua L., Pulp, Middle Atlas of Morocco, Biochemical composition, antioxidant activity, antimicrobial activity.*

CO314 : The Effect of Drying Modes on The Chemical Composition and Bioactivities of *Cannabis sativa* L. Seeds Oil from Morocco

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Abstract

Cannabis sativa L., commonly known as hemp, is a versatile plant valued for its seeds and oil, which exhibit significant bioactive properties. This study investigates the chemical composition, antioxidant, and antimicrobial activities of *Cannabis sativa* L. seed oil. The oil, extracted via cold pressing, is rich in polyunsaturated fatty acids, predominantly linoleic acid (omega-6) and alpha-linolenic acid (omega-3), along with a notable presence of tocopherols, phenolic compounds, and phytosterols. These constituents contribute to its potent antioxidant activity, demonstrated by effective free radical scavenging in assays such as DPPH. The antimicrobial properties of the oil were assessed against a range of Gram-positive and Gram-negative bacteria, as well as fungi. The results reveal moderate to strong inhibitory effects, attributed to bioactive compounds such as terpenes and phenolics. The findings highlight the potential of *Cannabis sativa* seed oil as a natural source of antioxidants and antimicrobials, with promising applications in food preservation, cosmetics, and pharmaceutical industries. Further research is recommended to elucidate the mechanisms of action and optimize its application in various fields.

Keywords : *Cannabis L sativa drying modes, seeds oil, chemical composition, biological activities.*

CO315: Newly synthesized benzimidazole derivatives: Synthesis, characterization and theoretical investigation

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Abstract

The chemistry of heterocyclic compounds represents one of the most intricate and captivating branches of organic chemistry, owing to its theoretical significance, diverse synthetic methodologies, and broad-spectrum applications in both biological and industrial fields. Among these, benzimidazole derivatives have attracted considerable attention due to their remarkable biological activities and extensive clinical applications. Notably, they exhibit potent antimicrobial properties against a wide range of pathogens, including bacteria and fungi, primarily by interacting with key biological targets such as DNA, enzymes, and cell membranes, thereby disrupting essential cellular functions. In this study, we report the synthesis of novel benzimidazole derivatives via a condensation reaction between aldehydes and o-phenylenediamine, followed by targeted molecular modifications. Our synthetic strategy emphasizes simplicity, efficiency, and cost-effectiveness, making it suitable for large-scale production. The structural characterization of the synthesized compounds was performed using advanced spectroscopic techniques, including ^{1}H NMR, ^{13}C NMR, LC-MS, and FT-IR. Additionally, a theoretical investigation was conducted using density functional theory (DFT) to optimize molecular structures, analyze electronic properties, and determine reactivity descriptors, providing deeper insights into their chemical behavior and potential biological interactions. Furthermore, the antimicrobial potential of the newly synthesized derivatives was assessed through *in silico* screening against bacterial and fungal targets, aiming to explore their effectiveness as promising antimicrobial agents.

Keywords *benzimidazole, antimicrobial, in silico , spectroscopy.*

CO316 : Unveiling the Differential Antioxidant Activity of Maslinic Acid in Murine Melanoma Cells and Rat Embryonic Healthy Cells After Sodium Nitroprusside (SNP) Treatment

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Abstract

Maslinic acid (MA) is a pentacyclic triterpene found in the waxy layer covering the fruit and leaves of the olive tree, belonging to the oleanane triterpenoid group. This compound has preliminarily demonstrated anticancer, anti-inflammatory, antioxidant, immune-activating, and antiviral properties, among others. This study highlights the need to evaluate its antioxidant capacity under oxidative stress conditions in *in vitro* cultured cell lines previously treated with sodium nitroprusside (SNP). To achieve this, various assays were conducted using murine melanoma cell lines (B16-F10) and normal smooth muscle cells (A10). First, cell viability was assessed using the MTT assay to determine the IC_{50} concentration in both cell lines. Subsequent treatments were carried out with concentrations lower than the IC_{50}. Next, cell activity was analyzed by flow cytometry using 1,2,3-dihydrorhodamine, and finally, the expression levels and activity of enzymes related to antioxidant defense were evaluated. The results demonstrated that MA is effective in protecting against oxidative cellular damage. Under the experimental conditions, it was observed that MA has a significant effect on the activity of these enzymes, modulating their function and regulating their expression depending on the stress condition, the administered dose, and the cell type. Notably, a greater protective effect was observed in stressed normal cells compared to tumor cells.

Key words: *antioxidant effect, maslinic acid, sodium nitropusside, stress oxidative*

CO317 : Evaluation of the Interaction Between Menthol and Camphor, Major Compounds of *Clinopodium nepeta* Essential Oil: Antioxidant, Anti-inflammatory and Anticancer Activities Against Breast Cancer Cell Lines

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Abstract

This study evaluates the antioxidant, anti-inflammatory, and anticancer activities of camphor, menthol, and their equimolar combination. In silico toxicity analysis confirmed the absence of toxic effects for both compounds. Antioxidant activity, assessed by 1,1-diphenyl-2-picrylhydrazyl (DPPH) and 2,2′-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) assays, revealed a synergistic effect of the equimolar combination with half-maximal inhibitory concentration (IC50) values of 10.3 µg/mL (DPPH) and 8.9 µg/mL (ABTS), surpassing the efficacy of ascorbic acid (IC50 = 12.4 µg/mL). Evaluation of anti-inflammatory activity showed that the combination more effectively inhibited 5-lipoxygenase (72.5% vs. 48.3% for camphor and 52.9% for menthol) and COX-1 and COX-2 cyclooxygenases (78.1% and 79.4% respectively, vs. 60.4% and 62.7% for camphor, 64.2% and 66.3% for menthol). Anticancer activity, tested onMCF-7, MDA-MB-231, and MDA-MB-436 breast cancer lines, revealed that the equimolar combination exhibited IC_{50} of 27.6, 31.2, and 36.5 µg/mL, respectively, with an IC50 of 52.3 µg/mL on normal cells, demonstrating remarkable selectivity for cancer cells. These results suggest that the camphor-menthol combination represents a promising therapeutic approach against pathologies associated with oxidative stress, inflammation, and carcinogenesis.

Keywords *: anti-cancer; anti-inflammatory; antioxidant activity; breast cancer; camphor; menthol; synergy*

CO318 : Synergistic Effects of *Ormenis multicaulis* and Carum carvi in Preventing Hepatobiliary Calcifications and Microlithiasis in Sprague Dawley Rats: A Histopathological Study

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Abstract

This study explores the synergistic effect of two plants : chamomile (*Ormenis multicaulis)* and caraway (*Carum carvi)* on the inhibition of hepatic microcalcification. This this experimental work, conducted in partnership with the Department of Pathological Anatomy at the University Hospital Center (CHU) of Marrakech (Morocco), and the Department of Neurophysiology at the Faculty of Sciences of Marrakech, aimed to assess the hepatoprotective potential effects of methanolic extracts, from either chamomile flowers, caraway seeds, or from a combination of the two plant samples on liver tissues of Sprague Dawley rats. Methanolic extracts were prepared and administered according to standard pharmacological protocols. Histopathological examination of liver tissues showed a notable decrease in crystal formation in the group treated with the combination of the two extracts, compared to the groups receiving single treatments. The synergistic effect observed suggests that the association of *O. multicaulis* and *C. carvi* methanolic extracts exerts a more potent protective action on hepatic tissues, likely through complementary mechanisms of antioxidative and anti-inflammatory pathways (Wakrim et al, 2023, Wakrim et al. 2024 submitted). These promising results open up new avenues for phytotherapeutic strategies targeting hepatic microcalcification and its associated pathologies. Further studies are required to elucidate the exact molecular interactions involved and to confirm the reproducibility of the effect in broader clinical models.

Keywords: *Carum carvi, Ormenis multicaulis, histopathology, hepatoprotection, synergistic effect, Sprague Dawley rats.*

CO319 : Micrografting in Certain Genotypes of Argan Trees *(Argania spinosa L.)*

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Abstract

The argan tree *(Argania spinosa L. Skeels)* is a forest species endemic to Morocco, belonging to the Sapotaceae family. It is mainly located in the upper southwestern region of Morocco (arid and semi-arid climates), where it grows wild and covers an area of approximately 952,200 hectares. This species plays a crucial role in maintaining ecological balance and preserving biodiversity, and it also arouses great medicinal and economic interest due to its multiple uses. Vegetative propagation of the argan tree remains difficult with a very low yield, hence the need to introduce new techniques, particularly *in vitro* culture, which allows for mass propagation of this national heritage. Micro-grafting has also been suggested to overcome the recalcitrance of rooting in certain plant species, for large-scale production of commercial cultivars, and for the renewal of old orchards.

In the present work, we aim to develop an efficient regeneration system through micrografting for the argan tree (Argania spinosa (L.)). To this end, experiments will first be conducted on seed germination to produce rootstocks. The seeds are transferred to a half-strength Murashige and Skoog (½MS) medium supplemented with zeatin. Then, micrografting will be carried out using scions obtained from in vitro shoots, following the simple apical cleft technique. Subsequently, the micrografted plants are transferred to a half-strength Murashige and Skoog (½MS) medium supplemented with gibberellic acid (GA3), 6-benzylaminopurine (BAP), and indole-3-butyric acid (IBA).

Germination began five days after culture initiation in darkness, marked by the emergence of the radicle. After four weeks, the germination rate reached up to 83.33%. Regarding micrografting, after two months of incubation in a growth chamber under a 16/8 h photoperiod and a temperature of 25°C ± 1°C, the best result was recorded in genotype G41, followed by genotype G27 and genotype G41/27, with success rates of 80%, 73%, and 60% respectively. These results indicate that there is no significant difference among the different genotypes regarding the success of micrografting. We will evaluate the graft union compatibility (scion/rootstock) through morphological and histological observations.

Keywords : *Argania spinosa L., in vitro culture, micrografting, micropropagation.*

CO320 : Co-production of enzymes and biosurfactants for eco-friendly biodetergent formulation

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Abstract

Conventional synthetic surfactants, derived from petrochemicals, while effective, often present significant environmental and health risks due to their low biodegradability and toxic effects. As a result to these challenges, there is a growing demand for sustainable and environmentally friendly cleaning solutions produced from renewable resources. In order to propose a solution for these problems, this study suggests a biotechnological method that uses microbial fermentation to produce biosurfactants and enzymes from agro-industrial by-products. In this study, the synthesis of these biomolecules is examined, analyzing their surface activity, emulsification ability and characterized in terms of stability across different environmental factors such as pH, and temperature.

Different waste substrates were tested for their efficiency in supporting microbial growth and biomolecule production. Among them, potato peels yielded the highest biosurfactant and enzyme production, demonstrating remarkable surface-active properties and high emulsification capacity. These biomolecules demonstrated substantial stability across a range of pH levels, in the presence of metal ions, surfactants, and commercial detergents. Their incorporation into experimental detergent formulations exhibited enhanced cleaning performance and offered comparable or superior efficiency to synthetic agents

The findings demonstrate the industrial feasibility of employing these biotechnologically derived molecules to create a viable alternative to conventional detergent ingredients, ensuring environmentally friendly cleaning products, supporting the circular economy by valorizing organic waste and lowering reliance on petrochemical-derived ingredients.

Keywords: *Biodetergency, enzymes, biosurfactant, eco-frindly cleaning products.*

CO321 : The Microencapsulation Effect on *Lactobacillus plantarum* S61: Enhancing Viability and Gastrointestinal Stability

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Abstract

Probiotics such as *Lactobacillus plantarum* S61 are increasingly applied in functional foods for their health-promoting properties, including modulation of gut microbiota and enhancement of immune responses. However, maintaining probiotic viability during processing and storage remains a critical limitation, as cells are highly sensitive to heat, oxygen, acid stress, and dehydration. Encapsulation offers a promising strategy to improve probiotic stability by incorporating cells into protective matrices. In this study, *L. plantarum* S61 was successfully encapsulated using maltodextrin alone or combined with sodium caseinate as wall materials via spray drying. Cell viability was monitored over 8 weeks of refrigerated storage at 4 °C, alongside the evaluations of gastrointestinal resistance, powder properties, and morphology. Encapsulation efficiency was confirmed, and the powders demonstrated appropriate moisture content and controlled water activity, both essential for prolonged storage. Overall, the addition of sodium caseinate improved probiotic stability during storage and simulated digestion, while powder characterization confirmed suitable physical properties for application in functional foods. Notably, sodium caseinate-containing powders showed better retention of cell viability over time compared to maltodextrin alone, supporting the protective role of protein in the matrix. These findings demonstrate the potential of the spray-drying technique, particularly with protein-enriched matrices, to develop stable probiotic powders for food applications, ensuring both functional performance and extended shelf life.

Keywords: *Lactobacillus plantarum S61; microencapsulation; spray-drying; probiotic;*

CO322: Phytochemical Study and Evaluation of the Antioxidant and Antimicrobial Activities of an Aqueous Extract Obtained by Reflux Heating of *Piper nigrum* Seeds

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Abstract

This study focuses on the phytochemical investigation and evaluation of the antioxidant and antimicrobial activities of an aqueous extract obtained by reflux heating from Piper nigrum (black pepper) seeds. Phytochemical screening revealed the presence of alkaloids, flavonoids, terpenoids, and phenolic compounds in the extract. The antioxidant activity was assessed using the DPPH radical scavenging assay, which demonstrated notable free radical inhibition, with an IC_{50} value of 28.7 ± 1.2 µg/mL. Furthermore, the aqueous extract exhibited significant antimicrobial activity against a panel of bacterial and fungal strains, indicating a broad spectrum of action. These findings suggest that the aqueous extract of Piper nigrum seeds is a rich source of bioactive compounds with promising antioxidant and antimicrobial properties. This highlights its potential for applications in the development of natural therapeutics and preservatives. Further studies are warranted to isolate and identify the specific active constituents responsible for these effects.

Keywords: *Piper nigrum ; Aqueous extract ; Antioxidant activity ; Antimicrobial activity ; Phytochemical screening.*

CO323: Étude multidisciplinaire de l'huile essentielle de *Laurus nobilis* : Composition chimique, bioactivités et interactions moléculaires

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Résumé

La présente étude s'intéresse à la caractérisation chimique de l'huile essentielle de *Laurus nobilis* (LN), obtenue par hydrodistillation avec un rendement de 0,5 % basé sur la masse sèche. L'analyse a été réalisée à l'aide de la chromatographie en phase gazeuse couplée à la spectrométrie de masse (GC-MS) ainsi que par microextraction en phase solide suivie d'une analyse de l'espace de tête (HS-SPME). La composition de l'huile essentielle est dominée par l'eucalyptol et le linalol, qui représentent ensemble 64,33 % du total des constituants identifiés.

Par ailleurs, les propriétés antioxydantes de l'huile essentielle de *Laurus nobilis* ont été évaluées à travers différents tests in vitro, notamment les essais DPPH, β-carotène/acide linoléique et $ABTS^{+}$. Le test DPPH a permis de déterminer une IC_{50} de 0,86 ± 0,38 mg/ml, tandis que le test β-carotène/acide linoléique a révélé une IC_{50} de 2,58 ± 0,10 mg/ml. En comparaison, l'activité mesurée par le test ABTS s'est avérée légèrement inférieure à celle de l'acide ascorbique, utilisé comme référence standard.

Enfin, les analyses de docking moléculaire ont mis en évidence que certains composés minoritaires, notamment le caryophyllène, le γ-elemene, le (-)-spathulénol, l'acétate d'α-terpinéol et l'α-terpinéol, présentaient les meilleures affinités de liaison avec les protéines cibles. Ces résultats suggèrent un potentiel thérapeutique intéressant de l'huile essentielle de *Laurus nobilis*, en particulier dans le cadre de la modulation de voies biologiques associées à ces cibles protéiques.

Mots clés : *Laurus nobilis ; huile essentielle ; eucalyptol ; linalol ; GC-MS ; DPPH ; ABTS ; IC_{50} ; activité antioxydante ; docking moléculaire.*

Oral Presentations
Theme 3

Session III: Quality, Safety, Nutrition, and Health – A Commitment to the Future
(Pathogens, xenobiotics, antimicrobials, probiotics, nutraceuticals…)

Sub-session T3-C: Environmental Health, Safety, and Emerging Technologies for Health
(Pollution, environmental microbiology, artificial intelligence, risk assessment, and biotechnologies)

CO323 : Impact de la pollution sur les eaux de la nappe phréatique de Sidi Allal Tazi Gharb, Maroc

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Résumé

La préoccupation environnementale suppose un certain dynamisme de base visant à préserver les écosystèmes contre tous types de pollution et à mieux gérer l'environnement. L'objectif de notre travail est de déterminer le degré de pollution de la nappe phréatique de Sidi Allal Tazi de la région de Kénitra (Maroc), nous avons sélectionné des éléments physicochimiques comme indicateur de pollution inorganique. Les échantillons ont été prélevés sur 10 puits (T1 ..... T10), les analyses physicochimiques des échantillons prélevés pendant une adonnée ont montré une grande fluctuation de certains paramètres tels que pH,Ca2+,Mg2+, Na+, NH4+,Cl-, NO3,SO42- .Par exemple :le potentiel hydrogène est de l'ordre de 7,41±0,164, la conductivité électrique est de l'ordre de 1720,1±187 µS/cm, la turbidité est de l'ordre de 1,72±2,33 NTU, le Mg2+ est de l'ordre de 74,74±120 NTU, les chlorures, nitrates et sulfates sont respectivement de l'ordre de 529,17 mg, 43,35 mg et 100,93 mg. Aussi, les résultats ont été comparés aux normes de l'OMS.Ces résultats révèlent que la qualité des eaux souterraines de Sidi Allal Tazi dépasse les normes nationales et pose un sérieux problème pour leur consommation directe.

Mots clés : *Eaux souterraines, Sidi Alala Tazi, physicochimie et Maroc.*

CO324: Effect of Fabric Dyes on the Physicochemical Characteristics of Cloth Facemasks

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Cloth facemasks are commonly used to protect against airborne contaminants in both healthcare and public settings. While the structural properties of these masks have been well studied, the influence of fabric dyes on their surface characteristics remains underexplored. This study examines how dye colors affect key physicochemical properties of mask surfaces, particularly hydrophobicity and electron donor–acceptor behavior. Contact angle measurements were performed on two layers of the masks: the inner polyester (PES) layer, which was consistent across all samples, and the outer layer, which differed in color (white, light blue, dark blue, and grey). The inner PES layer was found to be strongly hydrophobic, with a high water contact angle (118°), moderate electron acceptor character (5.5 $mJ \cdot m^{-2}$), and minimal electron donor character (0.1 $mJ \cdot m^{-2}$). In contrast, the white outer layer was hydrophilic ($\theta = 22°$), with a high electron donor value (57.7 $mJ \cdot m^{-2}$) and low acceptor character (0.1 $mJ \cdot m^{-2}$). Colored outer layers were more hydrophobic, with contact angles between 98.5° and 110.3°, and displayed variable donor (4–18 $mJ \cdot m^{-2}$) and acceptor (0.2–1.1 $mJ \cdot m^{-2}$) properties. Surface free energy calculations supported these findings, indicating that the white outer surface was hydrophilic ($\Delta Giwi > 0$), whereas the colored layers and inner PES layer were hydrophobic ($\Delta Giwi < 0$). These results suggest that fabric dyes significantly alter surface energy and wettability, which could influence microbial adhesion and should be taken into account in the development of reusable cloth facemasks.

Keyword: textile fibers, facemasks, dying, Physicochemical characterization, Cloth facemasks, Surface properties

CO325: Physicochemical Characterization of Gallstone Surfaces and Their Influence on *Salmonella typhi* Adhesion

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Abstract

Salmonella Typhi can adhere to and build biofilms on the surface of gallstones, causing abnormal gallbladder mucosa, which could lead to carcinogenesis. The surface physicochemical properties of microbial cells and materials have been shown to play a crucial role in adhesion. Therefore, this study aimed to investigate, for the first time, the surface properties of nine gallstones and to evaluate the influence of these parameters on the theoretical adhesion of *S.* Typhi to gallstone surfaces. The physicochemical properties were determined by SEM–EDX and contact angle measurements (CAM) while the predictive adhesion of *S.* Typhi on gallstones was estimated using the XDLVO approach. SEM–EDX analysis revealed that cholesterol is the principal component on the surface of all gallstones, with carbon and oxygen as the main elements. Aluminum was detected as a trace element in only three gallstones: GS2, GS4, and GS5. *S.* Typhi CIP5535 has a hydrophilic character (ΔG_{iwi} = 33.54 mJ m^{-2}), as well as strong electron donor (γ^- = 55,80 mJ m^{-2}) and weak electron acceptor properties (γ^+ = 1,95 mJ m^{-2}). Regarding gallstones, it was found that they have a hydrophobic character (ΔGiwi $<$ 0), while their electron donor/acceptor characters change according to each gallstone. Predictive adhesion showed that all gallstones could be colonized by *S.* Typhi ($\Delta G_{XDLVO}^{Total} < 0$) except GS1, GS5, and GS6 ($\Delta G_{XDLVO}^{Total} > 0$). Understanding the interfacial phenomena implicated in the process of bacterial adhesion makes it possible to limit or even inhibit the adhesion of *S.* Typhi on gallstone surfaces.

Keywords: *Gallstones, adhesion, physicochemical properties, XDLVO.*

CO326: Effects of road leaching on lake water quality: An analysis of health risks linked to heavy metals

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Abstract

Road leaching is a major source of lake water contamination, particularly in areas close to road infrastructure. This study examines the impact of this phenomenon on water quality in Dayat Roumi Lake. Seasonal sampling was carried out at six stations distributed around the lake. During these sampling campaigns, 16 parameters were measured, including 12 trace elements. Results showed that measured levels of trace elements in the lake water increased in the following order: Cd < Co < Cu < Zn < Ni < V < Mn < As < Cr < Pb < Li < Se. These recorded values were lower than those recommended by the Moroccan standard and the World Health Organization, except for Pb and Se. Correlation analysis revealed two principal water-contamination sources: natural geological origins and anthropogenic inputs. In addition, the Water Quality Index WQI showed that the lake's water quality is poor, and its use can be dangerous for human and animal health. Health risk assessment associated with prolonged exposure to trace elements in lake water revealed that the Hazard quotient HQ and Hazard index HI of certain elements, such as V, As, Cr, Pb, Li, and Se, are higher than 1 in adult and children, indicating a significant risk for people living near the lake. Children are particularly vulnerable, with higher levels of HQ and HI, and selenium poses a substantial risk to their health through ingestion and skin absorption. In both adults and children, the total risk of cancer due to metals is classified as follows: CI (Cr) > CI (Ni) > CI (As) > CI (Pb) > CI (Cd). The Cr presents the highest carcinogenic risk—by ingestion or dermal route—in both groups. The total risk for these five metals exceeds 1×10^{-4}, indicating a danger for residents who drink or swim in the lake.

Keywords: *heavy metals; health risk indexes; Dayat Roumi Lake; road leaching*

CO327: Age, growth and exploitation of *Chamelea gallina* on the eastern Mediterranean coast of Morocco

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Abstract

The present study aimed to estimate the age and evaluate the biometric relationships of the sandy clam, *Chamelea gallina*, along with its condition index, growth dynamics, and exploitation level. This research is essential for understanding the population structure and ensuring sustainable management of this commercially important species. Growth parameters, including shell length, shell thickness, shell height, and total, flesh, and shell weights, were precisely measured to establish detailed biometric relationships. Samples were collected monthly from the Cap de l'Eau (Ras el Ma) coastline in Saïdia (Moroccan Mediterranean) between December 2023 and November 2024. During each sampling session, key environmental parameters such as seawater temperature, salinity, and dissolved oxygen concentration were recorded to assess their influence on the species' biological responses. The analysis revealed that dissolved oxygen and temperature are the most significant factors affecting the condition index, highlighting the species' sensitivity to environmental fluctuations. The growth of *C. gallina* was characterised as isometric, indicating proportional increases in shell dimensions and body mass. Age determination identified three distinct age classes, facilitating the estimation of asymptotic length, growth rate, and theoretical age at zero size. Mortality analysis showed that fishing mortality exceeds sustainable thresholds, suggesting overexploitation. The results underscore the need for stricter fisheries management policies to prevent population decline and promote the long-term sustainability of *C. gallina* in the region.

Keywords: *Chamelea gallina, age, growth, exploitation, environmental factors, Mediterranean of Morocco*

CO328: Communication, Autism: The Impact of PECS in the Context of AAC in Individuals with ASD

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Abstract

Autism Spectrum Disorders (ASD) are developmental conditions characterized by difficulties in communication and social interaction. Augmentative and Alternative Communication (AAC) provides supportive tools and strategies to assist individuals, particularly non-verbal children with (ASD), in expressing themselves. Among the most recognized (AAC) methods is the Picture Exchange Communication System (PECS), developed in 1985 by Bondy and Frost. (PECS) enables users to communicate using pictures, fostering the development of functional and spontaneous communication skills grounded in real-life needs and motivations. This work highlights the significant role of (AAC), with a focus on (PECS), in improving communication for individuals with autism. It examines the six phases of (PECS), each designed to gradually build communication abilities, from simple exchanges of single images to more complex sentence structures. The methodology includes a review of empirical studies, clinical observations, and user testimonials. Findings from the literature indicate that (PECS) effectively enhances functional communication in many non-verbal children with (ASD). It often helps reduce frustration-related behavioral issues and, in some cases, promotes the emergence of verbal language. However, individual outcomes vary considerably. While some children show rapid improvement, others may progress more slowly or develop a dependency on pictorial communication, which could limit verbal expression. Despite its limitations, (PECS) remains a valuable, structured tool that promotes autonomy, reduces behavioral issues linked to communication barriers, and encourages social interaction. For optimal results, (PECS) should be tailored to each individual's needs and combined with other therapeutic and educational approaches that support holistic communication development.

Keywords: *Inclusion of autistic individuals, Augmentative and Alternative Communication (AAC), Picture Exchange Communication System (PECS), Social interaction, Communication barriers.*

CO329: Commercial fish as a bioindicator of Microplastic pollution in Morocco

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Abstract

The widespread presence of Microplastics (MPs) in the environment is well-documented, but significant gaps remain in understanding their distribution and the full scope of their potential effects on both ecosystems and human health. To better assess the risks posed by MPs, especially through marine food chains and human consumption, it is critical to monitor their ingestion by fish in natural environments. This study examined the contamination of 12 fish species, the most commonly consumed in Morocco, collected from the Atlantic Ocean off the Moroccan coast. Analysis of 240 fish (20 per species) revealed that all samples contained Microplastics. Plastic was found in the gills, gonads, and gastrointestinal tracts of all 12 species. The average number of Microplastics per fish ranged from 20.6 to 133.2 MPs, with the predominant forms being fragments (60%), fibers (30%), films (8%), and pellets and foams (1%). Notably, omnivorous and demersal species showed the highest contamination levels. Using infrared spectroscopy (ATR-FTIR), the study identified seven types of polymers, with high-density polyethylene (34%), polyethylene terephthalate (30%), and polypropylene (17.5%) being the most commonly found. The Microplastics were primarily dark or light in color, with noticeable red and blue particles. Fish ingested Microplastics of various sizes, predominantly those smaller than 1 mm. Scanning electron microscopy combined with energy dispersive X-ray analysis (SEM/EDX) showed visible signs of weathering on most MPs, with the presence of inorganic components on their surfaces. The risk assessment of MPs to fish, using the polymer hazard index (PHI), categorized the risk level as level V, suggesting that MPs may pose considerable risks to human health. The highest estimated daily intake (EDI) of Microplastics was observed in children (1,620 MPs/year), while the lowest intake was found in women (350 MPs/year) and men (337 MPs/year). Given the widespread contamination of commonly consumed fish species in Morocco, immediate regulatory action is needed to ensure the safety of the fisheries sector, both for local consumption and export. Policymakers should consider creating guidelines for acceptable levels of Microplastic contamination in fish to protect public health.

Keywords: *Microplastics; Marine pollution; Fisheries; Atlantic Ocean; Hazard; Human health.*

CO330: Temporomandibular Joint and Machine Learning: Systematic Review

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Abstract

Scientific publications concerning the use of artificial intelligence (AI) in healthcare have increased in number in recent years. This study aims to systematically synthesize current research and the influence of artificial intelligence (AI) models on the diagnosis of temporomandibular joint osteoarthritis (TMJOA) using different types of imaging. Seven databases (PubMed, Web of science, Scopus, Science Direct, Springer, Re-search Gates, and Google Scholar) were searched for articles on TMJ and AI from 1991 to 2024. One hundred and thirty-seven (137) were identified, of which 24 were included, totaling over 5000 patients between control and with TMJ OA. Many studies focused on the diagnosis of TMJ OA using radiographic images only (about 7782 (OPG, 8838 CBCT, and 3693 MRI). The other studies examined the 3D condylar shape and disease classification observed on radiographic images with incorporation of bimolecular data, radiomic features, demographics as well as clinical data to investigate the most effective models and promising features for the diagnosis of TMJ osteoarthritis. Various artificial intelligence models were used, from machine learning (XGBoots, Light GBM, Random forest...) to Deep Learning (VGG16, R-CNN, SSD...), on which the meta-analysis was performed."

Keywords: *Temporomandibular Joint, Osteoarthritis, Artificial Intelligence, Systematic Review.*

CO331: Biocontrol Potential of Olive Mill Wastewater (OMWW) as a Sustainable Approach to Mitigate *Pseudomonas savastanoi* Adhesion

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Abstract

This study presents a novel approach to managing *Pseudomonas savastanoi*, the phytopathogen responsible for olive knot disease, which manifests through tumor formation on the bark and foliage of olive trees, ultimately compromising plant health and reducing olive oil yields. The research aimed to evaluate the biocontrol potential of a coating derived from olive mill wastewater (OMWW), focusing on its impact on the early-stage adhesion of *P. savastanoi* to various olive tree tissues, including bark and upper and lower leaf surfaces. To elucidate the interaction mechanisms, surface physicochemical properties were characterized through contact angle measurements between the bacterial strain and plant substrates, conducted both prior to and following OMWW application. Initial adhesion assays revealed significant differences between the surfaces tested, with the lower leaf surface exhibiting the highest affinity for bacterial colonization. Post-treatment analysis demonstrated that OMWW application substantially reduced bacterial attachment, with inhibition rates reaching up to 95 %. Moreover, OMWW treatment induced notable modifications in surface physicochemical parameters particularly in the electron donor properties thereby impairing bacterial adherence. These findings highlight the pivotal role of surface energy characteristics in microbial attachment dynamics and support the use of OMWW-based coatings as a promising, sustainable strategy for mitigating olive knot disease and safeguarding olive oil production.

Keywords: *Pseudomonas savastanoi, Olive mill wastewater (OMWW), Biocontrol, Bacterial adhesion, Sustainability.*

CO332 : Machine Learning Applications in Biofilm Research: A Bibliographic Review

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Abstract

Biofilms are complex clusters of microorganisms firmly attached to surfaces and enveloped within a self-generated extracellular matrix, making them difficult to manage and treat in various fields like food safety, public health, and clinical microbiology. These biofilms are often resistant to antimicrobial treatments and can persist in challenging environments, leading to serious problems in both healthcare and food industries. Traditional methods for studying biofilms, like microscopy and culture-based techniques, often fall short in providing a complete understanding of how biofilms form, grow, and resist treatments. Recently, machine learning (ML) has emerged as a powerful tool to improve biofilm research. ML techniques can help identify biofilms, classify microbial species, model biofilm growth, and predict how biofilms will respond to treatments. These techniques include supervised learning, unsupervised learning, and deep learning, which allow researchers to analyze large sets of data, such as high-resolution images, genomic data, and environmental conditions, to better understand biofilm behavior. Machine learning models are also being used to predict key issues, like antimicrobial resistance in biofilms, which is especially important for foodborne diseases and public health efforts. This review provides an overview of the current applications of ML in biofilm research, highlighting its potential in improving biofilm management in healthcare, food safety, and public health, while also discussing the future directions of this field.

Keywords: *Biofilms, Machine Learning, Public Health, Microbial Communities.*

CO333 : Contamination of irrigation water with microcystins: assessment of their bioaccumulation and related health risk, case study Lalla Takerkoust Lake, Marrakech, Morocco.

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Abstract

Water scarcity is the greatest global challenge for people living in arid regions, like Morocco. Freshwater resources are vulnerable to over exploitation because water is needed for people, livestock and crops irrigation in these regions. However, water quality in aquatic ecosystems is altered by eutrophication; this phenomenon leads to excessive blooms of toxic cyanobacteria. When these toxins are accumulated in crop plants it poses serious human health risk when they enter the food chain. Over the past few decades, toxic bloom-forming cyanobacteria have been occurring during summer-autumn seasons in Lalla Takerkoust lake-reservoir and have been dominated by microcystin producing cyanobacterium *Microcystis aeruginosa*. In the Lalla Takerkoust agricultural perimeter, we detected the bioaccumulation of MCs in edible fruits exposed to environmentally realistic concentrations of MCs. The health-risk level for humans was high when contaminated fruits were consumed during bloom formation and decay periods (up to a 53-fold increase compared to the TDI = 0.04 µg kg^{-1}). In the same way, the risk level was also high for farm animals (up to a 19-fold increase compared to the TDI = 2.3 µg L^{-1}). To deal with such a biohazard, we explored the role of rhizospheric microbiota as potential bioremediation biosystems in mitigating MC accumulation in crop products. Therefore, greenhouse trials were conducted with crops in microorganism-free and microorganism-rich soils. MCs impaired nitrogen assimilation in microorganism-free soil. Moreover, MC bioaccumulation and health risk were reduced in plants grown in microorganism-rich soil.

Keywords*: microcystins, irrigation water, bioaccumulation, crop products, health risk*

CO334 : Search for metabolomic signatures to determine the exposome of honey bees (*Apis mellifera*), a colony health indicator.

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Abstract
Bees play a fundamental role in the balance of ecosystems, contributing to biodiversity and serving as bioindicators of environmental quality. however, in recent years, a worrying decline in bee populations has been observed worldwide. This phenomenon is attributed to various stress factors likely to weaken colonies and increase their mortality, including pesticides and pathogens. The links between these factors and the deterioration in bee health have been established, but the underlying molecular effects remain poorly understood. To better characterise these effects, controlled exposures with pesticides and experiments in natural conditions have been carried out. The aim of these studies is to identify biomarkers of bee metabolome capable of specifically signaling the cause of mortality, thereby adding to the targeted analyses. To achieve this, an analytical approach based on high-resolution mass spectrometry (HRMS) is being developed. The first results of this method will be presented here. Univariate and multivariate statistical analyses revealed distinct metabolomic profiles in bees exposed topesticides. The results of this study highlight the potential of this approach, not only to monitor and protect bee populations, but also to take advantage of their role as sentinel species, providing valuable information on the health of the ecosystem.

Key words: *exposome, metabolomics, bioinformatics, biomarkers, HRMS.*

Oral Presentations
Theme 4

Session IV: Co-products and Circular Economy – Toward Responsible Management of Bioresources
(Desalination, wastewater treatment and reuse, bioremediation, biotransformation, bioenergy, …)

Sub-session T4-A: Energy Valorization, Bioenergies, and Effluent Treatment
(Co-products, by-products, waste, energy, and bioremediation)

CO41: Extraction and Characterization of Maltenes from a Bio-Oil Produced via Hydrothermal Liquefaction of Olive Mill Wastewater: Towards Bioenergy Valorization

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Abstract

The use of fossil fuels for energy production continues to cause significant environmental issues, such as greenhouse gas emissions, air pollution, and the depletion of natural resources. This underscores the need for alternative energy sources. Biomass, especially agricultural by-products, is a viable option for bio-oil production, offering a renewable substitute for fossil fuels. However, improper management of these by-products can lead to environmental concerns.

In this context, olive mill wastewater, a by-product of the olive industry, offers a unique valorization opportunity. Produced in large quantities in the Beni Mellal-Khenifra region, these wastewater residues are often poorly managed, resulting in soil and groundwater pollution. However, their conversion into bio-oil through hydrothermal liquefaction (HTL) helps mitigate their environmental impact and provides a renewable, low-carbon energy source. Thus, valorizing olive mill wastewater via HTL addresses both environmental and energy challenges. This study focuses on extracting and characterizing the maltene fraction of bio-oil produced from the HTL of olive mill wastewater. Maltenes, a hydrocarbon-rich chemical fraction, are extracted and evaluated for their energy potential. The goal is to compare their calorific value with the total bio-oil to assess their effectiveness as an alternative fuel. The study uses GC-MS, FTIR, and NMR analyses to explore the applicability of maltenes for bioenergy and to demonstrate their energy performance compared to total bio-oil

Keywords: *Olive mill wastewater, Hydrothermal liquefaction (HTL), Bio-oil, Extraction, Maltenes.*

CO42: Hydrothermal Carbonization of Wood Sawdust: Process Optimization and Material Characterization

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Abstract

Hydrothermal carbonization (HTC) is an effective thermochemical process for converting lignocellulosic biomass into hydrochar, a carbon-rich material with significant potential in energy and environmental applications. This study optimized the production of hydrochar from wood sawdust using response surface methodology (RSM) with the Box-Behnken design. The effects of temperature (180–240°C), residence time (30–90 min), and water-to-solid ratio (10–20) on hydrochar yield were systematically examined. The Box-Behnken method was used to identify the optimal conditions for maximizing hydrochar production. The hydrochar produced under these optimal conditions was characterized using Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX), and thermogravimetric analysis (TGA). The characterization results were compared to raw wood sawdust to assess the effects of HTC on biomass transformation. Significant improvements were observed in the carbon content, surface morphology, and thermal stability of the hydrochar, enhancing its energy potential and suitability for various applications. These findings contribute to the advancement of sustainable biomass valorization strategies and demonstrate that HTC is a promising approach for upgrading wood sawdust into high-value carbon materials for energy and environmental applications.

Keywords: *Biomass, Hydrothermal carbonization, Process optimization, Physico-chemical characterization.*

CO43: Preparation and modification of nanocellulose for wastewater treatment: A review

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Abstract:

Water contamination by dyes and heavy metals poses significant environmental and health risks worldwide, driving the need for effective remediation solutions. Various technologies processes have been developed to treat contaminated water and mitigate these risks. Implementing these solutions can help protect ecosystems and safeguard public health from the harmful effects of water pollution. It is crucial for governments, industries, and communities to work together to invest in and prioritize the implementation of these technologies to ensure clean and safe water for current and future generations. Nanocellulose has emerged as a particularly promising eco-friendly adsorbent due to its unique combination of properties: exceptional adsorption capacity, superior mechanical strength, hydrophilic surface chemistry, and complete biodegradability. Compared to conventional macroscale materials, nanocellulose demonstrates significantly enhanced binding affinity and removal efficiency for pollutants, attributable to its high specific surface area and abundant surface hydroxyl groups that enable facile functionalization. Recent research has confirmed nanocellulose's remarkable effectiveness in chemical contaminant remediation through various modification approaches. This review aims to provide an overview of the most recent advances (2020–2025) in the preparation (e.g., mechanical, chemical, and enzymatic methods) and functional modification (e.g., carboxylation, amination, and polymer grafting) of nanocellulose to enhance its adsorption capacity for toxic heavy metals (Pb^{2+}, Cd^{2+}, Hg^{2+}) and dyes (methylene blue, Congo red).

Keywords: *Nanocellulose , Modification , Adsorption , Dye, Heavy metal, wastewater treatment*

CO44: Comparative Study of Bacterial Consortiums for the Simultaneous Degradation of Synthetic Dyes and Hexavalent Chromium

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Abstract

The treatment of industrial effluents containing synthetic dyes and heavy metals presents a serious environmental challenge due to their toxicity, persistence, and potential adverse effects on ecosystems and human health. This study investigates the bioremediation potential of two bacterial consortiums, isolated from polluted environments, in degrading both organic (Allura Red, Ponceau, Carmoisine Red) and inorganic (hexavalent chromium, Cr (VI)) pollutants.
In separate contamination experiments, the first consortium exhibited outstanding efficiency, achieving complete decolorization of 50 mg/L of the three dyes and significant reduction of 50 mg/L of Cr (VI). However, in the presence of both pollutants simultaneously, its efficiency declined slightly, yet it still maintained high decolorization and reduction capacities. In contrast, the second consortium showed weaker decolorization of dyes and Cr (VI) reduction, particularly under combined contamination, suggesting a lower adaptability to complex pollutant interactions.
These findings highlight the promising potential of the first bacterial consortium for industrial wastewater treatment, particularly in environments contaminated with both organic dyes and toxic heavy metals. The study underscores the importance of microbial-based strategies as sustainable and eco-friendly alternatives to conventional chemical treatments, which may produce harmful secondary pollutants. Further research is necessary to optimize bacterial consortia performance under real industrial conditions and to explore their large-scale application in wastewater treatment systems.

Key words: *Decolorization, hexavalent chromium, dyes, bioremediation, effluent treatment*

CO45: Optimization of Dye Adsorption in Aqueous Solutions: A Kinetic and Thermodynamic Study of Mechanically Treated Biochar

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Abstract

The increasing demand for sustainable and efficient technologies to remove organic pollutants, particularly dyes, has led to extensive research on biochar as an adsorbent. In our study, biochar derived from sugarcane bagasse underwent chemical modification with hydrogen peroxide (H_2O_2) and an additional mechanical treatment to enhance its adsorption performance.
We investigated the adsorption of methylene blue (MB) under various key parameters, including pH, adsorbent dosage, contact time, initial dye concentration, and temperature. The study of adsorption mechanisms through isothermal and kinetic models revealed that the mechanically treated biochar exhibited significantly improved performance, achieving a maximum adsorption capacity of 390 mg/g and a removal efficiency of 99.93% at an MB concentration of 100 ppm. This enhancement was attributed to the modified surface properties and increased reactivity.
Furthermore, recyclability tests demonstrated that the material retained 87% of its initial adsorption capacity after five adsorption-desorption cycles, highlighting its potential for repeated use in wastewater treatment applications.
We would be honored to present our findings at your conference and contribute to discussions on optimizing adsorption processes through kinetic and thermodynamic analyses.
Looking forward to your positive response.

Keywords: *Adsorption, Biochar, Mechanical Treatment, Kinetics, Isotherms, Thermodynamics.*

CO46: Enhanced Biomethane Production from Olive Mill Wastewater through Co-Digestion with Cow Dung, Fruit, Vegetable, and Fish Wastes: An Experimental and Kinetic Study

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Abstract

Olive mill wastewater (OMW) is the main effluent resulting in huge amounts from olive oil manufacturing. This effluent is mostly composed of organic matter and polyphenolic compounds, known for their antimicrobial activity and compromise their biological treatment. In this work, we investigate the influence of the co-digestion of olive mill wastewater with fruits, vegetable (FVW), fish waste (FW) and cow dung (CD) at two inoculum to substrate ratios at mesophilic conditions on the biomethane yield, solids and polyphenols removal efficiency. Kinetic modelling was also applied to describe biomethane production. The co-digestion of OMW with CD at an I/S ratio of 2:1, and a mixture consisting of 33% OMW, 33% FVW, and 33% FW at I/S ratio of 3:1 achieved biomethane yields of 155.00 $NmLCH_4\ gVS^{-1}$ and 132.20 $NmLCH_4\ gVS^{-1}$, respectively after 49-day retention time at 37°C whereas the mono-digestion of OMW was completely inhibited. These treatments demonstrated strong performance in terms of volatile solids and polyphenol removal, achieving rates of 76%, 81%, and 95% and 84%, respectively. Similarly, the logistic function model provided a good fit for predicting biomethane production, with high R^2 values of 0.9941 and 0.9930, respectively.

Keywords: *Anaerobic co-digestion, Olive mill wastewater Fruits and vegetable waste, Fish waste. Cow dung*

CO47: Exploring the Potential of Treated Dairy Factory Wastewater Reuse (Whitewater) in Agriculture: A Comprehensive Analysis of Its Viability for Crop Irrigation in the Meknes Region

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Abstract

Morocco, like other Mediterranean countries, experiences substantial drought episodes, making it one of the most water-deprived areas globally. The escalating frequency and severity of droughts are exerting increasing pressure on the agricultural economy and represent a significant threat to national food security. The adoption of treated wastewater reuse for agricultural irrigation is among the water conservation strategies being implemented in these regions, specially the one comes from the dairy industry (whitewater). The present investigation, done in 2024 in the region of Meknes through a questionnaire, is undertaken with the objective of disseminating information on the reuse of treated wastewater originating from a dairy facility, and fostering a social approach to its utilization by farmers as a resource for crop irrigation. The data were gathered from a representative sample of 30 farmers residing within a 5-kilometer radius of dairy factory. This sample selection aimed to ensure a diverse and geographically proximate representation of agricultural practices within the vicinity of the facility. The analysis identifies the farmer and the farm, with a focus on the land situation and ownership status, production system, and irrigation method. 57% of Farmers in this region are grappling with a critical water scarcity situation, facing the harsh reality of wells reaching depths of up to 80 meters before encountering a resilient sandstone layer. In recent years, the water in the borewell contains suspended fine sand coming from the aquifer, exacerbating despair within the agricultural community. This issue, affecting 280 individuals from the local population, underscores the magnitude of the challenge they face in securing their livelihoods. The findings reveal that, under these critical circumstances, 82% of farmers surveyed are open to incorporating whitewater as an additional resource for crop irrigation, with 16% of respondents view whitewater as a viable sole source for irrigation, suggesting a growing recognition of its potential as a reliable and environmentally-friendly water supply for their farming operations. This alternative presents an opportunity to incentivize farmers to transition from their customary crops to forage crops. Such a shift could have multifaceted benefits, including improved soil health, increased water efficiency, and potentially higher yields. Wastewater reuse is a component of sustainable practices, yet its implementation requires a meticulous assessment of available technologies and their logistical, social, and environmental implications. Therefore, it is advisable to consider this approach as part of comprehensive field studies prior to recommendation.

Keywords: *Reuse, wastewater, whitewater, drought, water conservation.*

CO48: Isolation of a Chromium-Resistant Bacterial Strain from Oued Martil, Morocco, for Environmental Bioremediation.

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Abstract

The rapid increase in overpopulation and industrialization has led to the discharge of large volumes of wastewater contaminated with heavy metals. Hexavalent chromium (Cr^{6+}) is a significant pollutant due to its toxicity, persistence, and high bioavailability. This study aims to isolate Chromium-resistant bacteria for environmental bioremediation.
Among seven bacteria that tolerated 100 ppm of Cr^{6+}, one strain was selected for further analysis due to its higher resistance of up to 1000 ppm. The strain's biochemical properties, as well as its resistance to other heavy metals, were evaluated. Additionally, the strain's growth was assessed under various environmental conditions, including pH, temperature, NaCl concentration, and Cr^{6+} levels. Also its ability to reduce different concentration of Cr^{6+} was assessed using a photocolorimetric method with 1,5-diphenylcarbazide (DPC) at 540 nm. The isolated strain was gram positive, bacillus-shaped, and capable of forming endospores. It showed high tolerance to heavy metals, including 300 ppm Cu, 200 ppm Ni, and 200 ppm Hg. The strain exhibited strong growth across a broad pH range, from pH 5 to pH 10, highlighting its adaptability to pH fluctuations. It grew well at 37°C, with moderate growth at 25°C. However, its growth declined as the NaCl concentration increased from 3% to 7%. Furthermore, the strain's optical density decreased with higher Cr concentrations, indicating a gradual inhibition of growth due to the metal's toxicity. This strain was capable of reducing100% of 50ppm within 48h. These results suggest that the isolated bacterial strain is a promising candidate for Cr^{6+} bioremediation, offering a potential solution for environmental cleanup.

Keywords: *Bioremediation, hexavalent Chromium pollution, heavy metal resistant bacteria,1.5-diphenylcarbazide.*

CO49: Impact of Microcystins-contaminated water on Strawberry (*Fragaria vulgaris*) hydroponic culture: Phytotoxic effects, antioxidant defense, microcystins transfer and health risk assessment

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Abstract

Global warming and eutrophication may lead to increased incidence of harmful algal blooms and related production of cyanotoxins mainly Microcystins (MCs). MCs-contaminated waters used for crop irrigation were reported to adverse phytotoxic effects. The conducted study was based on hydroponic culture of Strawberry (Fragaria vulgaris L.) involving a direct exposure of plants to MCs and used to assess the phytotoxic effects, bioaccumulation, transfer, and human health risks of MCs. The exposure of F. vulgaris L. seedlings to MCs concentrations (5-20 µg/L) lasted 60 days and induced several adverse effects. Besides plant growth parameters decreases, and photosynthetic disturbances, the oxidative stress indicators (Catalase, Peroxidase, and Superoxide dismutase) showed significant elevation at 10 and 20 µg/L of MCs. The MCs bioaccumulation, transfer, and health risks were evaluated using strawberry plants and Meriones shawi animals (set as an example of food chain model). The bioaccumulation of MCs was found to be highest in the roots, followed by leaves, fruits, liver, stomach, and fecal matter. The transfer of MCs to animal organs was low, and the daily toxin intake of adult consumers of strawberry fruit receiving MCs (5- 20 µg/L) did not exceed the WHO recommended limit (0.04 µg MC-LR/Kg of bw/day). However, strawberry fruits (10 and 20 µg/L) and Meriones' consumption of plant-contaminated leaves may pose a moderate health risk. The results reflect the necessity of implementing legislation regulating the quality of irrigation water in terms of MCs concentrations with a view to prevent adverse effects to crops and human exposure, and to introducing management strategies for MCs-associated risks mitigation.

Keywords: *Microcystins, Phytotoxic effects, Bioaccumulation, Transfer, Health risks.*

CO410: Plants-beneficial microorganisms-nature bioremediation of mine tailings sites

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Abstract

Uncontrolled mine waste disposal globally poses severe environmental and health risks due to high concentrations of toxic substances like heavy metals and organic pollutants. In this study, we adopted a novel approach based on the use of low-cost amendments that can be used in small to tailing sites for better plant growth and reducing health risks. The abandoned tailings mine are low in fertility and only patchily discovered by vegetation which should hinder the material of aeolian erosion. Organo-mineral amendments based on marble waste (Mw), clay (Cy), and compost (Cp) were carried out to determine, in greenhouse conditions, their impact on plant growth of *Lupinus angustifolius* L., a legume plant found close to the mining site. Our findings demonstrated that incorporating these organo-mineral amendments into mine tailings led to a significant enhancement in plant growth, with limited metal translocation to shoot parts (Cu: 37.44, Zn: 28.40, and Pb: 19.36 mg kg^{-1}) than in the root's biomass (Cu: 565.60, Zn: 433.52, and Pb: 301.44 mg kg^{-1}). They also mitigate the mobility of heavy metals. Microbial biomass carbon increased up to 4-fold, whereas β -glucosidase, N-acetyl- ß -glucosaminidases, L-Arginase, and acid phosphatase (Pho) increased up to 1.9-fold, 47-fold, 12.85-fold, and 2-fold, respectively. Furthermore, soil carbon and nitrogen contents increased up to 11.15-fold and 9.41-fold, respectively. This study suggested a positive and impactful influence on the intricate processes of soil carbon and nitrogen cycling, indicative of increased microbial activity, and offered a nature-based solution to mitigate the environmental impact of extensive mining.

Keywords: *Acidic mine tailings, Clay, Marble waste, Compost, Heavy metal immobilization, Microbial activity.*

CO411: Biochemical profiling and seasonal trends of Alginates in *Cystoseira humilis* (Phaeophyceae): Implication for Potential Commercial Harvesting Strategy

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Abstract

Alginates are linear polysaccharides in brown seaweed cell walls, composed of α-L-guluronic acid (G) and β-D-mannuronic acid (M) linked by 1-4 glycosidic bonds [1]. Their hydrocolloid properties depend on the M/G ratio. Alginate gels are valued for their fast dissolution, low toxicity, affordability, and use in low-calorie foods [2]. In the present study, the seasonal variability of the content and physicochemical properties of alginates during the 2021 life cycle of the brown seaweed *Cystoseira humilis* from the Atlantic Moroccan coast was investigated through spectroscopic characterization (FTIR and 1H NMR). According to the obtained results, the alginate yield of *Cystoseira humilis* showed temporal fluctuations with a gradual increase during spring and summer periods to reach the highest value in June (29.03%). Thereafter, a marked decrease was observed in autumn, with a minimum of 12.71% in October. The highest M/G ratio (1.25) was recorded in early summer, during the full growth phase before thalli maturity, which corresponds to the period of maximum algal flexibility. Overall, the FG fraction ranged between 44% and 51%, with the peak values observed in mid-autumn and mid-winter, specifically in November and January (51%). This increase is likely associated with enhanced thalli stiffness during the senescence phase. During this period, the content of MM dyads (12%) and GG blocks (15%) remained relatively stable, while alternate fragments (MG; GM) reached a high proportion (73%). Notably, thallus length of *Cystoseira humilis* during this stage did not exceed 10 cm. Studying the alginate cycle in *Cystoseira humilis* determines the best harvesting season for industrial exploitation. Post-reproductive biomass retains high alginate content with favorable M/G ratios, balancing ecological preservation with economic valorisation.

Keywords: *Cystoseira humilis, seasonal variation, alginate, yield, spectroscopy analysis, Morocco.*

CO412: Biochar: An innovative solution for CO_2 capture and environmental remediation

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Abstract

Biochar, derived from the thermochemical transformation of biomass waste, emerges as a versatile material for environmental applications, including CO_2 capture and water remediation. This review explores the production processes, such as pyrolysis, gasification, and hydrothermal carbonization, emphasizing their impact on the physicochemical properties of biochar. Key characterization techniques, including pH analysis, scanning electron microscopy (SEM), and nuclear magnetic resonance (NMR), are highlighted to understand biochar's structural and functional attributes. The material's effectiveness in adsorbing inorganic pollutants and its role in mitigating heavy metal contamination are examined. Additionally, biochar's capacity for CO_2 sequestration through advanced activation methods positions it as a promising solution for reducing greenhouse gas emissions. The findings underscore biochar's potential as a cost-effective, sustainable alternative to conventional adsorbents, contributing to circular bioeconomy and environmental sustainability.

Keywords: *Biochar, Biomass, Characterization, CO_2, Pyrolysis, Gasification, Hydrothermal Carbonization.*

Oral Presentations
Theme 4

Session IV: Co-products and Circular Economy – Toward Responsible Management of Bioresources
(Desalination, wastewater treatment and reuse, bioremediation, biotransformation, bioenergy, …)

Sub-session T4-B: Material Valorization and Extraction of Bioactive Compounds from Co-products, By-products, Waste, and Bioactive Materials and Extracts

CO414: Discovery, Purification, and Functional Analysis of Two Novel Thiol Peroxidases (TP24p15 and TP37m5) Uncovered via Metagenomic Library Screening

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Abstract

Metagenomics enables the cloning and expression of heterologous bacterial genes without the need for culturing the source organisms. A functional metagenomics approach was employed to explore the enzymatic repertoire of camel fecal microbiota and to identify novel enzymes with potential applications in animal feed supplementation and lignocellulose degradation. Using a robotic screening platform, a fosmid library was analyzed to identify "hit" clones exhibiting target enzymatic activities. This study focused on peroxidase activity, particularly from the clones designated as 24p15 and 37m5. The application of functional metagenomics to dromedary microbiota offers a promising avenue to discover enzymes capable of breaking down recalcitrant lignocellulosic materials. Two tagged thiol peroxidases, TP24p15 and TP37m5, were expressed using the pET-21(a+) vector and purified in a single step via affinity chromatography. The purified TP24p15 exhibited a molecular mass of approximately 14 kDa, while TP37m5 displayed a molecular mass of 17 kDa. Both enzymes, classified as non-heme thiol peroxidases, were completely inhibited by DTNB and NEM. The optimal pH and temperature for TP24p15 were determined to be 10 and 70°C, respectively, while TP37m5 exhibited optima at pH 4.5 and 50°C. Notably, the thermostability of both enzymes was enhanced in the presence of copper ions, at concentrations of 2 mM and 5 mM for TP24p15 and TP37m5, respectively. These enzymes demonstrated activity across a broad spectrum of phenolic substrates, including 2,4-dichlorophenol (2,4-DCP) and 2,6-dimethoxyphenol (2,6-DMP). Given their remarkable properties, TP24p15 and TP37m5 show significant potential as additives for animal feed and as agents for lignocellulose degradation.

***Keywords**: Metagenomics, Thiol Peroxidase, Functional Screening, Animal Feed, Lignocellulose Degradation.*

CO415 : Evaluation of Total Phenolic and Flavonoid Content, and Antioxidant Activity of Clove Extracts

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Abstract

Cloves has long been known for its use in various fields (pharmaceutical, cosmetic, food processing).
This work aims to contribute to the quantitative study of total polyphenols and flavonoids contained in organic extracts of cloves (*Syzygium aromaticum*), in addition, to evaluate their antioxidant properties.
Natural phenolic and flavonoid compounds are plant secondary metabolites that hold an aromatic ring bearing at least one hydroxyl group, that can directly contribute to antioxidant action.
Our results show that the hydro ethanolic extracts contain an important polyphenol and flavonoids content, and also, it showed an important antioxidant potential using the antiradical activity against the DPPH- radical (2,2-diphenyl-1-picrylhydrazil), the ABTS free radical scavenging method, a ferric reducing power and its was found that our extract is a metal chelating agent.

Keywords : *cloves, antioxydant potential, polyphenolic content, flavonoids content.*

CO416: Production of a thermal *endo*-polygalacturonase from *Aspergillus niger* HO32: Purification, characterization, and application

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Abstract

A novel *endo*-polygalacturonase (PGC-AN64) from *Aspergillus niger* HO32 was produced using orange peel by-product as a substrate, then purified, characterized, and its utility in clarification of orange juice was elucidated. The enzyme was purified by ammonium sulfate fractionation (80 %) and gel filtration chromatography on Sephacryl® S-200 HR column. Its pH and temperature optima were 6.5 and 70 °C, respectively, and was stable over a pH range of 5–7 and temperature 60–80 °C. The 26-residue NH2-terminal sequence of PGC-AN64 showed high homology with those of *Aspergillus* pectinases. Metal ions (Na^+, Ca^{2+}, Mg^{2+}, Mn^{2+}, and Zn^{2+}) positively affect PGC-AN64 activity, while Ba^{2+}, Cd^{2+}, and Cr^{3+} negatively affect its original activity. Interestingly, PGC-AN64 exhibited a considerable substrate specificity and catalytic efficiency compared to the commercial enzymes PECLYVE V (P1) and PECLYVE CP (P2). More interestingly and compared to P1 and P2, PGC-AN64 showed that the clarification process had a significant effect on the transmittance percentages with 84.68 ± 2.08, 88.05 ± 1.79, and 93.13 ± 3.58 % for PGC-AN64, P1, and P2, respectively. Furthermore, color parameters increase in the L* and b* values after the clarification process, leading to a decrease in the a* value. The obtained results suggest that PGC-AN64 revealed its potential in orange juice clarification.

Keywords : *Orange peel by-product, Endo-polygalacturonase, Aspergillus niger, Clarification process.*

CO417: Biotechnological valorization of olive leaf extracts Through Lactic fermentation: enhaning Antimicrobial, Antioxidant and Bioremediation potential

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Abstract

Olive leaves represent an abundant agro-industrial by-product with significant biotechnological potential. This study investigates the valorization of olive leaf extracts from three varieties (Picholine Marocaine, Koroneiki, and Arbequina) through fermentation by Lactobacillus plantarum. Olive leaves were extracted using water, and hydroethanol (70%, v/v) to obtain bioactive compounds.

The fermentation process significantly enhanced the antibacterial activity against major pathogens, mainly *Liseria monocytogenes* ATCC® 19117™, *Micrococcus luteus* ATCC® 14110 ™. As well as antifungal potency against *Rhodotorula glutinis* ON209167.1(UMP22). An improvement in antioxidant activity was also observed using the total antioxidant capacity assay, compared to non-fermented extracts. These results open avenues for future research on the biotransformation of phenolic compounds and their potential role in heavy metal detoxification and bioremediation.

Overall, these findings highlight the potential of fermented olive leaf extracts as a sustainable source of natural antimicrobial, antioxidant, and detoxifying agents, contributing to both the valorization of agro-industrial by-products and environmental remediation efforts.

Keywords: *Olive leaves, fermentation, Antimicrobial, Antioxidant, Biotransformation, Bioremediation.*

CO418: Valorization of olive by-products in the Tangier-Tetouan-Al Hoceima, Fez and Rabat regions: case of olive and argan tree grignions.

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Abstract

The olive tree (Olea europea L.) is a specific tree of the Mediterranean basin, its cultivation in the North of Africa existed before the arrival of the Romans, among its most popular varieties nationally is the Moroccan picholine (zitoune beldi). On a national scale, the region of Tangier and Fez are classified among the qualified areas of high production.
The objectives of this study are to determine the hygienic and physico-chemical quality of olives from 33 samples of olive pomace taken from different regions (Tangier, Fès and Rabat) and other argan samples, Also aims to select strains with high fermentative power and recover olive waste, in particular pomace, and test the quality of these by-products to be able to use them as livestock feed (2 sheep and a capricorn).
The results show that the chemical composition of the pomace is interesting from a nutritional point of view and the microbiological analysis shows a significant load of microorganisms of technological interest (yeasts and lactic flora). The result of the valorization shows that the pomace can be transformed by fermentation to produce a probiotic biomass. On a pilot scale, weight gain was observed after 30 to 45 days, for sheep and capricorn, comparing with the control case.

Keywords : *pomace, microbiology, valorization, olive oil and argan tree.*

CO419: History of microalgae: from their origin to modern applications

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Abstract

Microalgae, which emerged more than 2.4 billion years ago, have played a key role in the evolution of Earth's atmosphere and are now an essential resource in various fields. Long overlooked and underutilized except for Spirulina, traditionally consumed by certain populations their scientific study began in 1890 with the isolation of Chlorella. Their industrial valorization accelerated in the 1970s, particularly for biomass production. Meanwhile, their application in wastewater treatment emerged as early as the 1950s-1960s, with significant advancements such as algal ponds and photobioreactors integrated into wastewater treatment plants. Today, microalgae are at the forefront of innovative strategies for bioremediation and the mitigation of emerging pollutants, illustrating their transition from little-known microscopic organisms to a valuable resource for environment, industry and Biomedical Applications, among others.

Keywords : *Microalgae, Wastewater treatment, Emerging pollutants, Algal ponds, Photobioreactors, Bioremediation.*

CO420: Sustainable valorization of shrimp by-products in the region of Laayoune-Sakia El Hamra: Potential for chitin and chitosan production

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Abstract

Shrimp fisheries in Laayoune-Sakia El Hamra region present an important source of food and income to the local communities. However, significant amounts of shrimp shell waste remain underutilized despite their potential for high-value biopolymer production. This study explores the sustainable exploitation and valorization of shrimp by-products through the extraction of chitin and chitosan. The research evaluated key fishing indicators such as effort, catch per unit effort (CPUE), and turnover to evaluate the economic viability of shrimp fisheries. Seasonal variations in CPUE influenced market dynamics, reflecting fluctuations in fishing activity and species availability. Turnover varied depending on catches and market prices. The port of Laayoune exhibits a diversity of shrimp species, including the deep-water rose shrimp, *Parapenaeus longirostris* (Lucas) and the narwhal shrimp, *Plesionika narval* (Fabricius). For valorization, chitin and chitosan were extracted from three shrimp shell waste samples: mixed industrial waste, *P. longirostris*, and *P. narval*. The extraction process involved demineralization, deproteinization, bleaching, and deacetylation, followed by physicochemical characterization. Results demonstrated species-dependent variations in chitin yield and composition, highlighting the potential for optimizing extraction protocols based on raw material characteristics. This study demonstrates the importance of integrating fisheries science and technology to enhance the circular economy in the seafood sector. The valorization of fishing by-products, such as chitin and chitosan, can contribute to diversifying income sources and promoting more sustainable fishing practices.

Keywords *Shrimp, exploitation, chitin, chitosan, circular economy, waste valorization.*

CO421: *Crocus sativus* (le safran) et ses sous-produits : éléments préventifs, thérapeutiques et génoprotecteurs.

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Resumé:

Les stigmates de Crocus sativus ou le safran est l'épice la plus chère qui existe sur terre. Traditionnellement, cette épice est utilisée pour plusieurs fins dans le domaine culinaire, le textile, la peinture, le domaine médical et pharmaceutique. Elle a de nombreuses activités, notamment l'activité antispasmodique, stimulante, anti-inflammatoire, antitumorale, antioxydante, antidiabétique. Ses propriétés ont été attribuées aux molécules qui sont biologiquement actives y compris la crocine, la picrocrocine et le safranal.
Notre travail a été réalisé dans le contexte général d'étudier la valorisation de la plante de Crocus sativus qui est actuellement cultivée uniquement pour ses stigmates issus de la fleur (3 stigmates par fleur). En effet, pour obtenir 1 kg de safran sec, 300 kg de tépales sont collectées ce qui correspond à environ 1,5 t de feuilles, 100 kg de spathes et des centaines de bulbes et de tuniques. Ces sous-produits sont actuellement inutilisés et ont été très peu étudiés.
Pour cela, on s'est intéressé à la valorisation des énormes biomasses perdues et notamment des sous-produits de la culture de Crocus sativus du Maroc oriental afin de contribuer à une meilleure connaissance des potentiels moléculaires de ces sous-produits (fleurs, feuilles, spathes, tuniques et bulbes).
Ainsi, le but de ces travaux de recherche est d'évaluer quelques propriétés biologiques (antioxydant, chélateur des métaux, antibactérien, l'alpha amylase et de l'alpha glucosidase) et pharmacologiques (l'effet hypoglycémiant, hypolipidémiant, antigénotoqique, antidiabétique , effet hépatoprotecteur et l'effet néphroprotécteur…).

Mots-clés : *Crocus sativus, la valorisation, sous-produits , propriétés biologiques.*

CO422 : Multi-residue methods for the analysis of priority organic micropollutants in aqueous environmental matrices

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Abstract

Priority organic micropollutants (drug residues) present in the environment and the potential risks associated with them have become a matter of current concern. The knowledge and techniques for the analysis of these substances in human biological matrices such as blood plasma, urine and serum are well documented and mastered. On the other hand, awareness of the presence of these micropollutants in the environment is relatively recent, and the experimental challenges involved mean that this area remains largely unexplored. The analysis of aqueous environmental samples is constantly evolving, with increasingly selective extraction techniques.
The liquid-solid extraction method: Solid phase separation (SPE) involves preconcentrating the diluted sample and minimizing the loss of the analytes of interest, using different types of cartridges such as Isolute, ENV+, Oasis HLB, Oasis MCX/ Oasis MAX, depending on the physicochemical properties of the analytes. The separation, detection and quantification of these analytes requires a more powerful system, such as high performance liquid chromatography-ultraviolet coupled with mass spectrometry (HPLC-UV/MS), liquid chromatography coupled with tandem mass spectrometry (HPLC-MS/MS), to increase the number of analytes, The multiplication of the original analytical strategies for drug residues makes it possible to increase the sensitivity and to separate the matrix components to be studied, thus improving the specificity and the quality of the analyses.
The management of an environmental matrix is chronologically divided into pre-treatment, extraction, purification and concentration stages, designed to allow detection and quantification. This review describes these strategies.

Keywords: *Priority organic micropollutants, drug residues; solid phase separation (SPE); cartridges; multi-residue methods.*

CO423: Towards eco-friendly alternatives to prevent $CaCO_3$ scale formation in brackish water demineralization processes

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Abstract

The reverse osmosis membranes of the demineralization plant in the Tan-Tan region are affected by scale formation, mainly due to the high hardness of the brackish water. In previous studies, scale deposits collected from the membranes were analyzed using various analytical techniques, revealing that they are primarily composed of calcium carbonate in the forms of calcite, aragonite and vaterity. Subsequent monitoring of the physical and chemical quality of the region brackish water showed high concentrations of calcium and magnesium, with total hardness 100 °F and total alkalinity 142 °F, confirming the water strong scaling potential. In the present study, we conducted a thermodynamic assessment of the scaling tendency using the Legrand-Poirier-Leroy method (LPL) method on representative sample. The ionic balance was below 5%, indicating precise chemical analysis. Moreover, the supersaturation index exceeded 1, confirming their tendency to from scale. The amount of calcium carbonate to be dissolved and carbon dioxide to be added to achieve calco-carbonic equilibrium exceeded 20 mg/L and 122 mg/L, respectively. These findings demonstrate that the LPL method effectively characterizes the scaling behavior of the Tan-Tan region brackish water and determines its position relative to calco-carbonic equilibrium.

Keywords: *reverse osmosis, membranes, demineralization, brackish water, scaling.*

CO424: *Chemical Characterization of Biodiesel Derived from Jatropha curcas for Use in Combustion Engines*

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Abstract

This work focuses on the study of using biodiesel derived from the Jatropha curcas plant as an alternative fuel for vehicle engines. With the continuous increase in global petroleum consumption, the search for alternatives to fossil fuels has become essential to address current economic, environmental, and security challenges. Biodiesel is emerging as a promising solution. In this study, the oil extracted from Jatropha curcas seeds was first subjected to physicochemical characterization, revealing initial properties that differed from those of conventional diesel. A transesterification reaction was then carried out to convert the oil into biodiesel. The resulting biodiesel showed physicochemical characteristics similar to those of diesel fuel, particularly in terms of viscosity and density, with significant improvements in certain properties.

In conclusion, the results of this study confirm the potential of Jatropha curcas biodiesel as a sustainable and efficient alternative to fossil fuels. Its use could not only reduce dependence on petroleum but also promote the valorization of non-edible plant resources, while minimizing the environmental impact associated with conventional fuel usage.

Keywords: *Jatropha curcas, Oil, Biodiesel, Energy, Transesterification, Engine, Environment.*

CO425: 3D-QSAR, ADMET and Molecular Docking Study of a Series of 2-Substituted 1H-Benzimidazole-4-Carboxamide Derivatives Inhibitors Against Enteroviruses

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Abstract

A series of bioactive benzimidazole derivatives were theoretically evaluated for their antiviral activity against enteroviruses, with a particular focus on coxsackievirus B and coxsackievirus A16. A structure-activity relationship (SAR) analysis enabled the development of a highly effective predictive model that can serve as a reference for the design and synthesis of new antiviral agents targeting these viruses. The model was constructed using multiple linear regression (MLR) and neural network (NN) methodologies, and its reliability was confirmed through cross-validation techniques. Among the evaluated compounds, compound 9 exhibited promising inhibitory activity against enterovirus A16, as supported by molecular docking studies and ADMET (absorption, distribution, metabolism, excretion, and toxicity) profiling. These findings highlight compound 9 as a potential lead candidate for further drug development

Keywords: *QSAR; MLR; neural network; cross-validation; ADMET; molecular docking; benzimidazole; enterovirus.*

CO426: Exploring alginate potential in benthic and newly encountered pelagic *Sargassum* species (Brown Seaweeds) on the Moroccan Atlantic Coast

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Abstract

The greater distribution of *Sargassum* biomass, especially around coastal and offshore areas, offers sustainable prospects for biopolymer extraction, particularly for alginate, which is a commonly used hydrocolloid in the food and pharmaceutical industries as well as environmental applications. This study case investigates the alginate extraction yield and its chemical characterisation using FTIR and ^{1}H NMR spectroscopy from two benthic *Sargassum* species (the introduced *Sargassum muticum* and the local *Sargassum vulgare*) along with two newly reported pelagic *Sargassum* species (sp1 and sp2) on the Moroccan Atlantic coast. The ^{1}H NMR spectra of the extracted alginates displayed characteristic signals for monads (M, G) and diads (MM, GG and MG/GM), consistent with M/G ratios of 1.19, 1.12, 1.08 and 1.27. The presence of dominant M-block diads (F_{MM} = 29%, 24%, 26%, and 28%) indicating a strong potential for elastic, flexible gel forming. These results assist in developing more optimized approaches to sourcing alginates from floating versus attached *Sargassum* resources in blue biorefinery frameworks.

Keywords: *Benthic Sargassum, Pelagic Sargassum, Alginate, FTIR, ^{1}H NMR.*

Poster Presentations
Theme 1

Session I: Innovative and Sustainable Primary Production Integrating Life Cycle Assessment (LCA):
(water resource preservation, biological control and biopesticides, plant biostimulants…)

CA11: Evaluating the Efficacy of Rhizobium Isolates as Biological Control Agents Against and *Clavibacter michiganensis subsp. Michiganensis* (Bacterial Canker) in *Solanum lycopersicum* (Tomato)

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Abstract

This study investigates the potential of rhizobium isolates derived from bean plant root nodules as biological control agents against *Clavibacter michiganensis subsp. michiganensis* (*Cmm*), a significant pathogen affecting tomato plants. A comprehensive evaluation was conducted involving the isolation and characterization of 14 distinct rhizobium isolates through a series of morphological, biochemical, and enzymatic analyses. Among these isolates, five were identified to exhibit *in vitro* substantial antagonistic activity against *Cmm*, with isolate RF8 demonstrating the highest inhibition rate of 19.9 in laboratory Petri dish assays. Further greenhouse experiments revealed that these rhizobium isolates effectively reduced both the incidence and severity of *Cmm* disease in tomato plants. Particularly noteworthy was the performance of isolate RF3, which achieved a remarkable reduction in disease incidence, reporting a rate of only 26.66% in comparison to a striking 90% in the positive control group. Additionally, isolates RF3, RF8, and RF11 were found to significantly lessen the severity of the disease, with severity indexes recorded at 1.6 and 1.7, respectively, compared to the control. The presence of various hydrolytic enzymes indicates that these rhizobium isolates employ a multifaceted approach to biocontrol mechanisms, thereby enhancing their potential for sustainable agricultural practices. Overall, this research underscores the promising role of rhizobium isolates in the management of plant diseases and contributes valuable insights toward the development of innovative, eco-friendly strategies for crop protection.

Keywords: *Antagonistic activity, biological control, Clavibacter michiganensis subsp. michiganensis, Rhizobium, Solanum lycopersicum.*

CA12: Assessment of Ultrasonic Processing Effects on the Stability and Therapeutic Potential of Bioactive Compounds in Mastic Gum (Pistacia lentiscus)

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Abstract

The physicochemical properties of Pistacia lentiscus, an aromatic and medicinal plant native to eastern Morocco, have historically facilitated the use of its resin across various sectors. The resin, also referred to as gum, is extracted by making incisions in the plant's stems and main axis, which allows a transparent, colorless liquid to exude from the porous tissues. This resin, due to its adhesive properties, has been utilized for wound healing. This study aims to investigate the effects of ultrasound on the extraction of bioactive compounds from Pistacia lentiscus resin, with a comprehensive analysis of its chemical composition. The study employs traditional techniques, such as hydrodistillation, alongside advanced methods including Headspace analysis, solid-phase microextraction (SPME), and ultrasound-assisted solid-phase microextraction (US-SPME). The findings demonstrate that ultrasound-assisted extraction significantly enhances both the concentration and selective extraction of bioactive components, particularly monoterpenes, thereby highlighting its potential for applications in pharmaceutical and industrial contexts.

Keywords: *Resin; Pistacia lentiscus; SPME; GC/MS; US-SPME; Headspace*

CA13: Le contexte des changements globaux et leur impact sur la distribution d'herbiers marins et de la faune associée dans la lagune de Nador

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Résumé

Le projet porte sur l'impact des changements globaux sur la distribution des herbiers marins et de la faune associée dans la lagune de Nador. Ses objectifs principaux sont la caractérisation des communautés d'herbiers marins, l'identification de la faune associée et l'évaluation environnementale des effets du réchauffement climatique, de l'acidification des océans et de l'eutrophisation sur ces habitats.
La méthodologie inclut quatre missions d'échantillonnage en 2024-2025, des analyses physico-chimiques in situ (température, pH, oxygène dissous, salinité, turbidité, chlorophylle a), des analyses génétiques des herbiers et des études sur les nutriments et les éléments traces métalliques (ETM). Les données collectées seront intégrées dans des bases SIG pour la cartographie des associations phanérogame/faune et l'évaluation de la résilience des herbiers face aux perturbations.
Les résultats attendus comprennent l'identification des principales espèces d'herbiers ("Zostera noltei", "Zostera marina", "Cymodocea nodosa") et du benthos associé, l'évaluation de la qualité des eaux superficielles, ainsi que la présentation des données sous forme de cartes SIG. Des essais de restauration seront menés dans les zones les plus affectées, et les indicateurs écologiques du projet IMAP-MPA seront renseignés pour renforcer les efforts de conservation et de gestion durable de cet habitat fragile.

Mots-clés : *Lagune de Nador, Herbiers marins, Faune benthique, Évaluation environnementale, Résilience écologique, Cartographie*

CA14: Valorization of Strawberry Tree Leaves from Tazekka Natural Park through nutritional and phytochemical assessments

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Abstract

Arbutus unedo L. leaves have a great potential to serve as an important source of bioactive compounds for applications in food and pharmaceutical industry. Therefore, the chemical composition, nutritional value and antioxidant properties of *A. unedo* L. leaves were investigated. Samples were obtained by maceration, decoction, and infusion using water, ethanol, methanol and hexane. Colorimetric methods were used to determine polyphenols and flavonoid in leaves extract. The antioxidant activity was assessed with DPPH and TAC assays. Total carbohydrates content and total proteins content were determined using the phenol sulfuric acid test and Lowry's method respectively. Yield results are significantly different and vary markedly depending on the solvent and extraction technique. Our results suggest that the yield increases with increasing solvent polarity. The best performance was observed using the maceration technique and ethanol as solvent (32%), followed by extraction with methanol (28.57%), hexane (20%) and water (17%). Extraction by decoction and infusion have also shown high yields with water as solvent (22.5%% and 20%). The best scavenging activity has been shown by the ethanolic extract (IC_{50} = 5.4 ± 0.09 µg/mL), which contained the highest amount of phenolics (23.35 ± 1.49 g GAE/100 g DW). Moreover, analysis of the carbohydrates and protein content revealed that these compounds were more concentrated in the ethanolic extract. These results indicate the importance of *A. unedo* leaves as a source of natural substances that could be used as dietary supplements or in pharmaceutical applications.

Keywords: *Arbutus unedo, antioxidant activity, nutritional value, phenolic compounds*

CA15: Dynamique Spatio-Temporelle des Communautés Demersales Capturées par Chalutage de Fond le Long de la Côte Méditerranéenne Marocaine en Relation avec les Conditions Environnementales

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Abstract

Comprendre les variations spatio-temporelles ainsi que les préférences d'habitat des communautés marines est essentiel pour interpréter le fonctionnement des écosystèmes et assurer une gestion efficace des ressources halieutiques. À partir des données issues des campagnes de chalutage scientifique menées par l'Institut National de Recherche Halieutique entre 2018 et 2021, une analyse quantitative a été réalisée afin de (1) caractériser les patrons spatiaux saisonniers des communautés demersales, incluant à la fois les espèces d'intérêt économique et celles non ciblées par les pêcheries, et (2) explorer les interactions entre ces communautés et les facteurs environnementaux pour mieux comprendre la dynamique de leur structuration. Plusieurs paramètres environnementaux ont été pris en compte, notamment la profondeur, la température de surface et du fond, la salinité, la concentration en chlorophylle-a, l'oxygène dissous, le pH et la nature du substrat. La profondeur s'est révélée être le principal facteur expliquant la variabilité observée, tant en termes de paramètres écologiques que de composition des espèces demersales. Les résultats confirment que les communautés demersales de la côte méditerranéenne marocaine sont fortement influencées par leur environnement, affichant une structuration déterminée par un gradient environnemental du large vers la côte et présentant une faible variabilité saisonnière. Ces résultats ont des implications majeures pour la gestion des pêcheries, en fournissant des informations clés sur les paramètres influençant la distribution des communautés demersales, notamment dans le cadre des pêcheries mixtes, à l'image de la pêcherie chalutière opérant en Méditerranée marocaine.

Mots-clés : *structure des communautés ; facteurs environnementaux ; gestion des pêcheries ; Méditerranée marocaine ; diversité spécifique.*

CA16: Biotransformation of *Crocus sativus* L. By-products: Evaluation of Enzymatic, Antioxidant, and Antimicrobial Activities after Microbial Fermentation

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Abstract

The valorization of agro-industrial by-products through microbial fermentation is a promising strategy for developing natural bioactive compounds. This study focuses on the enzymatic, antioxidant, and antimicrobial properties of Crocus sativus L. by-products (stigmas, tepals, and floral residues) following fermentation with selected microorganisms. Solid-state and submerged fermentation were carried out using specific bacterial and fungal strains known for their ability to enhance bioactivity.

Post-fermentation extracts were analyzed for enzymatic activity (amylase, cellulase, and pectinase), total phenolic and flavonoid contents, and antioxidant capacity using DPPH and FRAP assays. The antimicrobial activity was evaluated against common foodborne pathogens, including Escherichia coli, Staphylococcus aureus, and Candida albicans, through the disk diffusion method.

The results demonstrated a significant increase in enzyme production, particularly cellulase and pectinase, after fermentation. Antioxidant activity was markedly enhanced, correlating with increased levels of phenolic compounds. Furthermore, the fermented extracts exhibited moderate to strong antimicrobial effects, especially against Gram-positive bacteria.

These findings highlight the potential of microbial fermentation as a green technology to valorize saffron floral by-products into functional ingredients with possible applications in food preservation, pharmaceuticals, or cosmetics.

Keywords: *Crocus sativus, Fermentation, By-products, Enzymatic activity, Antioxidant activity, Antimicrobial properties*

CA17: Optimizing Cultivation Depth for Enhanced Biomass and Agar Production in *Gracilaria gracilis* from the Nador Lagoon

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Abstract

This study examines the cultivation potential of *Gracilaria gracilis* at three depths (0.2, 0.6, and 1.0 m) in the Nador Lagoon, Morocco, with a focus on optimizing growth performance, agar yield, and rheological properties. Environmental parameters (temperature, turbidity, salinity, pH, and dissolved oxygen) were continuously monitored, confirming favorable conditions for seaweed farming. The highest daily growth rate (DGR) was achieved at a depth of 0.2 m over a 30-day culture period. Additionally, maximum agar yield and melting temperature were recorded at 0.2 m, while the highest gel viscosity and gelling temperature were observed at 1.0 m. Statistical analysis confirmed that water depth significantly affects both DGR and agar yield ($p < 0.05$). The study also demonstrates that alkaline pretreatment improves the melting temperature and gel viscosity, although it reduces both agar yield and gelling temperature. These findings underscore the critical role of cultivation depth in balancing biomass production and agar quality, offering a depth-specific strategy that enhances economic viability for small-scale farmers and supports the development of sustainable, profitable seaweed farming practices in the Nador Lagoon.

Keywords: *Gracilaria gracilis; seaweed cultivation; water depth; agar; sustainable aquaculture; Nador lagoon.*

CA18: Assessment of groundwater contamination with heavy metals and risks to human health - Case of the Angads plain, Morocco

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Abstract

A good water quality is vital for human health and the protection of the environment. Water contamination, particularly by heavy metals, is a major threat due to their toxicity, persistence and capacity to accumulate in organisms. This pollution, which is constantly increasing worldwide, is exacerbated by demographic growth and economic activities. In this context, a study was carried out to assess the quality of the groundwater in the Angads plain.

The results revealed that concentrations of several heavy metals were above WHO limits. The Heavy Metal Pollution Index (HPI) and the Heavy Metal Evaluation Index (HEI) revealed that all samples were fit for consumption. Health risks revealed that HI values for dermal exposure were below the limit, while for oral exposure were above the limit. In addition, the carcinogenic risk (CR) results revealed that there is a possibility of developing cancer through lifelong exposure to this groundwater.

Keywords *Groundwater, Pollution, Heavy metals, Angad, Morocco*

CA19: Development of biopesticides against fungal diseases

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Abstract

Scab is a fungal disease affecting several fruit species, including apple trees, medlars and olive trees, causing significant agricultural losses. This study aimed to identify the mould responsible for scab; this identification is based on macroscopic and microscopic observation, as well as enzymatic tests (lipase, cellulase, urease and maltase). We are also exploring natural-based biopesticides. In our case, we are currently testing essential oils of cumin, ginger and clove and also the on-feed lactic bacteria from fermentation of glucose 1% and galactose 6%, are tested in vitro. Preliminary results show promising potential for some of these substances in inhibiting fungal growth, paving the way for environmentally friendly alternatives to chemical fungicides.

Keywords: *Scab, biopesticides, essential oils, inhibiting fungal.*

CA110: *Harnessing Rhizospheric Pseudomonas Isolates to Control Botrytis cinerea on Tomato*

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Abstract

Botrytis cinerea is a serious pathogen that can cause significant losses in a wide range of crop species worldwide. It affects various parts of the plant, including leaves, stems and flowers. Chemical synthetic fungicides are used to control this disease. However, these products endanger human and environmental health. The use of synthetic fungicides has been shown to stimulate the emergence of pathogen resistance. An organic alternative is recommended for a more sustainable solution to the problem. This study was done in order to elucidate the mode of action involved in the control of B.*cinerea* using fluorescent *Pseudomonas* isolates from tomato roots. The results show that all 76 isolates inhibit fungal growth during *in vitro* bioassay using dual culture technique. Five isolates of *Pseudomonas* (Q6B, Q13B, Q7B, Q14B and Q1B) cause significant inhibition levels ranging from 65 to 73%. These isolates inhibit fungal growth in both fruits and leaves. Each isolate tested produced antifungal metabolites (siderophores, hydrogen cyanide and enzymes). Results of this study show that all tested *Pseudomonas* isolates have a strong efficacy in biological control against *B. cinerea* and can be used for environmentally sustainable control.

Keywords: *Pseudomonas; B. cinerea; biological control; antifungal; tomato*

CA111: *Exploring Pseudomonas Siderophores: Production, Spectrophotometric Detection, and Botrytis Inhibition*

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Abstract

Botrytis cinerea is a serious pathogen that can cause significant losses in a wide range of crop species worldwide. It affects various parts of the plant, including leaves, stems and flowers. Chemical synthetic fungicides are used to control this disease. However, these products endanger human and environmental health. The use of synthetic fungicides has been shown to stimulate the emergence of pathogen resistance. An organic alternative is recommended for a more sustainable solution to the problem. This study was done in order to elucidate the mode of action involved in the control of B.*cinerea* using fluorescent *Pseudomonas* isolates from tomato roots. The results show that all 76 isolates inhibit fungal growth during *in vitro* bioassay using dual culture technique. Five isolates of *Pseudomonas* (Q6B, Q13B, Q7B, Q14B and Q1B) cause significant inhibition levels ranging from 65 to 73%. These isolates inhibit fungal growth in both fruits and leaves. Each isolate tested produced antifungal metabolites (siderophores, hydrogen cyanide and enzymes). Results of this study show that all tested *Pseudomonas* isolates have a strong efficacy in biological control against *B. cinerea* and can be used for environmentally sustainable control.

Keywords: *Pseudomonas, siderophores, hydroxamate, catecholate*

CA113: Evaluation of Safety and Antibiotic Resistance Profiles of Lactic Acid Bacteria for Biocontrol Applications

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Abstract

Thirty lactic acid bacteria (LAB) strains, previously isolated from different food matrices and soil samples, have demonstrated promising biocontrol activity against bacterial (*Erwinia amylovora., clavibacter michiganensis* subsp. *michiganensis*.) and fungal (*Botrytis cinerea*, *Fusarium* spp, etc.) plant pathogens, in addition to a great plant growth promoting traits. These strains were further characterized for safety through antibiotic resistance profiling and virulence factor assessment. Using disk diffusion assays (ISO 10932/EFSA standards), antibiotic susceptibility testing revealed that all strains were susceptible to chloramphenicol (C30) and ampicillin (AMP 10), while their resistance varied in relation to clindamycin (DA 2; 43% resistant), doxycycline (DO30; 7%), and tetracycline (TE 30; 7%), with universal intrinsic resistance to gentamicin (CN 10). Critically, all strains showed γ-haemolysis (non-haemolytic) and lacked DNase activity, confirming the absence of virulence markers. These results complement the strains' established plant growth-promoting and antagonistic activity against phytopathogens, reinforcing their potential as safe and effective biocontrol agents. The combination of demonstrated pathogen inhibition, favourable antibiotic susceptibility profiles, and the absence of haemolytic/DNase activity positions these LAB strains as promising candidates for sustainable plant disease management, pending field-scale validation of their efficacy and environmental compatibility.

Keywords: *Lactic acid bacteria, biocontrol agents, antibiotic resistance, plant pathogens, microbial safety, sustainable agriculture*

CA114: The influence of the BG11 culture medium on the growth rate of Scenedesmus and Chlorella under the same culture conditions for bioenergy, industrial, and environmental valorization

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ABSTRACT

Microalgae, particularly *Scenedesmus* and *Chlorella*, are of great interest in biotechnology due to their ability to produce biomolecules with various applications in the fields of bioenergy, nutrition, cosmetics, and environmental management. A study was conducted in the laboratory at Ibn Tofail University under controlled conditions to assess the growth of these two strains in a modified BG11 culture medium. *Scenedesmus* was cultivated as an isolated strain, while *Chlorella* came from a mixed sample.

The microalgae were cultivated in a culture chamber with a constant temperature and a light/dark cycle. Regular agitation ensured optimal homogenization of the medium. The results showed that *Scenedesmus* experienced rapid and continuous growth, achieving a higher cell density than *Chlorella*, which showed slower growth due to interspecific competition. This difference can be attributed to the fact that *Scenedesmus* fully exploited the resources of the medium without competition, while *Chlorella* faced competition for nutrients.

The isolation of strains, as well as the choice of conditions and culture medium, are crucial factors for optimizing biomass productivity. *Scenedesmus*, grown in monoculture, was able to efficiently use the nutrients in the medium, promoting its rapid development. In contrast, the coexistence of multiple species in *Chlorella* limited its growth potential. These results highlight the importance of strain selection and culture methods to achieve a high biomass yield. In this context, the use of monoclonal cultures, like that of *Scenedesmus*, appears to be a more effective approach, especially for industrial, environmental, and energy applications.

Keywords: *Scenedesmus, Chlorella, growth conditions, culture medium, BG11, growth rate.*

CA115: Artificial Intelligence and Water Resource Management: A Synthesis of Recent Work

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Abstract

Artificial Intelligence (AI) is revolutionizing natural resource management, particularly water, by improving the modeling and forecasting of groundwater levels. This study reviews different AI-based approaches for groundwater monitoring, drawing on three major contributions in the field. First, a physics-informed deep learning approach is examined to model groundwater flow and analyze the impact of climate change in Canada. Second, a comparison of AI methods applied to groundwater level forecasting in Burkina Faso highlights the relative performance of machine learning (ML) and deep learning (DL) models. Finally, a study conducted in France on piezometric level prediction evaluates the effectiveness of local, global, and hybrid approaches. These studies draw on data such as time series of water levels, precipitation, evapotranspiration, and soil characteristics. The comparative analysis shows that the 1D-CNN algorithm in Canada slightly outperforms the hybrid models, with a projected increase in groundwater levels of +5 to +7 cm, potentially reaching +70 cm by 2090. In Burkina Faso, XGBoost offers the best performance for groundwater forecasting. The study suggests integrating new variables and implementing a real-time monitoring system. In France, the hybrid approach does not provide significant improvements. Time series regression models remain effective but could be optimized through better parameter adjustment and the integration of expert knowledge. These results highlight the importance of model selection and knowledge integration to improve groundwater level forecasting.

Keywords: *Groundwater, Artificial Intelligence, Machine Learning, Deep Learning, Modeling, Hydrological Forecasting.*

CA116: Health risks associated with heavy metals in Sardina pilchardus from Betoya Bay, Morocco

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Abstract

Aquatic resources, primarily fish, are considered a major source of human exposure to heavy metals. Fish can often absorb heavy metals from food, water, and sediments as they are generally at the top of the aquatic food pyramid. Fish is widely consumed in many parts of the world due to its high content of protein, minerals, vitamins, and essential fatty acids, especially omega-3. In this context, this study examines the concentrations of heavy metals (As, Cd, Cr, Co, Cu, Fe, Hg, and Zn) in Sardina pilchardus from Betoya Bay, collected in winter and summer.

The results revealed a significant variation between tissues ($p < 0.05$), with the liver being the most contaminated. A seasonal increase in heavy metals was observed during the rainy season, especially for As, Cd, Hg and Zn. The Metal Pollution Index (MPI) showed no overall toxicity except in the liver, and the Estimated Daily Intake (EDI) values remain below the Provisional Tolerable Daily Intake (PTDI), indicating no health risk. However, Cd and Fe levels exceed these limits in children. The Hazard Quotient (HQ) and Total Hazard Quotient (THQ) indices associated with muscle consumption suggest a non-carcinogenic risk for adults. In addition, the carcinogenic risk indices (CR_{iAs} and CR_{Cr}) indicate a potential risk for both adults and children, highlighting the need for measures to reduce heavy metal contamination. In the short term, heavy metal concentrations in fish do not appear to pose an immediate risk to human health or ecosystems. However, there is evidence of long-term accumulation due to human activities, which could be of concern.

Keywords *Fish; Sardina pilchardus; Heavy metals; Mediterranean Sea; Morocco*

CA117: Effet du stress salin sur la germination et la croissance *in vitro* des variétés de *Cannabis sativa* L. : Beldia et Khardala

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Résumé

L'étude de la tolérance à la salinité de *Cannabis sativa* est cruciale pour améliorer la productivité, la durabilité de sa culture et pour la sélection variétale. Afin d'étudier cette tolérance, des embryons isolés de graines mûres ont été cultivés *in vitro* dans différentes concentrations de NaCl pendant 30 jours : 0 ; 42,8 ; 85,5 ; 171,1 ; 256,6 et 513,3 mM de NaCl. Les résultats ont montré que le taux de germination est passé de 100 % dans le témoin à 20 % pour la variété Khardala et 0 % pour la variété Beldia à la concentration de 513,3 mM de NaCl. La croissance des plantules *in vitro*, évaluée à travers la longueur des parties aériennes et racinaires, le nombre de feuilles produites ainsi que la biomasse fraîche et sèche de ces parties, a été impactée de manière significative en fonction des concentrations de NaCl, avec des variations notables entre les deux variétés étudiées. En conclue que le *Cannabis sativa* ne tolère pas le stress salin (513,3 mM de NaCl). Les taux de germination des deux variétés n'étaient pas significativement différents. La concentration élevée de NaCl a principalement affecté la partie racinaire des deux variétés. À une concentration de 85,5 mM de NaCl, a causé une réduction du système racinaire de 62 % pour la variété Beldia et de 88,7 % pour la variété Khardala. La variété Beldia s'est révélée plus résistante que la variété Khardala.

Mots-clés : *Cannabis sativa, Stress salin, Germination in vitro, Khardala, Beldia*

CA118: Calibration of an Artificial Nose Designed for Food Quality Control

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Abstract

This research focuses on the calibration of different MQ series gas sensors for the precise detection of various gases within an artificial nose system designed for food quality control. The MQ3 sensor was calibrated using ethanol, while the MQ2 sensor was calibrated with hydrogen sulfide. The MQ135 sensor was calibrated for carbon monoxide, the MQ4 sensor for methane, and the MQ137 sensor for ammonia. These gases are commonly found in spoiled food. Each calibration process involved systematically exposing the sensors to controlled concentrations of the respective gases to establish baseline responses, thereby enhancing their accuracy. The results demonstrate the effectiveness of each calibration in improving the sensors' sensitivity and reliability, making them suitable for practical applications in environmental monitoring and food safety.

Keywords: *Food quality control, Spoiled food, Artificial nose, Calibration, Sensitivity, Gas sensors*

Poster Presentations
Theme 2

Session II: Post-Harvest Processing: Combating Deterioration and Losses:
(1) Challenges of fermentations, (2) valorization pathways for alternative proteins, (3) antimicrobials, (4) packaging (active, bio-based, smart), (5) innovative approaches in cleaning and disinfection, (6) secondary metabolites of aromatic and medicinal plants, (7) innovative strategies for food biopreservation…

CA21: Nutritional Value, Phytochemical Study, and Biological Activities of Moroccan *Crocus sativus* L. Stigmas and Its By-Products

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Abstract

This study investigates the nutritional value, phytochemical composition, and biological activities of *Crocus sativus L.* (saffron) stigmas and by-products from the Taliouine region of Morocco. Stigmas, tepals, and leaves were manually separated, dried, and extracted using a hydroethanolic solvent (70/30, v/v), yielding extraction efficiencies ranging from 25.33% for leaves to 63.77% for tepals. Proximate analysis determined dry matter, organic matter, and moisture content, while HPLC-RID and GC-MS techniques characterized carbohydrate profiles, amino acids, and mineral composition. Phytochemical screening revealed significant levels of polyphenols and carotenoids, correlating with strong antioxidant activity as assessed by ABTS and FRAP assays. The extracts exhibited notable biological effects, including inhibition of acetylcholinesterase and butyrylcholinesterase enzymes, suggesting neuroprotective potential. Cytotoxicity assays against cancer cell lines (MCF-7, MDA-MB-231, HCT-116, etc.) demonstrated antitumor activity, whilegenotoxicity was evaluated using the comet assay. Statistical analysis (ANOVA) confirmed data reproducibility. In conclusion, this study highlights the nutritional and phytochemical richness of Moroccan saffron and its by-products, along with their diverse biological activities, supporting potential applications in nutraceutical and therapeutic development.

Keywords : *Crocus sativus L., phytochemical composition, antioxidant activity, neuroprotective effects, cytotoxicity, nutritional analysis.*

CA22: Phytochemistry and Pharmacological properties of *Portulaca oleracea* L

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Abstract

Portulaca oleracea L., commonly known as purslane, is an annual herbaceous plant belonging to the Portulacaceae family. It often grows spontaneously in cultivated or disturbed areas. **Objective:** This work presents a systematic review of the phytochemical compounds and pharmacological activities of *Portulaca oleracea L.* (PO), aiming to provide a comprehensive overview of existing research to support the future valorization of this plant resource. **Materials and Methods:** The study is based on the keywords "purslane" and "*Portulaca oleracea L.*" to gather relevant data on this plant from various scientific databases, including Google Scholar, Web of Science, PubMed, ScienceDirect, and Springer. **Results:** Recent phytochemical studies have shown that purslane is a rich source of flavonoids, organic acids, esters, alkaloids, cerebrosides, lignans, and polysaccharides. Purslane extracts or compounds exhibit a wide range of biological activities, including antimicrobial, antidiabetic, anti-inflammatory, antioxidant, anticancer, renoprotective, anti-Alzheimer, and hepatoprotective properties. **Conclusions:** Purslane is a medicinal plant with diverse pharmacological effects. Due to its numerous beneficial properties, it holds significant potential for applications in the agri-food and pharmaceutical industries.

Keywords : *Portulaca oleracea L, Purslane, Phytochemistry, Pharmacology.*

CA23: Microbial lipases: A promising tool for dermatological applications

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Abstract

Microbial lipases are highly versatile biocatalysts widely studied in industrial and biotechnological fields, yet their dermatological applications remain largely underexplored. This poster examines their emerging roles in dermatology, including contributions to skincare, wound healing, and acne treatment. This poster also highlights the complementary functions of other microbial enzymes such as keratinases and collagenases in managing skin disorders. Despite promising prospects, challenges remain, including enzyme stability, limited skin penetration. To overcome these hurdles, innovative approaches like genetic engineering and nanotechnology are discussed. Ultimately, this work emphasizes the largely untapped potential of microbial lipases in revolutionizing enzyme-based dermatological treatments and advancing next-generation cosmetic solutions.

Keywords: *Microbial lipases, dermatology, skincare, enzyme therapy, nanotechnology.*

CA24: Smart packaging based on bioactive molecules for sustainable food preservation

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Abstract

Smart packaging technologies have emerged as a promising solution to enhance food preservation and improve consumer experience. These innovations integrate advanced functionalities into packaging materials, such as sensors, indicators, and active components, to monitor and extend the shelf life of food products. Active packaging features, including oxygen scavengers, moisture regulators, and antimicrobial agents, help preserve food quality by controlling environmental factors like oxygen, humidity, and microbial activity. Additionally, intelligent sensors and freshness indicators provide real-time feedback on temperature, ripeness, and spoilage, allowing consumers to track the condition of the product. These technologies not only ensure food safety but also reduce food waste by offering clear information on optimal storage conditions. The development of biodegradable and eco-friendly smart packaging materials, such as bioplastics and edible coatings, supports sustainability efforts in the food industry. This study explores the key technologies behind smart packaging, their current applications, and future trends, with a focus on their potential impact on food waste reduction, consumer health, and environmental benefits.

Keywords: *Smart packaging, food preservation, sensors, sustainability, food waste, biodegradable materials.*

CA25: Flash chromatography-guided valorization of *Rosmarinus tournefortii* By-products for circular economy and bioactive applications

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Abstract

The sustainable utilization of agricultural by-products is a key strategy for promoting a circular economy and reducing environmental waste. This study explores the valorization of *R. tournefortii* de Noé solid by-products, focusing on the extraction, purification, and characterization of bioactive compounds using flash chromatography. Nine fractions were successfully isolated and analyzed through FTIR, UHPLC-MS/MS, and 2D NMR, leading to the identification of novel labdane diterpenoids, 24-nor-ursane triterpenoids, and ent-kaurane diterpenoids. HPLC-DAD profiling highlighted rosmadial and luteolin as major phenolic compounds. The bioactive potential of these fractions was confirmed through antioxidant, antimicrobial, and enzyme inhibition assays. The crude extract exhibited a strong antioxidant effect, with specific fractions showing significant activity. Purified fractions rich in luteolin and 3-hydroxyflavone demonstrated promising applications for pigmentation control. Furthermore, antimicrobial assessments revealed that 24-nor-ursane triterpenoids and a fraction containing ent-kaurane and carnosol exhibited strong inhibitory activity against *Rhodotorula glutinis*. Molecular docking studies reinforced the pharmaceutical relevance of these bioactives, with certain fractions acting as potent inhibitors of key enzymes involved in metabolic processes. Notably, some compounds demonstrated stronger enzyme inhibition than standard references. These findings underscore the potential of *R. tournefortii* by-products as a valuable resource for developing bioactive agents with applications in health, skincare, and food preservation. By integrating sustainable biotransformation strategies, this research contributes to circular economy initiatives, offering innovative solutions for waste reduction and the valorization of natural compounds in pharmaceutical, cosmetic, and nutraceutical industries.

Keywords: *Sustainable by-product valorization; Flash chromatography; Circular bioeconomy; Natural antioxidants; Antimicrobial agents; Molecular docking.*

CA26: Post-Harvest Quality Assessment and Loss Reduction in Exported Clementines: Case of Fina Berkane and Bruno Varieties in Morocco

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Abstract

Citrus fruits, mainly clementine, intended for export undergo packaging in specialized stations before being shipped to different countries, mainly European countries, Canada, Russia, and the United States, with a total quantity of 600,550 tons out of an average production of 2,213,576 tons.

The packaging process for citrus fruits, regardless of variety, follows a sequence of steps that require appropriate techniques and strict hygiene practices.

The objective of this study is to contribute to the evaluation and preservation of citrus fruit quality in packaging stations and during export by assessing two clementine varieties based on physicochemical quality criteria.

Samples of Fina Berkane and Bruno varieties were collected from two packaging stations in the Berkane region at different stages of the clementine packaging process, namely: upon reception, after degreening, after degreening rest, after first drying, after second drying, and as the final product. The physicochemical parameters analyzed included color (L*, a*, b* system), soluble dry matter (°Brix), pH, and vitamin C content.

According to the results, there is a significant change in color based on L*, a*, and b* system. This change is mainly due to the degreening process. In addition, a slight decrease in the fruit's soluble dry matter content, along with a slight increase in pH and vitamin C levels, was observed during the packaging process.

pH and soluble dry matter help maintain microbiological stability during the packaging and export process. These findings warrant further investigation, particularly through improving the preservation of clementines against spoilage using natural products.

Keywords: *Citrus, clementine, packaging station, vitamin C.*

CA27: Microbial Biofilms in Table Olive Fermentation: Role and Optimization

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Abstract

In natural environments, microorganisms rarely exist as free-floating single cells but instead adhere to solid surfaces in contact with liquids, forming structured poly microbial aggregates known as biofilms. During table olive fermentation, both lactic acid bacteria (LAB) and yeasts establish such biofilms on both olive skins and also on fermentation containers. These microbial communities play a crucial role in transforming raw olives into a fermented, probiotic-rich food. However, the particular role of biofilms in the process is still unclear. Several key questions are present about the dynamics of biofilm formation, how they affect the kinetics of fermentation, and the quality and nutritional characteristics of the final product. Filling in these knowledge gaps is necessary in order to promote microbial engineering technology in food biotechnology. This work aims to explain the functional contribution of LAB and yeast biofilms to fermentation dynamics, optimize the process through controlled biofilm management, and develop stable starter strains with high capability to produce stable biofilms for consistent fermentations. It further aims to develop specific biotechnological tools for monitoring and controlling fermentation. The expected results will enhance the efficiency and quality of table olive production and contribute to the enhancement of Morocco's agri-food sector's competitiveness. By providing a response to consumer demand for safe, health-promoting fermented foods, the research is also beneficial to sustainable food processing technologies.

Keywords: *Biofilm, lactic fermentation, table olive, Lactobacillus, probiotic yeasts, microbial engineering.*

CA28: Valorization of Moroccan Brown Seaweeds through Optimized Alginate Extraction, Structural Characterization, Development of Biofilms, and Evaluation of Antimicrobial Activities.

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Abstract

The valorization of brown seaweed has become increasingly important due to their abundance and ecological impact. Morocco, with its dual maritime coastline, hosts a rich and diverse algal biomass. In response to the massive proliferation of certain algal species and their harmful environmental effects, their exploitation represents a promising solution. The main objective of this study was to optimize the extraction of alginates using an alkaline method by investigating the influence of various operational parameters, such as temperature, extraction time, particle size, and sodium carbonate concentration. Under optimized conditions, significant yields were achieved up to 20.8% for sodium alginate and 36% for calcium alginate. Structural analyses using Fourier-transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD) confirmed the presence of characteristic mannuronate and guluronate units, indicating the quality of the extracted polymers. In parallel, post-extraction residues were evaluated for their antimicrobial activity. Minimum inhibitory concentration (MIC) tests revealed strain-dependent activity, with notable effects against certain bacteria and fungi. Subsequently, biofilms were prepared from the extracted polymers and tested for their antimicrobial activities, suggesting potential applications in biomedical and food packaging fields. These findings highlight the potential of Moroccan brown seaweeds as a sustainable source of functional biopolymers and bioactive compounds for various high-value applications.

Keywords: *Valorization; Sodium alginate; Calcium alginate; FTIR; XRD; Antimicrobial activity; MIC (Minimum Inhibitory Concentration), biofilms.*

CA29: Improving the fermentation of unsalted Moroccan Picholine Green Olives using heat-shock treatment.

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Abstract

Table olives, an essential category of fermented vegetables, exist in treated and natural forms. Treated green olives require an alkaline treatment before brining to initiate fermentation. This study explores the impact of heat shock treatment on the fermentation of unsalted Moroccan Picholine green olives. The results demonstrate that applying heat shock at 70°C significantly reduces enterobacteria and enhances acidification, lowering the pH from 5.0 to 3.6. In contrast, non-heat-treated olives exhibited only a slight pH decrease. The treatment also showed strong antimicrobial activity, effectively inhibiting *E. coli*, *P. aeruginosa*, *L. monocytogenes*, and *S. aureus*. Additionally, significant antifungal activity was observed against various strains. These findings highlight the potential of heat shock treatment as a promising method to improve the fermentation of green olives, enhancing both safety and quality. This approach could contribute to optimizing olive processing while reducing dependence on chemical preservatives.

Keywords : *Picholine, Geen Olives, Heat-shock, Fermentation, Table olives*

CA210: Antibiofilm effect of *Zataria multiflora* Boiss. essential oil against *Streptococcus pneumoniae* and *Pseudomonas aeruginosa*

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Abstract

The fact of antibiotic-resistance requires to find new compounds with antimicrobial activity. Essential oils (EOs) and their compounds offer an excellent possibility for decreasing the number of antibiotic-resistant strains. The major problem is the low water solubility of EOs. Therefore, their application in pharmaceutical products and different microbiological experiments is difficult. Microbial infections affect a large number of people worldwide. Some EOs are used traditionally for the treatment of these infections. Therefore, our research aimed to test the antibiofilm activity of *Zataria multiflora* EO (ZEO) against some bacterial pathogens and to improve its bioavailability by preparing Pickering emulsion (PE). The composition of the ZEO was analysed with GC-MS. The antibiofilm activity of ZEO was investigated by spectrophotometric assay. In the biofilm inhibitory experiment, the PE and conventional emulsion of ZEO stabilised with Tween80 surfactant were involved. Our results showed that the main compound of ZEO was thymol besides carvacrol and *p*-cymene. In the microbiological experiment, the PE of ZEO inhibited the biofilm formation both of *Streptococcus pneumoniae* and *Pseudomonas aeruginosa*. The effect of the PE of ZEO was higher than the activity of conventional emulsion of ZEO stabilised with Tween80 surfactant. We have demonstrated that the PE of ZEO could inhibit the biofilm formation of bacteria more effectively than the conventional emulsion.

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Keywords *Zataria multiflora* Boiss.; essential oil; antibiofilm activity; antibacterial effect

CA211: Sustainable Valorization of *Ulva sp*. from the Marchica Lagoon: Towards the Optimization of Bioactive Compound Extraction

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Abstract

Located in the northeast of Morocco, the Marchica Lagoon is a unique coastal ecosystem known for its rich biodiversity and ecological importance. It hosts a wide range of marine species, including various macroalgae with great potential for biotechnological and pharmaceutical applications. Marine macroalgae are a valuable source of bioactive compounds, offering a variety of natural molecules that can be used in health, cosmetic, and agricultural sectors.
In this context, the present study aims to evaluate the potential of the green alga *Ulva sp*. as a source of bioactive compounds through the optimization of extraction methods. Particular attention is given to the selection of pre-treatment procedures and extraction protocols in order to maximize protein content while preserving their integrity. Our results showed significant variation depending on the techniques used, with higher protein yields obtained from lyophilized algal extracts. This protocol will be adopted for subsequent steps involving the evaluation of the biological activities of these extracts, with the aim of valorizing this marine resource for pharmaceutical and biotechnological applications.

Keywords: *Marchica Lagoon, Marine macroalgae, Ulva sp., Bioactive molecules.*

CA212: Impact of Antibiotic and Pesticide Residues on the Sanitary Quality of Animal-Derived Foods

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Abstract

The extensive use of antibiotics and pesticides in animal husbandry raises serious concerns about the safety of animal-derived foods, such as meat, milk, and eggs. These residues, persisting due to improper use or inadequate withdrawal periods, represent major health hazards. Antibiotic residues drive antimicrobial resistance, a critical public health challenge, while pesticide residues, including persistent organic pollutants, may cause endocrine disruption and neurotoxicity effects.
This review synthesizes recent scientific findings to examine the sources, health, and environmental impacts of these residues, alongside regulatory measures like maximum residue limits (MRLs) set by the European Union and Codex Alimentarius. Challenges persist, particularly in developing nations, where regulatory enforcement is inconsistent and affordable detection methods are scarce. Proposed solutions include prudent antibiotic use, organic farming, and bioremediation techniques. Sustainable agricultural practices and robust global surveillance are essential to ensure the sanitary quality of animal-derived foods.

Keywords: *Antibiotic residues, pesticide residues, food safety, public health, animal-derived foods, antimicrobial resistance.*

CA213: Biotechnological Enhancement of Phenolic Compound Production in *Pelargonium graveolens* Hort.: Elicitor-Based Approaches, LC-MS/MS Metabolite Profiling, and Evaluation of Biological Activities

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Abstract

To support sustainable approaches in plant biotechnology, this study explores the use of chitosan (CHT) and salicylic acid (SA) as elicitors to stimulate the biosynthesis of phenolic and flavonoid compounds in Pelargonium graveolens callus cultures. Cultures grown on solid media were exposed to different concentrations of these elicitors, and metabolite changes were characterized using LC-MS/MS. The elicitor treatments markedly enhanced the accumulation of key secondary metabolites, particularly total phenolics and flavonoids. Among the detected compounds, kaempferol and rutin showed notable increases under specific treatments. This phytochemical enrichment was associated with improved biological activities, including enhanced antioxidant potential and significant inhibition of enzymes linked to skin aging. These results underscore the efficacy of elicitation strategies in optimizing the bioactive profile of plant cell cultures and support their application in the development of natural, plant-based cosmeceutical products.

Keywords: *Elicitation, Pelargonium graveolens, Phenolic compounds, LC-MS/MS profiling, anti-ageing activities, Plant biotechnology.*

CA214: Phytochemical Characterization and Evaluation of the Biological Properties of Sargassum spp. By-products: Biotechnological Potential of Crude Extracts and Fermented Products

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Abstract

Brown seaweeds of the genus Sargassum are recognized as a promising source of bioactive compounds with diverse biotechnological applications. This study focuses on the characterization of Sargassum spp. by-products by analyzing their phytochemical composition and biological activities, with a comparative assessment between crude extracts and fermented supernatants. In the initial phase, crude extracts were prepared and subjected to phytochemical analyses, including the determination of total polyphenols, flavonoids, total sugars, and reducing sugars. Their antioxidant, antimicrobial, and antifungal activities were subsequently evaluated. In a second phase, the solid by-product was fermented for six days using the lactic acid bacterium strain S61. Throughout the fermentation process, key physicochemical parameters such as pH, acidity, viscosity, and surface tension were monitored. The resulting supernatant was then analyzed to assess its biological properties. The comparison between crude extracts and fermented supernatants revealed a significant enhancement in biotechnological potential following fermentation, particularly with respect to antimicrobial and antioxidant activities.

Keywords*: Sargassum spp., lactic fermentation, phytochemistry, biological activities, biotechnology*

CA215 : Étude biochimique de *Alsidium corallinium*, une algue rouge de la lagune de Marchica

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Résumé

L'étude des composés biochimiques des algues marines constitue une étape essentielle dans la valorisation de leur potentiel biotechnologique, notamment dans les domaines nutritionnel, pharmaceutique et cosmétique. La présente étude a pour objectif de caractériser la composition biochimique de l'algue rouge *Alsidium corallinium*, collectée dans la **lagune de Marchica** à **Nador (Maroc)**. Les analyses effectuées sur l'extrait brut ont permis de quantifier plusieurs paramètres : la chlorophylle a, la chlorophylle b, les protéines totales, le glucose et la proline. Les résultats montrent une teneur notable en **chlorophylle a (16.78 ± 3.38 mg/g)** et en **chlorophylle b (5.85 ± 2.17 mg/g)**, traduisant une activité photosynthétique élevée. La teneur en **protéines** est de (**1.32 ± 0.53 mg/g)**, tandis que le **glucose** atteint (**0.063 ± 0.005 mg/g)**, indiquant une faible réserve glucidique. La **proline**, acide aminé impliqué dans la réponse au stress, est présente à une concentration de (**1.58 ± 0.44 µg/g)**, suggérant une capacité d'adaptation à des conditions environnementales variables.**Ces résultats préliminaires soulignent l'intérêt de** *Alsidium corallinium* **et incitent à approfondir son étude à travers d'autres analyses biochimiques et biologiques**, en vue d'une meilleure valorisation de cette espèce dans divers domaines industriels.

Mots-clés : *Composition biochimique,Chlorophylle a-b,Protéines,Glucose,Proline*

CA216: *Serenoa repens* Extracts: Evaluation of Antimicrobial Effects and Chemical Characterization

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Abstract

Serenoa Repens, commonly known as saw palmetto, is a hardy dwarf palm recognized for its medicinal berries, which are rich in fatty acids and phytosterols. The lipido-sterolic extract derived from its dried fruit is widely employed in phytotherapy, particularly for the prevention and management of symptoms associated with benign prostatic hyperplasia (BPH).
This study aims to identify the main components of saw palmetto berry extracts obtained through solvent extraction and evaluate their antimicrobial activity. Gas chromatography (GC/MS) and high-performance liquid chromatography (HPLC) analyses revealed the presence of key components, including free fatty acids (with oleic and lauric acids as the major fatty acids), and phenolic acids, with the composition varying according to the extraction solvent used. The antimicrobial activity was assessed against two Gram-positive, two Gram-negative, and four fungal strains. While the extracts demonstrated limited antibacterial activity (inhibition zones <11 mm), a notable exception was observed against *Micrococcus luteus*, which showed a measurable response; they exhibited notable antifungal effects, with inhibition zones ranging from 12 to 19 mm. These findings highlight the therapeutic potential of *Serenoa repens* extracts, particularly their promising antifungal properties.

Keywords: *Serenoa Repens, Identification, GC, HPLC, Antimicrobial activity, Antifungal activity*

CA217 : Optimisation d'une formulation antifongique à base d'eucalyptol, β-pinène et α-terpinène contre *Candida albicans* et *Candida glabrata* : étude par plan de mélanges

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Résumé

Cette étude s'est attachée à optimiser une formulation antifongique à base de molécules bioactives naturelles l'eucalyptol, le β-pinène et l'α-terpinène contre les souches *Candida albicans* et *Candida glabrata*, deux pathogènes opportunistes majeurs. Une méthodologie de plan de mélanges centré augmenté à trois constituants a été employée, permettant de tester douze formulations différentes et de modéliser l'effet des proportions de chaque composé sur l'activité antifongique, mesurée par la concentration minimale inhibitrice (CMI). Les résultats ont mis en évidence des effets antifongiques variables selon la composition du mélange. Pour *C. albicans*, les analyses statistiques ont révélé que l'eucalyptol seul (σ_1) et son interaction binaire avec le β-pinène (σ_{12}) influençaient significativement la CMI ($p < 0,05$), tandis que pour *C. glabrata*, les effets linéaires de chacun des trois composés (σ_1, σ_2, σ_3) ainsi que l'interaction ternaire (σ_{123}) se sont avérés statistiquement significatifs ($p < 0,05$). Les modèles obtenus ont présenté une bonne capacité prédictive, avec des coefficients de détermination (R^2) respectivement de 0,86 et 0,96 pour *C. albicans* et *C. glabrata*. L'optimisation par la fonction de désirabilité a permis d'identifier des formulations capables d'atteindre des CMI minimales de 0,123 % et 0,125 % contre *C. albicans* et *C. glabrata*, respectivement. Un effet synergique marqué entre les composés a été observé, confirmant que les mélanges optimisés présentaient une activité antifongique supérieure à celle des molécules prises isolément. La formulation conjointe optimale contre les deux souches simultanément a été déterminée à 22,26 % d'eucalyptol, 42,9 % de β-pinène et 34,82 % d'α-terpinène, permettant d'atteindre des CMI de 0,290 % et 0,301 %, respectivement. Ces résultats suggèrent que la combinaison stratégique de ces trois molécules naturelles constitue une approche prometteuse dans le développement de formulations antifongiques efficaces contre les espèces de *Candida*.

Mots-clés : *C.albicans ; C.glabrata ; Activité antifongique ; Eucalyptol ; β-pinène ; α-terpinène ; Plan de mélange.*

CA218: Phytochemical Profile, Genotoxicity and In Silico Toxicity Assessment, Antioxidant, and Neuroprotective Effects of *Clinopodium nepeta* Essential Oil: Inhibition of Acetylcholinesterase, Butyrylcholinesterase, and Monoamine Oxidase

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Abstract: The aim of this study was to evaluate the chemical composition, genotoxicity, in silico predicted toxicity, antioxidant activity and neuroprotective potential of essential oil (EO) extracted from the aromatic and medicinal plant *Clinopodium nepeta*, native to eastern Morocco. Chemical composition was assessed by gas chromatography-mass spectrometry (GC-MS), revealing the presence of 19 compounds, the main ones being neoisomenthol (29.66%), dihydrocarvone (11.07%) and pulegone (9.4%). Infrared spectra obtained by the attenuated total reflection technique (ATR-FTIR) showed remarkable similarities with typical oxygenated monoterpene profiles, confirming the predominance of these compounds among the main constituents of the EO. In silico genotoxicity and predicted toxicity assessments indicated the absence of genotoxicity for this essential oil, suggesting its safe use. The antioxidant activity of the essential oil was assessed using three different methods. The neuroprotective potential of this EO was evaluated through its ability to inhibit key enzymes involved in neurodegenerative processes. The essential oil demonstrated significant inhibitory activity against acetylcholinesterase with an IC_{50} of 31.88 ± 2.23 µg/mL, butyrylcholinesterase with an IC_{50} of 29.90 ± 2.99 µg/mL, and monoamine oxidase (MAO) with an IC_{50} of 12.92 ± 1.22 µg/mL. These results highlight the potential applications of *C. nepeta* essential oil in pharmaceutical development, particularly for neurological conditions.

Keywords: *Clinopodium nepeta; chemical composition; genotoxicity; antioxidant, acetylcholinesterase, butyrylcholinesterase, monoamine oxidase.*

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Poster Presentations
Theme 3

Session III: Quality, Safety, Nutrition, and Health: A Commitment to the Future
(pathogens, xenobiotics, antimicrobials, probiotics, nutraceuticals, …)

CA31: Antioxidant and antimicrobial effects of microalgae

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Abstract

Microalgae are photosynthetic microorganisms known for their rapid growth, adaptability to various environments, and high metabolic diversity. Over the past decades, they have emerged as promising candidates in the search for sustainable sources of natural compounds with biological activities, particularly in the fields of food, health, and pharmaceuticals. Among their most notable properties are antioxidant and antimicrobial activities, largely attributed to their rich content in bioactive molecules such as pigments (carotenoids, chlorophylls), phenolic compounds, polyunsaturated fatty acids, and sulfated polysaccharides.
These compounds can play essential roles in protecting human cells from oxidative stress and combating microbial infections, making microalgae a potential natural alternative to synthetic additives and conventional antimicrobials. Their multifunctionality also opens perspectives for applications in nutraceuticals, functional foods, cosmetics, and biomedicine.
This study aims to investigate the antioxidant and antimicrobial potential of selected microalgae species through both a comprehensive literature review and experimental approaches. Antioxidant activity will be evaluated using in vitro assays such as DPPH and ABTS radical scavenging methods, while antimicrobial properties will be tested against a range of Gram-positive and Gram-negative bacteria, as well as fungi, using agar well diffusion and minimum inhibitory concentration (MIC) techniques.
This ongoing work lays the groundwork for identifying novel microalgal strains with significant bioactive potential and supports their future integration into health-promoting products.

Keywords: *microalgae, antioxidant, antimicrobial, bioactive compounds, functional food, natural products.*

CA32: Optimization of Anticandidal, Antibacterial and Antioxidant Activities of Citrus Essential Oils Using a Simplex–Centroid Mixture Design

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Abstract

The rise of antibiotic-resistant pathogens has become a global health crisis, urging the development of alternative antimicrobial strategies. Essential oils (EOs), particularly those derived from citrus fruits, have shown promising biological activities.

This study aimed to enhance the anticandidal efficacy of essential oils from *Citrus sinensis*, *Citrus aurantium*, and *Citrus limon* by optimizing their combinations. It also aimed to maximize their antibacterial and antioxidant potential through synergistic mixtures.To optimize the biological activities of the essential oils (EOs), a simplex–centroid mixture design was employed to determine the most effective combinations. A special cubic model was applied to predict and interpret the responses in terms of anticandidal activity.

The chemical composition of each EO was analyzed using gas chromatography–mass spectrometry (GC-MS) to identify their major bioactive compounds. The anticandidal activity of the oils and their mixtures was evaluated against *Candida albicans* and *Candida glabrata* using minimum inhibitory concentration (MIC) assays. Additionally, the antibacterial activity was assessed using standard microbiological techniques. The antioxidant potential of each EO and optimized mixture was determined using three complementary assays. The optimized essential oil mixtures demonstrated potent anticandidal activity, with MIC values of 0.00122% (v/v) for *Candida albicans* and 0.0005% (v/v) for *Candida glabrata*. The mixture ratios achieving these results consisted of 33.2% *C. sinensis*, 33.6% *C. limon*, and 33.2% *C. aurantium*. This specific combination was necessary to simultaneously achieve MIC values of 0.001425% and 0.001825% against *C. albicans* and *C. glabrata*, respectively.

The study successfully demonstrates that optimized mixtures of essential oils can serve as effective natural anticandidal agents.This optimization strategy offers a promising avenue for combating antibiotic resistance.

Keywords *Citrus sinensis; Citrus limon; Citrus aurantium; essential oils; experimental mixture design; anticandidal activity; antibiotic resistance*

CA33: Évaluation des paramètres physico-chimiques et bactériologiques de la nappe phréatique des Béni Amir, région de Béni Mellal-Khénifra, Maroc: Perspectives pour une gestion durable de l'eau souterraine

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Résumé

L'eau est une ressource vitale, mais ses propriétés physiques et chimiques la rendent susceptible de pollution. Cette étude se concentre sur l'analyse des caractéristiques physico-chimiques et bactériologiques de la nappe phréatique des Béni Amir. Au total, quinze points d'eau ont été échantillonnés au cours des années 2022 et 2023. Les paramètres étudiés comprennent le pH, la conductivité, la turbidité, la dureté (TH), le TAC, la minéralisation, l'oxydabilité, la composition minérale, la présence de substances toxiques et la qualité bactériologique. Les résultats révèlent que 93,33 % des échantillons avaient un pH supérieur à la valeur minimale recommandée de 6,5 par l'OMS, à l'exception de l'échantillon P6 (pH = 6,1). De manière générale, la qualité physico-chimique des eaux est considérée comme satisfaisante. Toutefois, environ 80 % des échantillons ont montré la présence de micro-organismes, principalement E. coli, ce qui suggère une pollution légère selon les normes de l'OMS (2004). Ces observations mettent en évidence la nécessité de poursuivre l'analyse microbiologique des eaux souterraines des Béni Amir pour évaluer plus finement la qualité de la nappe phréatique de cette region.

***Mots-clés**: Eau souterraine, propriétés physico-chimiques, qualité bactériologique, Béni Amir, nappe phréatique.*

CA34: Sustainable Bioproduction of Industrially Relevant Enzymes and Biosurfactants from Food Waste

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Abstract

Food waste represents a major global challenge, with millions of tons discarded annually, contributing to environmental pollution, resource depletion, and greenhouse gas emissions. Simultaneously, industries rely on synthetic surfactants and enzymes, which pose environmental concerns due to their low biodegradability, toxicity, and dependence on petrochemical resources. Thus, developing sustainable bioprocesses to convert food waste into high-value biomolecules could provide an innovative and eco-friendly alternative to conventional industrial compounds. This study aimed to identify microbial strains capable of co-producing industrially relevant enzymes, specifically amylase, cellulase, and protease, along with biosurfactants. To achieve this, we investigated cost-effective culture media derived from both solid and liquid food waste. Through this approach, we successfully isolated approximately a dozen bacterial strains from various effluents rich in organic and inorganic pollutants. These isolates were then screened for their potential to produce the targeted biomolecules. The results revealed notable variability in enzymatic and biosurfactant production depending on the culture medium used. Among the 14 isolates tested, Bacillus sp. CWL demonstrated the highest production levels in a specific substrate-based medium, underscoring its potential for industrial applications. This work highlights the economic feasibility and sustainability of biotechnological approaches using low-cost and renewable substrates. By converting underutilized organic waste into valuable biomolecules, this study not only fosters the development of cost-efficient and eco-friendly bioproducts but also contributes to reducing environmental impact, aligning with the principles of the circular economy.

CA35 : Acceptability of Three Mediterranean-Inspired Snacks with Health Benefits

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Abstract

The Mediterranean Diet, renowned for its health benefits, is a traditional dietary pattern rich in fruits, vegetables, whole grains, olive oil, and lean proteins, widely recognized for promoting longevity and reducing the risk of chronic diseases.

In our study, and to analyze the preferability and the acceptability of a snacks made from Mediterranean foods, two focus groups were conducted, by teens and young adults respectively, to analyze the sensorial acceptability of tomato chips with bread and oregano, almou and date bars. For this purpose, the focus groups took place in public coffee, for 2 hours. The first focus group was composed by 8 teens from 14 to 18 years old, from different social categories, 3 females and 5 males. The second focus group, composed by 8 young adults from 18 to 22 years old, from different social categories, 5 females and 3 males.

After tasting, the results show that for the first focus group, the majority like extremely the tomato chips with bread and oregano, whereas they like very much Amlou and date bars.

For the second focus group, they like moderately tomato chips with bread and oregano and date bars while they like extremely Amlou.

Amlou was the most preferable by the focus groups, maybe is due to it is already known by Moroccans.

Keywords: *Mediterranean Diet, Focus group, tomato chips, almou, date bars*

CA36: Novel clean label approach: Assessment of antimicrobial potential of combined use of aromatic and medicinal plants and bacteriocin against *Salmonella enterica*, *Bacillus cereus* and *Staphylococcus aureus* in model sausages

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Abstract

The growing demand for clean-label products has intensified research into natural antimicrobial agents for food preservation. Essential oils (EOs) and crude extracts (CEs) from aromatic and medicinal plants (AMPs), along with bacteriocins, offer promising alternatives to synthetic preservatives. This study evaluated the efficacy of EO or CE from nine AMPs and their association with bacteriocin OS1 against *Salmonella enterica*, *Bacillus cereus,* and *Staphylococcus aureus* in a refrigerated sausage model. Sausage batches were treated with EOs of rosemary, thyme, clove, nutmeg, laurel, garlic, blue gum, and CEs of saffron and safflower, and/or bacteriocin, and stored for 15 days at 8°C. The data were analyzed using Spearman correlation analysis, variance analysis, and the Mann-Whitney test. Based on statistical analysis, bacteriocin OS1 alone (at 200 AU/g) minimally affected *S. enterica* counts, with 0.03-0.23 Log CFU/g reduction, and moderately reduced *B. cereus* (0.31-0.54 Log CFU/g) over the storage period. Notably, *S. aureus* displayed no susceptibility to OS1. The three populations demonstrated significant and variable sensitivity to the tested AMPs. Rosemary-EO showed the highest reduction in *S. enterica* and *B. cereus,* while *S. aureus* was most susceptible to garlic-EO. The combination of rosemary-EO and OS1, as well as laurel-EO and OS1, showed a synergistic effect, significantly reducing *B. cereus* and *S. enterica.* Furthermore, *S. aureus* exhibited greater resistance to AMPs, whether alone or combined with bacteriocin. These findings highlight species-dependent interactions between certain AMP extracts and bacteriocins validated within a sausage matrix, providing a natural food preservation approach aligned with consumer demand for clean-label products.

Keywords: *Natural preservation, Crude extract, Essential oil, Hurdle technology, Lactic acid bacteria, Meat preservation.*

CA37: Valorization of *Crocus sativus* stamens by-products: antibacterial potential of glycosylated and aglycone flavonoids against MDR pathogens

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Abstract

The rise of multidrug-resistant bacteria poses a significant global health challenge, necessitating the exploration of alternative antimicrobial strategies beyond conventional antibiotics. In this context, natural bioactive compounds derived from plants have gained increasing attention due to their potential antibacterial properties. This study explores the phytochemical composition and antibacterial potential of glycosylated and aglycone flavonoids from hydrolyzed and non-hydrolyzed fractions of *Crocus sativus* stamens, often discarded as by-products. Fractions were analyzed using UHPLC-MS/MS, revealing diverse phenolic and flavonoid profiles, with the hydrolyzed ethyl acetate fraction (AEH) exhibiting the highest concentrations of aglycones, such as quercetin and epicatechin. Antibacterial efficacy was assessed against Gram-positive and Gram-negative strains using agar diffusion and MIC determination. AEH demonstrated significant activity against Staphylococcus aureus (18,75 mm inhibition zone) and methicillin-resistant S. aureus (MIC: 6,25 mg/ml), surpassing other fractions and comparable to standard antibiotics. The results suggest *Crocus sativus* stamens as a sustainable source of bioactive compounds with potential applications in combating MDR infections. These findings emphasize the role of hydrolysis in enhancing bioactivity and support the valorization of saffron by- products for pharmaceutical use.

Keywords: *Crocus sativus stamens; UHPLC-MS/MS; Glycosylated flavonoids; Aglycone flavonoids; Antibacterial activity; Multidrug-resistant bacteria.*

CA38: Impact of Storage on the Phytochemical Composition and Bioactivity of Saffron Corms

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Abstract

Saffron (*Crocus sativus* L.) corms, often discarded due to their small size, represent a valuable by-product with potential health benefits. This study aims to enhance the value of saffron corms by comparing stored corms (HEES) and fresh corms (HEEF) in terms of chemical composition, antioxidant, genotoxic, and cytotoxic effects. Both corm types were macerated in 50% ethanol, and levels of polyphenols, flavonoids, carotenoids, lycopene, anthocyanins, saponins, and sugars were quantified. Their antioxidant capacity was assessed through DPPH, FRAP, and β-carotene assays, while genotoxicity was evaluated via comet assays, and cytotoxicity was tested on CCD18 normal colon cells using MTT and crystal violet assays. Results showed that stored corms contained higher levels of phenolic compounds (0.781 ± 0,42 µg GAE/mg extract), flavonoids (1.13 ± 0,64 µg QE/mg extract), and carotenoids (27.99 µg β-carotene/g dry matter), compared to fresh corms. HEES also exhibited stronger antioxidant activity with an IC50 of 169.57 µg/mL in the DPPH assay, while HEEF showed an IC50 of 434.37 µg/mL. Both extracts displayed genotoxicity at 50 µg/mL and cytotoxicity on normal colon cells (CCD18) at approximately 300 µg/mL. Stored saffron corms are a rich source of bioactive molecules and exhibit greater antioxidant activity compared to fresh corms. However, both extracts demonstrate genotoxic and cytotoxic effects at higher doses, emphasizing the need for careful evaluation of their potential therapeutic applications. These findings suggest that saffron corms, particularly those that are stored, could be valuable in health-related fields but warrant further investigation.

Keywords: *Crocus sativus L.; corms; Bioactive molecules; Antioxidant activity; Genotoxicity; Cytotoxicity*

CA39: The Dual Therapeutic Potential of *Lactobacillus plantarum* Supernatant: Antifungal and Anticancer Perspectives

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Abstract

Natural bioactive compounds with both antimicrobial and anticancer activities are gaining increasing attention for their potential applications in health-promoting strategies. *Lactobacillus plantarum* supernatant, rich in postbiotic metabolites, has demonstrated promising anticancer effects alongside notable antifungal properties. This bibliographic review summarizes current scientific evidence on the anticancer potential of *L. plantarum* supernatant, highlighting its ability to modulate cancer-related pathways while considering the contribution of its antifungal activity to overall bioactivity. In vitro studies have reported that cell-free supernatants from *L. plantarum* strains induce apoptosis and cell cycle arrest in colorectal, breast, and liver cancer cells by regulating key apoptotic markers such as Bax, Bcl-2, and caspase-3. Concurrently, antifungal compounds produced by *L. plantarum*, including organic acids and bacteriocins, have been associated with reduced pathogen-induced inflammation, which may indirectly support anticancer effects by alleviating microbe-driven tumor-promoting environments. Additionally, anti-inflammatory actions and bioactive molecules such as short-chain fatty acids and exopolysaccharides contribute to inhibiting tumor cell proliferation. Collectively, these findings suggest that *L. plantarum* supernatant, through its combined antifungal and anticancer mechanisms, holds promise as a natural agent for cancer prevention or adjunctive therapy. Further clinical research is needed to confirm these effects and explore functional food or nutraceutical applications.

Keywords: *Lactobacillus plantarum; Supernatant; Anticancer activity; Antifungal properties*

CA310: Impact of Surface Properties on *Pseudomonas savastanoi* Adhesion: A Comparative Study of the Moroccan Picholine and Spanish Arbequina Olive Cultivars

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Abstract

The adhesion of *Pseudomonas savastanoi* to plant surfaces is a critical step in the development of olive knot disease. This study compares the adhesion behavior of this phytopathogenic bacterium on two olive cultivars with contrasting agroecological profiles: Picholine marocaine, a Moroccan endemic cultivar known for its resistance, and Arbequina, a widely cultivated Spanish variety in the Mediterranean basin. The physicochemical properties of bark and leaves (upper and lower surfaces) were characterized using contact angle measurements. In parallel, bacterial adhesion assays were conducted to evaluate the degree of initial colonization on each surface. The results reveal significant differences: Picholine exhibits less hydrophobic surfaces and surface interaction energies less favorable to adhesion, thereby limiting bacterial attachment. In contrast, Arbequina displays physicochemical traits that promote stronger adhesion, particularly on the lower leaf surface and bark. These findings highlight the influence of varietal differences on susceptibility to *P. savastanoi*. Integrating these parameters into varietal selection and integrated disease management strategies could improve prevention of this bacterial disease in olive cultivation.

Keywords : *Pseudomonas savastanoi, Bacterial adhesion, Physicochemical properties, Olive cultivars, Picholine marocaine, Arbequina.*

CA311: Biochemical composition, antioxidant and antimicrobial activities of carob pulp (*Ceratonia siliqua L.)* from Khenifra province (Morocco).

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Abstract

The carob tree (Ceratonia siliqua L.), leguminous and agro-silvo-pastoral tree, has significant socioeconomic, environmental, industrial, pharmacological, and nutritional value. Its pulp is prized for its high concentration of minerals and bioactive substances, as well as its antibacterial and antioxidant properties. This study examines how the biochemical composition and antioxidant and antimicrobial qualities of Ceratonia siliqua L. pulp from various geographic areas in the Middle Atlas region of Morocco are affected by soil from the carob tree basal geographic zones at varying depths (A = 0 cm to 10 cm, B = 10 cm to 30 cm, and C = superior at 30 cm) (edaphic conditions). The greatest concentrations of bioactive components (total polyphenols and flavonoids) were found in the carob pulp extract from Sidi Hsine. These high numbers were linked to soils that were rich in heavy metals were linked to these increased readings. Conversely, the largest concentration of water-soluble tannins was found in the Lehri carob pulp extract, which was correlated with greater iron and lower calcium levels in the soil. Principal Component Analysis also showed relationships between the biochemical makeup of carob pulp, including its antioxidant and antibacterial properties as well as its concentration of bioactive chemicals, and soil properties. Based on each region's distinct biochemical profile, antioxidant, and antibacterial qualities, this study offers insightful information to direct the targeted valorization of Ceratonia siliqua L. pulp.

Keywords *Carob pulp, Khenifra province, Morocco, Biochemical composition, antioxidant activity, atimicrobial activity.*

CA312: The Role of Artificial Intelligence and the Dietary Microbiota in Colorectal Cancer Pathogenesis

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Abstract

Introduction : Colorectal cancer (CRC) is influenced by multiple factors, including the gut microbiota, which is largely modulated by diet. Dysbiosis linked to an unbalanced diet can promote the emergence of pro-carcinogenic bacteria like *Fusobacterium nucleatum (Fn)* or *Bacteroides fragilis (Bf)*, contributing to tumor initiation and progression. Given the complexity of interactions between diet, microbiota, and oncogenesis, artificial intelligence (AI) is emerging as a powerful tool for modeling these interactions, identifying at-risk profiles, and proposing targeted prevention strategies. Objective: To explore how AI can analyze diet-induced changes in gut microbiota and their contribution to CRC pathogenesis, aiming to identify high-risk profiles and support personalized prevention strategies. Methodology : A literature review was conducted using the PubMed, Scopus, and Web of Science databases, including publications up to March 2025. Keywords used were: "colorectal cancer," "gut microbiota," "diet," "artificial intelligence," "machine learning," "dysbiosis," "nutritional prevention," and "metagenomics." Results and Conclusion : Data from analyzed publications demonstrate that AI enables the identification of microbial profiles associated with dietary habits, directly linked to CRC risk. Diets rich in processed foods, saturated fats, and simple sugars promote the proliferation of pro-oncogenic bacteria like *Fn,* while diets rich in fiber and unsaturated fatty acids foster protective bacterial diversity. Machine learning algorithms achieve high predictive performance, exceeding 90% in some studies. These results highlight the power of AI in modeling the complex interactions between nutrition, microbiota, and oncogenesis, paving the way for personalized CRC prevention based on dietary modulation of the microbiota.

Keywords : *Colorectal cancer, Gut microbiota, Artificial intelligence, Machine learning, Dysbiosis and Personalized prevention.*

CA313: Machine Learning Applications in Biofilm Research: A Bibliographic Review

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Abstract

Biofilms are complex clusters of microorganisms firmly attached to surfaces and enveloped within a self-generated extracellular matrix, making them difficult to manage and treat in various fields like food safety, public health, and clinical microbiology. These biofilms are often resistant to antimicrobial treatments and can persist in challenging environments, leading to serious problems in both healthcare and food industries. Traditional methods for studying biofilms, like microscopy and culture-based techniques, often fall short in providing a complete understanding of how biofilms form, grow, and resist treatments. Recently, machine learning (ML) has emerged as a powerful tool to improve biofilm research. ML techniques can help identify biofilms, classify microbial species, model biofilm growth, and predict how biofilms will respond to treatments. These techniques include supervised learning, unsupervised learning, and deep learning, which allow researchers to analyze large sets of data, such as high-resolution images, genomic data, and environmental conditions, to better understand biofilm behavior. Machine learning models are also being used to predict key issues, like antimicrobial resistance in biofilms, which is especially important for foodborne diseases and public health efforts. This review provides an overview of the current applications of ML in biofilm research, highlighting its potential in improving biofilm management in healthcare, food safety, and public health, while also discussing the future directions of this field.

Keywords: *Biofilms, Machine Learning, Public Health, Microbial Communities.*

CA314: Physicochemical Characterization of Gallstone Surfaces and Their Influence on *Salmonella* Typhi Adhesion

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Abstract

Salmonella Typhi can adhere to and build biofilms on the surface of gallstones, causing abnormal gallbladder mucosa, which could lead to carcinogenesis. The surface physicochemical properties of microbial cells and materials have been shown to play a crucial role in adhesion. Therefore, this study aimed to investigate, for the first time, the surface properties of nine gallstones and to evaluate the influence of these parameters on the theoretical adhesion of *S.* Typhi to gallstone surfaces. The physicochemical properties were determined by SEM–EDX and contact angle measurements (CAM) while the predictive adhesion of *S.* Typhi on gallstones was estimated using the XDLVO approach. SEM–EDX analysis revealed that cholesterol is the principal component on the surface of all gallstones, with carbon and oxygen as the main elements. Aluminum was detected as a trace element in only three gallstones: GS2, GS4, and GS5. *S.* Typhi CIP5535 has a hydrophilic character ($\Delta G_{iwi} = 33.54$ mJ m^{-2}), as well as strong electron donor ($\gamma^- = 55{,}80$ mJ m^{-2}) and weak electron acceptor properties ($\gamma^+ = 1{,}95$ mJ m^{-2}). Regarding gallstones, it was found that they have a hydrophobic character ($\boldsymbol{\Delta Giwi < 0}$), while their electron donor/acceptor characters change according to each gallstone. Predictive adhesion showed that all gallstones could be colonized by *S.* Typhi ($\boldsymbol{\Delta G^{Total}_{XDLVO} < 0}$) except GS1, GS5, and GS6 ($\boldsymbol{\Delta G^{Total}_{XDLVO} > 0}$). Understanding the interfacial phenomena implicated in the process of bacterial adhesion makes it possible to limit or even inhibit the adhesion of *S.* Typhi on gallstone surfaces.

Keywords: *Gallstones, adhesion, physicochemical properties, XDLVO.*

CA315: Anti-biofilm potential of clove essential oil for continuous glucose monitoring medical devices: toward an innovative strategy for preventing healthcare-associated infections.

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Abstract

Biofilm-associated infections represent a major challenge in the use of implantable or indwelling medical devices, particularly those used for continuous glucose monitoring (CGM) in critical care settings. The formation of biofilms on sensor surfaces can impair device accuracy and compromise patient safety. Given the limitations of conventional antimicrobial agents, natural and biocompatible alternatives are increasingly being explored.

This study investigates the anti-biofilm activity of clove essential oil (*Syzygium aromaticum*), rich in eugenol, a compound known for its broad-spectrum antimicrobial and antifungal properties. In vitro assays were conducted to assess the capacity of this essential oil to inhibit biofilm formation on surfaces mimicking those of glucose monitoring sensors. Preliminary results demonstrate a significant reduction in microbial growth and structural disruption of the biofilm, including on multidrug-resistant strains commonly found in intensive care units (*Staphylococcus aureus, Pseudomonas aeruginosa, Candida albicans*).

These findings suggest a promising avenue for incorporating essential oil-based formulations into functional coatings for medical devices, aiming to provide long-term biofilm prevention without promoting antimicrobial resistance. Further investigations are warranted to evaluate biocompatibility, physicochemical stability, and in vivo efficacy.

Keywords: *Anti-biofilm activity, Clove essential oil, Continuous glucose monitoring sensors*

Poster Presentations
Theme 4

Session VI: Co-products and Circular Economy: Towards Responsible Management of Bioresources
(Desalination, treatment and reuse of wastewater, bioremediation, biotransformation, bioenergy)

CA41: The production of biohydrogen from organic waste through anaerobic fermentation processes

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Abstract

The biological production of hydrogen from organic waste represents a sustainable and innovative approach to energy generation. This process relies on anaerobic fermentation, a natural method in which specific bacteria convert organic matter into energy in the absence of oxygen. By utilizing various types of organic waste, the process not only contributes to renewable energy production but also helps with waste management. During anaerobic fermentation, microorganisms play a crucial role in breaking down organic materials, leading to the production of valuable gases such as hydrogen and methane. Hydrogen, in particular, is gaining recognition as a clean fuel source, with significant potential for use in energy production, transportation, and various industrial applications. This study aims to explore the potential of different microbial strains capable of producing hydrogen from organic waste. By isolating wild bacteria from diverse environmental samples, we seek to identify the most effective strains for hydrogen production. The findings of this research could provide insights into optimizing the fermentation process and enhancing the efficiency of hydrogen production, ultimately contributing to a more sustainable energy future.

Keywords: *Hydrogen; Organic waste; Anaerobic fermentation; Biogas; Microorganisms.*

CA42: Biotransformation of Tomatoes and Their By-Products by Lactic Acid Bacteria: An Innovative Path to Healthier Tomato-Based Foods

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Abstract

Tomatoes and their processing by-products represent a rich source of bioactive compounds, including lycopene, flavonoids, and phenolic acids. However, conventional methods of producing tomato juice and paste may not fully exploit their functional potential. This research aims to explore the biotransformation of tomatoes and their by-products through lactic acid bacteria (LAB) fermentation to develop novel, health-promoting tomato-based foods.
The study focuses on utilizing selected LAB strains to enhance the antioxidant capacity, nutritional profile, and shelf life of tomato juice and paste. The fermentation process is designed to improve bioavailability of key compounds, generate potential new aromatic profiles, and valorize tomato waste materials in a circular bioeconomy framework. Fermentation kinetics, microbial viability, antioxidant assays (DPPH, ABTS), and physicochemical parameters are being monitored throughout the process.
This innovative approach presents a promising avenue for the development of functional foods with improved health benefits, while promoting sustainability through the valorization of agricultural by-products.

Keywords: *Bio-transformation, Fermentation, Antioxidant Activity, Lactic Acid Bacteria, Tomato By-Products.*

CA43 : Biotechnological Valorization of Carob (*Ceratonia siliqua* L.) Seed Powder via Microbial Fermentation

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Abstract:
Carob (*Ceratonia siliqua* L.) is a Mediterranean plant known for its rich nutritional and functional composition. While the pulp is widely used in the food industry, carob seeds remain largely underexploited despite their high content of galactomannans and polyphenols. This study aims to valorize carob seed powder through microbial fermentation using Lactobacillus plantarum, *Aspergillus niger*, and *Penicillium crustosum*. Two fermentation phases were carried out: (1) a lactic fermentation in modified MRS medium over 9 days, and (2) a fungal fermentation using YEG and YEP media over 4 days. Samples were collected at the beginning (T_0) and end (Tf) of fermentation. Physicochemical and biochemical analyses included pH, titratable acidity, viscosity, surface tension, reducing sugars (DNS), total polyphenols (Folin–Ciocalteu), flavonoids ($AlCl_3$), and total antioxidant capacity (TAC). Antimicrobial activity was evaluated through agar well diffusion on bacterial and fungal strains. The results revealed that fungal fermentation, particularly with *Penicillium crustosum* in the presence of carob powder, significantly enhanced antioxidant activity and produced measurable antimicrobial effects. These findings highlight the biotechnological potential of carob seed powder as a functional ingredient with added antioxidant and antimicrobial properties.

Keywords: *Carob seed powder, fermentation, Lactobacillus plantarum, Aspergillus niger, Penicillium crustosum, Antioxidant activity, antimicrobial activity.*

CA44: The valorization of flavedo's biological properties through bioconversion via lactic acid bacteria.

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Abstract

The valorization of agricultural waste represents a promising approach to address the environmental and economic challenges associated with the waste produced by the agri-food industry. This work focuses on the combined use of citrus by-products, particularly the peels (flavedo) from juice processing industries, as alternative carbon sources in fermentation media. These substrates, rich in phenolic compounds and prebiotic fibers (Xylooligosaccharides), have been incorporated into culture media for the growth of lactic acid bacteria, particularly Lactiplantibacillus plantarum, as the primary carbon source. The study aims to assess the fermentative potential of this formulation and to characterize the biological activities of the obtained extracts, such as antibacterial, antioxidant, and anti-inflammatory activities, among others. This approach aligns with the sustainable valorization of agri-industrial co-products and paves the way for their potential use in the development of pharmaceutical formulations or dietary supplements in the form of capsules, for preventive or therapeutic purposes.

Keywords: *Flavedo, xylooligosaccharides***,** *Lactiplantibacillus plantarum, fermentation , valorization, by-products.*

CA45: Characterization of immobilized *endo*-polygalacturonase PGC-AN64 forms from *Aspergillus niger* HO32 with potential biotechnological interest

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Abstract

The aim of this work is the characterization of immobilized purified *endo*-polygalacturonase PGC-AN64 from *Aspergillus niger* HO32 regarding sodium alginate (SA), and sodium alginate combined with guar gum (SA-Gu) or chitosan (SA-Ch), and its application. The immobilization efficiency of PGC-AN64 was 75, 83, and 77% for PGC-AN64-SA, PGC-AN64-SA-Ch, and PGC-AN64-SA-Gu, respectively. The immobilization procedure improves the thermostability and pH stability of immobilized PGC-AN64. The PGC-AN64 beads exhibited greater stability, with half-lives (t1/2) of 8, 11, and 16 h at 80°C, and protected its activity at around 56, 58, and 56% at pH 5 after an incubation time of 12, 22, and 24 h, respectively for PGC-AN64-SA, PGC-AN64-SA-Gu, and PGC-AN64-SA-Ch. Furthermore, the reusability of immobilized PGC-AN64 maintained about 50% of its original activity following 4 successive cycles. for PGC-AN64-SA, and about 64% for PGC-AN64-SA-Ch and 51% for PGC-AN64-SA-Gu after 6 continuous cycles. Transmittance percentages (T%) were significantly influenced by the clarification process with 85.20±1.68, 84.64±1.19, 84.13±1.33, and 84.13±1.33 for PGC-AN64, PGC-AN64-SA, PGC-AN64-SA-Ch, and PGC-AN64-SA-Gu, respectively. X-Ray Diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy in attenuated total reflection (ATR) mode with field emission scanning electron microscopy (FE-SEM) were used to examine the characteristics of PGC-AN64 in free and immobilized forms. The reduction in total soluble solids (TSS) after the clarification process, and the color parameters following the clarifying process result in a reduction in a* values and rise in L* and b* value. These results emphasize that the immobilization of PGC-AN64 on organic and food supports (SA, SA-Ch, and SA-Gu) enables the economical and efficient use of the enzyme, while enhancing its stability and reusability. This approach offers promising prospects for the agri-food industry, ensuring product safety without posing any health risks to consumers.

keywords : *Endo-polygalacturonase, Aspergillus niger, Immobilization; Reusability; Clarification process.*

CA46: The Valorization of Low-Quality Date Fruits for Microbial Enzyme Production

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Abstract

Date palm (*Phoenix dactylifera* L.) is a crucial crop in arid and semi-arid regions, valued for its nutritional, cultural, and economic significance. Among its primary products are the date fruits, which are widely consumed and serve as a dietary staple and a key income source for many rural communities. Despite their rich carbohydrate and fiber content, a substantial portion of harvested dates is discarded due to cosmetic defects, over ripeness, or surplus production, leading to considerable post-harvest losses.

The study explores the valorization of these low-quality dates as a sustainable and cost-effective substrate for microbial enzyme production via submerged fermentation. Date pulp was used to cultivate selected microorganisms capable of producing eco-friendly biocatalysts. This biotechnological approach supports circular economy principles by converting agricultural waste into high-value enzymatic products.

The results highlight the potential of utilizing undervalued fruit biomass for industrial applications, contributing to food waste reduction, environmental sustainability, and rural economic development.

Keywords : *Datepalm, Microorganisms, Fermentation, Enzymes, Valorization, Sustainability.*

CA47: Isolement, identification et criblage de souches bactériennes productrices de bioplastiques biodégradables : Cas des polyhydroxyalcanoates (PHA)

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Abstract

Face à l'augmentation de la pollution causée par l'accumulation de plastiques conventionnels non biodégradables dans l'environnement, un intérêt croissant s'est manifesté pour le développement d'alternatives durables, telles que les polymères biodégradables. Les polyhydroxyalcanoates (PHA), des polyesters d'origine bactérienne, sont considérés comme l'une des alternatives les plus prometteuses aux plastiques issus du pétrole.

Dans cette étude, l'objectif est d'isoler, d'identifier et de cribler des souches bactériennes capables de produire des PHA. Un total de 48 souches isolées à partir de différents échantillons de sol, ont été criblés pour leur capacité de production du PHA à l'aide du colorant Nile Blue A. Deux d'entre elles ont présenté une fluorescence rose-orangée, caractéristique d'une accumulation intracellulaire de PHA. Elles ont été identifiées comme appartenant au genre *Bacillus*, plus précisément à l'espèce *Bacillus megaterium* et *Bacillus subtilis*.

Les souches sélectionnées ont été cultivées dans un milieu MSM liquide afin de favoriser l'accumulation de PHA, après l'extraction les analyses quantitatives ont révélé que *Bacillus megaterium* est la plus adéquate en termes de production et d'accumulation de PHA, avec une quantité de 0,260 ± 0,01 g/L de PHA, représentant 44 % de sa biomasse sèche, tandis que *Bacillus subtilis* a présenté une accumulation plus faible de PHA (0,164 ± 0,005 g/L) soit 10,48 % de sa biomasse.

Ces résultats ouvrent la voie à l'exploitation de souches bactériennes indigènes pour la production de bioplastiques biodégradables à partir de ressources naturelles renouvelables tel que les résidus de datte afin de réduire le cout de production de ce polymère.

Mots clés : *polyhydroxyalcanoate, polymères biodégradables, Nile Bleu A, criblage, extraction.*

CA48: Biomedical potential of nanoparticles produced by sustainable biosynthesis methods

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Abstract

The rise of nanotechnology represents a major turning point in the biomedical field, offering innovative solutions for the diagnosis, prevention, and treatment of numerous pathologies. Nanoparticles (NPs), in particular, are distinguished by their remarkable physicochemical properties at the nanoscale. Among the various manufacturing approaches, green synthesis—based on the use of bio-sources such as plant extracts, microorganisms, or algae—is emerging as a sustainable, eco-responsible alternative compatible with human health requirements. The characteristics of NPs produced through this process, influenced by various synthesis parameters, give them multiple functionalities: antimicrobial, antioxidant, anticancer, immunomodulatory activities, etc., as reported in the literature.
These properties open the door to numerous biomedical applications, including targeted delivery systems, vaccine or genetic vectors, high-sensitivity diagnostic devices, topical formulations for therapeutic purposes, and supports for tissue engineering. The integration of these biologically derived nanomaterials into healthcare strategies represents a promising prospect for more targeted, effective, and environmentally friendly medicine.

Keywords: *Sustainable nanotechnologies; Nanoparticles; Green synthesis; Biological properties; Biomedical applications*

CA49: Exploring microbial mechanisms for sustainable remediation of heavy metal pollution

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Abstract

Heavy metal pollution remains a persistent environmental challenge due to the toxicity, persistence, and bioaccumulative nature of metals such as cadmium, lead, and chromium. Traditional remediation methods are often costly and may generate secondary contaminants. Microbial remediation has emerged as a promising, sustainable alternative that leverages natural microbial processes to reduce or neutralize heavy metals in contaminated environments. This approach involves several mechanisms, including biosorption, bioaccumulation, biotransformation and biomineralization, which enable microbes to immobilize or detoxify metal ions effectively. Some microorganisms possess adaptive strategies to survive and thrive in contaminated sites, enabling them to effectively contribute to the bioremediation of heavy metals. This work explores these microbial mechanisms in detail and discusses their potential to support environmentally friendly remediation technologies aimed at restoring contaminated environments, Understanding and harnessing these biological processes is essential for developing cost-effective and sustainable solutions to mitigate heavy metal contamination worldwide.

Keywords: *Microorganism, bioremediation, heavy metals, biosorption, bioaccumulation, Biotransformation.*

CA410: *Assessment of the Phytotoxicity of Dairy Wastewater Using the Lettuce Plant (Lactuca sativa) and Duckweed Plant (Lemna minor) as Bioindicators*

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Abstract

Dairy industry effluents may contain trace metal contaminants, the nature and concentration of which depend on the treatment processes applied during wastewater purification. The presence of these metals in liquid discharges represents a significant environmental concern due to their potential toxicity to both aquatic and terrestrial ecosystems. Furthermore, their bioaccumulation in the food chain poses a risk to human health, necessitating stringent monitoring and appropriate remediation strategies. To evaluate the impact of dairy wastewater, two separate studies were conducted using the same treated effluents. The first study focused on three lettuce (Lactuca sativa) seed varieties (Batavia, Têtue de Nîmes, and Madrilène) exposed to different concentrations of treated wastewater (25%, 50%, 75%, and 100%) and varying seed densities. Germination rate, seedling length, and biomass were measured to assess potential phytotoxic effects. The results showed no significant differences between treatments in terms of germination rate or stem length.The second study aimed to assess the toxic effects of water constituents and the same treated wastewater on duckweed (Lemna minor), following the ISO 20079 international standard for growth inhibition tests. The experiment was conducted over one week, using the same wastewater concentrations and five replicates per treatment. The results showed no significant differences in the number of fronds between treatments, indicating no observable phytotoxic effects on Lemna minor. However, a significant variation in pH was observed between the beginning and the end of the study, suggesting potential physicochemical changes in the test medium over time.

Keywords: *Phytotoxicity, dairy wastewater, Lactuca sativa, Lemna minor.*

CA411: Impact of submerged fermentation on the bioconversion of *Crocus sativus corms*

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Abstract

Crocus sativus corms are an underutilized agro-industrial by-product with promising potential for sustainable valorization. The aim of this study is to determine the impact of submerged fermentation using *Aspergillus niger* on the yield of bioactive compounds and carbohydrase enzymes of fresh and stored corms of *Crocus sativus*.
the optimal concentration was first determined through solid-state fermentation followed by submerged fermentation under controlled conditions. After incubation, the culture supernatants were collected and analyzed for enzymatic activities, including amylase, cellulase and pectinase.
Antioxidant capacity of the supernatants was also determined using ABTS essay to assess the release of bioactive compounds during fermentation.
The results revealed a considerable enhancement in enzymatic and antioxidant activities with visible differences were found between fresh and stored corms. These results underline the potential of fungal fermentation as a helpful method to bioconvert *Crocus sativus* corms into bioactive compounds that can be employed in the industry.

Keywords: *Crocus-sativus, corms, Enzymes, fermentation, Aspergillus-niger, by-products.*

CA412: Potentiel agro-industriel de quatre algues marines du littoral méditerranéen marocain: approche biochimique et biotransformation

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Résumé

La valorisation des algues marines représente un axe stratégique pour le développement durable des zones côtières marocaines, en raison de leur richesse en composés bioactifs et de leur potentiel industriel. Cette étude explore la valorisation de quatre espèces d'algues marines *(Ulva lactuca, Ulva rigida, Sargassum barbata aurantia, Hypnea musciformis)* issues de la côte méditerranéenne marocaine. Des analyses proximales ont été réalisées pour déterminer les teneurs en humidité, cendres et matières grasses. Parallèlement, des analyses biochimiques ont permis d'évaluer les teneurs en protéines, phosphore et cellulose. Une fermentation lactique a ensuite été réalisée à l'aide de *Lactobacillus plantarum* S72, dans le but d'améliorer la biodisponibilité des composés bioactifs. Les dosages des sucres totaux et réducteurs, des polyphénols, des flavonoïdes ainsi que les activités antioxydante, antimicrobienne et antifongique ont été évalués avant et après fermentation. Les résultats obtenus mettent en évidence des différences significatives entre les espèces et confirment leur potentiel dans les domaines agroalimentaire, pharmaceutique et cosmétique. Cette approche intégrée contribue à poser les bases d'une filière locale de valorisation durable des algues marines marocaines.

Mots-clés : *Algues marines, Méditerranée marocaine, Lactobacillus plantarum, Fermentation lactique, Analyse proximale, Composés bioactifs, Activité antioxydante.*

CA413: Valorization of Secondary Metabolites of Argan Tree (*Argania spinosa* L.): Analysis of Polyphenol Content and Antioxidant Activity.

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Abstract

The argan tree (*Argania spinosa* (L.) Skeels) is a fruit and forest tree belonging to the Sapotaceae family. It is an endemic species of Morocco, mainly growing in the southwestern part of the country. This national heritage has attracted considerable interest in recent years due to the importance of its products, especially its oil. Its bioactive compounds have great potential for applications in various sectors, notably pharmaceuticals, cosmetics, agri-food, and sustainable agriculture, which today form the basis for the development of many products intended for cosmetic, medicinal, and industrial uses.

This potential is mainly attributed to the presence of secondary metabolites, particularly polyphenols, which have strong antioxidant properties. In this context, the aim of this study is, first, to extract and monitor the evolution of the polyphenol content in argan tree tissues, using callus obtained from several somatic embryogenesis induction trials from argan tree leaves. The callus, which appear at the base of microcuttings during the micropropagation process, as well as the leaves of argan vitroplants, are also included. The study also aims to evaluate the antioxidant activity of the extracts from these different tissues.

The results showed that the highest polyphenol content was recorded in the leaf extracts, reaching up to 10.51 mg GAE/ml. In contrast, the calli derived from microcuttings showed a moderate yield of total polyphenols, reaching up to 6.74 mg GAE/ml, while those obtained from somatic embryogenesis induction exhibited a low total polyphenol content, at 1.75 mg GAE/ml. Moreover, a positive correlation was observed between high polyphenol content and stronger antioxidant activity. The highest values recorded for each type of explant were 1.5 mg TE/ml, 0.88 mg TE/ml, and 0.59 mg TE/ml, respectively.

Keywords : *Argania spinosa L., antioxidants, polyphenols, callus, vitroplants.*

CA414: Bioleaching of metallic pollutants in mining residues by an indigenous strain: *Aspergillus niger*.

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Abstract

Bacterial leaching of metals from mining ores, also known as bioleaching. In order to improve the economic feasibility of fungi leaching process, experiments were conducted to identify an agricultural or food waste, which would replace the sucrose used in laboratory tests, as carbon source for organic acids production by Aspergillus niger. A sample of mining residues containing high concentration of sulfur (70.708 g/kg), Al (28.789 g/kg), Fe (16.259 g/kg), Cu (2.403 g/kg), Zn (1.207 g/kg), Cr (0.076 g/kg), Pb (0.036 g/kg), As (0.025 g/kg), and Cd (0.002 g/kg) was used for the study. Two organic residues were used as substrates: mixture of household waste and aromatic and medicinal plants (D) and whey permeate (PL). As a result, (PL) was an excellent carbon source for organic acids production, but the fermentation with substrate (D) was more efficient than (PL) for mobilizing Pb, Cr, As, and Cd, achieving reduction rates of up to 72.64% for chromium and 64.83% for lead. Similarly, substrate D performed better for iron (Fe), with a yield of 48.99% compared to 32.08% for PL. These results suggest that the chemical composition of the substrates has a strong influence on the bioleaching mechanisms.

Keywords: *Mine soil, fungi, Bioaccumulation, Heavy Metals, Mining ore.*