DCE 25

6th DOCTORAL CONGRESS IN ENGINEERING

DOCTORAL CONGRESS IN ENGINEERING

Book of Abstracts

Symposium on Environmental Engineering

U.PORTO
FEUP FACULDADE DE ENGENHARIA
UNIVERSIDADE DO PORTO

DCE 25 6th DOCTORAL CONGRESS IN ENGINEERING

Book of Abstracts

of the

Symposium on Environmental Engineering

Editors:
Ana Silva, Carla Santos, Filipe Francisco, Inês N. Rodrigues,
Inês M. Rodrigues, Juliana Sá, Orleane Brito,
Luiza Sena, Miguel Costa, Tânia Silva,
Sofia Sousa, Vítor Vilar

Porto
June 2025

LEADING THE CHANGE FOR A GREENER FUTURE

SYMPOSIUM ON ENVIRONMENTAL ENGINEERING

This volume contains the peer-reviewed and accepted abstracts presented at the Symposium on Environmental Engineering of the 6th Doctoral Congress in Engineering – DCE25, held at the Faculty of Engineering of the University of Porto (FEUP), between June 30th and 1st July, 2025.

Title: Book of Abstracts of DCE25 Symposium on Environmental Engineering

Edited by Ana Silva, Carla Santos, Filipe Francisco, Inês N. Rodrigues, Inês M. Rodrigues, Juliana Sá, Orleane Brito, Luiza Sena, Miguel Costa, Tânia Silva, Sofia Sousa, Vítor Vilar

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WELCOME

Message from the Organizing Committee

We warmly welcome all participants to the Symposium on Environmental Engineering (SEE), held in the scope of the 6th Doctoral Congress in Engineering (DCE25), hosted at the Faculty of Engineering of the University of Porto (FEUP), Portugal, on the 30th June and 01st July 2025.

This Symposium is organized by PhD students of the Doctoral Program in Environmental Engineering (PDEA) at FEUP, with the support of the Associate Laboratory ALiCE (integrating the R&D Units LEPABE, LSRE-LCM and CEFT) and CERENA.

The Symposium covers a wide range of themes in the field of Environmental Engineering, aligned with the UN Sustainable Development Goals. It includes both oral and poster presentations, mainly covering the following topics:

- Water and Wastewater: New Directives, New Opportunities, New Challenges
- Waste Management: Towards New Approaches
- Clean Air and Energy: Becoming Accessible for All
- Sustainability and Innovation: Seeking a New Future

We are truly grateful to our invited speakers for accepting our invitation and sharing their expertise, thereby enhancing the quality and impact of the Symposium.

The Symposium received 81 submissions, reviewed with the support of the Scientific Committee, resulting in 17 oral and 64 poster presentations.

We would like to take this opportunity to express our sincere appreciation to all authors for their valuable contributions, as well as to the Symposium Organizing Committee, the Scientific Committee, Associate Laboratory ALiCE (comprising the R&D Units LEPABE, LSRE-LCM, and CEFT), CERENA, and all participating institutions for their invaluable support.

Porto, June 2025

The Symposium Organizing Committee

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The city of **Porto**, known as “Cidade Invicta” (the invincible city), is the second largest city of **Portugal**, the capital of the Porto district and the northern region. Porto is built along hillsides overlooking the mouth of the Douro River, and it is an outstanding urban landscape with a 2,000-year history.

Porto’s continuous growth is related to the sea (the Romans gave it the name Portus, or port). It was declared a World Heritage Site by UNESCO in 1996 and considered the European Best Destination in 2014 and 2017.

Explore Porto’s charming streets, historic landmarks such as the Sé Cathedral, Clérigos Tower and Dom Luís I Bridge, and savor local culinary favorites like the “Francesinha” (a must-try hearty sandwich for any visitor), “bacalhau” dishes (cod fish), and “pastel de nata” (creamy custard tart with a crisp, flaky crust).

Across the Douro River lies Vila Nova de Gaia, famed for its port wine cellars and stunning views of Porto’s skyline. Visit the cellars to discover the region’s rich winemaking heritage and the history of port wine production, from the historic lodges to the modern tasting rooms.

Don’t miss the opportunity to witness the stunning sunset from Jardim do Morro or visit the Serra do Pilar, a UNESCO World Heritage Site offering panoramic views of Porto and the Douro River.

Together, Porto and Vila Nova de Gaia offer a unique mix of culture, history, and gastronomy. For details on accommodation, public transport, sightseeing tours, gastronomy, nightlife and culture may be found in the Official Portal of Porto Tourism and Visit Porto and the North Portal.

PROGRAMME

Monday, June 30th, 2025

07h20 – 08h20 *Lobby*	**REGISTRATION**
	DCE 25 General Program
08h20 – 08h45 *Main Auditorium**	**OPENING CEREMONY** **Jaime Cardoso**, *President of the DCE25 Scientific Committee, Vice-President of FEUP's Scientific Council, Head of Research Area and Doctoral Affairs*, FEUP **Vítor Vilar**, *DCE25 Chair, Principal Researcher*, LSRE-LCM/AliCE, FEUP
08h45 – 09h10 *Main Auditorium**	**KEYNOTE LECTURE** *Chair:* **Rita Lado**, *DCE25 Co-Chair, Principal Researcher*, LSRE-LCM/ALiCE, FEUP *Author Workshop: A Whistlestop Tour of Common Ethical Pitfalls of Well-Intentioned Researchers* **Kay Tancork**, *Executive Publisher, Chemical Engineering*, Elsevier
09h10 – 10h00 *Main Auditorium**	**LIFE AFTER A PhD: WHAT CAN YOU DO?** *Chairs:* **Tânia Lopes**, *DCE25 Co-Chair, Assistant Researcher*, LEPABE/ALiCE, FEUP **Jaime Cardoso**, *Vice President of FEUP Scientific Council*, FEUP
09h10 – 09h35	*Carrer Horizons for Early-Stage Researchers* **Bruno Béu**, *Advisor to FCT's Board of Directors*, FCT **Rui Munhá**, *Science Officer*, FCT
09h35 – 10h00	*CoLABs and CTIs: A Catalyst for Doctorates and the Innovation Ecosystem* **João Lobo Ferreira**, *Head of Interface Mission*, ANI
10h00 – 10h30 *B Corridor*	**COFFEE BREAK & POSTER SESSION & EXHIBITION**
10h30 – 12h20 *Main Auditorium**	**ROUND TABLE WITH CoLABs, CTIs AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE** *Chairs:* **João Lobo Ferreira**, *Head of Interface Mission*, ANI **Adélio Mendes**, *Full Professor*, FEUP **Pedro Ávila**, *Director of Operational Sustainability*, REN **Luís Seca**, *Director*, AAET (Association Alliance for the Energy Transition)

Monday, June 30th, 2025

	Marco Ferraz, *Head of Upstream and Industrial Innovation Center*, Galp **Joana Maria**, *Executive Director*, Vortex-CoLAB **Simão P. Cardoso**, *Product Manager*, Paralab Engineering **Jaime Gabriel Silva**, *Head of innovation area*, Águas do Douro e Paiva S.A. and SimDouro S.A. (both AdP Group), and *Invited Teacher*, ISEP **Luís Filipe Santos**, *Product Prescription and Technical Support*, FIBRAN **Ricardo Rato**, *Executive Director*, HyLab **Luís Tiago Ferreira**, *Responsible for the Smart Cities, Public Lighting, and Open Data*, E-Redes **Mónica Read**, *Projects and Works Engineer*, Águas e Energia do Porto **Joana Monte**, *R&D and Innovation Senior Consultant*, KPMG **Luís Seca**, *Member of the Executive Board*, INESC TEC
12h20 – 12h30 *FEUP Central Garden*	**DCE25 OFFICIAL PHOTO**
12h30 – 14h00 *FEUP Central Garden*	**LUNCH BREAK**
14h00 – 15h20	**WORKSHOPS**
14h00 – 14h35 (1st Session) 14h45 – 15h20 (2nd Session) *Auditorium B001*	*Workshop 1 – "Depression and anxiety in PhD students: Preventing emotional exhaustion and burnout"* **Fernanda Mendes**, *FEUPs GOI-Orientation and Integration Unit* **Helena Lopes**, *FEUPs GOI-Orientation and Integration Unit*
14h00 – 14h35 (1st Session) 14h45 – 15h20 (2nd Session) *Auditorium B002*	*Workshop 2 – "My career with a PhD: to open up or close a gap?"* **João Henrique Almeida**, *FEUP Talent Unit*
14h00 – 14h35 *Auditorium B003*	*Workshop 3 – "La Caixa: Funding Opportunities?"* **Gisela Coromines i Calders**, *Doctoral Fellowships Programme Manager*, Fundació "la Caixa" **Inês Claro**, *Doctoral INPhINIT Fellow*, Fundació "la Caixa"
14h45 – 15h20 *Auditorium B003*	*Workshop 4 – "The ERC and the ERC-Portugal Programme: How Preparation Meets Opportunity"* **Bruno Béu**, *Advisor to FCT's Board of Directors*, FCT **Rui Munhá**, *Science Officer*, FCT

Monday, June 30th, 2025

Symposium on Environmental Engineering

15h30 – 16h30 *Auditorium B032*	***WELCOMING SESSION*** **Vítor Vilar**, *General Chair of DCE25, Chair of the Symposium on Environmental* Engineering, Principal Researcher, FEUP
	***SESSION I:* ROUND TABLE – Navigating Water Sector Challenges: Insights from Utilities and Industry** *Chairs:* **Marta Carvalho Marques**, *Business Development Manager*, Ponto Verde Serviços-BCSD Portugal **Nuno Brôco,** *Chairman & CEO*, Águas do Tejo Atlântico **Juliana Sá,** *PhD Student*, FEUP
12 min per intervention	**Ruben Jorge**, *Co-Founder & Chief Scientist*, AST **António Rodrigues**, *R&D Manager*, VentilAQUA **Miguel Leal**, *Senior Technician*, Águas de Gaia **Vincenzo Rocca**, *Areas Sales Manager*, Lutz-Jesco
10 min	**Discussion**
16h30 – 17h00 *B Corridor*	**COFFEE BREAK & POSTER SESSION & EXHIBITION**
17h00 – 18h30 *Auditorium B032*	***SESSION II: URBAN WASTEWATER: NEW DIRECTIVE, NEW OPPORTUNITIES, NEW CHALLENGES*** *Chairs:* **Ana Alexandra Pereira**, *Assistant Researcher*, FEUP **Filipe Moisés**, *PhD Student*, FEUP
17h00 – 17h50	**KEYNOTE LECTURES**
12 min	*Urban Wastewater Directive Revision: Evolution or revolution?* **Nuno Brôco**, *Chairman & CEO,* Águas do Tejo Atlântico
12 min	*Advanced Environmental Control Technologies: State of the Art Integrated Analytical Solutions for Emerging Contaminants* **Daniel Ettlin**, *General Manager – CEO,* UNICAM Sistemas Analíticos
12 min	*Mass Spectrometry-Based Strategies for Monitoring Organic Micropollutants in Wastewater. Essential Role of Analytical Chemistry in Wastewater Treatment & Regulation* **Félix Hernández**, *Full Professor,* University Jaume I
10 min	**Discussion**
17h50 – 18h30	**ORAL COMMUNICATIONS**
8 min	**OC 1.** *Quaternary Treatment of Urban Wastewater: Pilot-Scale Evaluation of Ozone Injection via NETmix Technology* **Carla S. Santos**, *PhD Student,* FEUP
8 min	**OC 2.** *Three-Dimensional Electrosorption of a Pharmaceutical Mixture via Pine* **Nuria Bernárdez-Rodas**, *PhD Student,* Universidade de Vigo

Monday, June 30th, 2025	
8 min	**OC 3.** *Photo-Fenton Treatment of Ceramic Membrane Filtration Retentate for a Zero-Waste* **Vanessa E. Mendes**, *PhD Student,* FEUP
8 min	**OC 4.** *Optimization of Urban Wastewater Hydroponics for Ornamental Plant Production and Pollutant Removal* **Ounísia Santos**, *PhD Student,* Polytechnic Institute of Leiria
8 min	**Discussion**
18h30 – 19h30 *FEUP Central Garden*	**SOCIAL EVENT** **WELCOME DRINK (TUNAFE & TEUP)**

Main Auditorium: Auditorium Prof. Dr. José Marques dos Santos

Tuesday, July 1st, 2025

08h00 – 09h00 *Lobby*	**REGISTRATION**
Symposium on Environmental Engineering	
09h00 – 09h30 *Auditorium B032*	***SESSION III: WASTEWATER TREATMENT*** **ORAL COMMUNICATIONS** *Chairs:* **Cristina Santos**, *Assistant Professor*, FEUP **Carla Santos**, *PhD Student*, FEUP
8 min	**OC 5.** *Effect of Sludge Retention Time on Bacterial Community Dynamics and Antibiotic Resistance in Conventional Activated Sludge Treatment* **Sara Ribeirinho-Soares**, *PhD Student,* FEUP
8 min	**OC 6.** *Innovative Use of Chestnut Shell Tannins for Efficient Wastewater Treatment in Aquaculture* **Isabella T. Tomasi**, *PhD Student,* FEUP
8 min	**OC 7.** *Enhancing Aerobic Granular Sludge Systems for Leachate Co-treatment: Impact of Saline Stress, Fill-Draw Operation, and Biomedia Incorporation* **Sara G.S. Santos**, *PhD Student,* FEUP
6 min	**Discussion**
09h30 – 10h30 *Auditorium B032*	***SESSION IV: CIRCULAR ECONOMY*** *Chairs:* **Joana M. Dias**, *Associate Professor*, FEUP **Inês M. Rodrigues**, *PhD Student*, FEUP
09h30 – 09h45	**KEYNOTE LECTURE** *EPR to Emerging Waste Streams: The Case of RECAPS* **Marta Carvalho Marques**, *Business Development Manager*, Ponto Verde Serviços-BCSD Portugal
09h45 – 10h30	**ORAL COMMUNICATIONS**
8 min	**OC 8.** *Kinetics of the Continuous Struvite Crystallization from Sidestream Digestate in a Planar Oscillatory Flow Crystallizer: Optimization at Lab-Scale* **Luiza Sena**, *PhD Student,* FEUP
8 min	**OC 9.** *Spent Printed Circuit Boards: Selective Leaching* **Lídia Cunha**, *PhD Student,* FEUP
8 min	**OC 10.** *Closing the Gold Loop: an Innovative and Sustainable Approach to Recover Precious Metals from Integrated Circuits* **Márcia A.D. Silva**, *PhD Student,* FEUP
8 min	**OC 11.** *Sustainability Challenges and Opportunities of Solid-State Batteries in EV Applications* **Joana R. Gouveia**, *PhD Student,* FEUP
6 min	**Discussion**

Tuesday, July 1st, 2025

10h30 – 11h00 *B Corridor*	**COFFEE BREAK & POSTER SESSION & EXHIBITION**
11h00 - 11h45 *Auditorium B032*	***SESSION V: SUSTAINABLE ENERGY AND CLEAN AIR*** *Chairs:* **Tânia Lopes**, *DCE25 Co-Chair, Assistant Researcher*, FEUP **Luíza Sena**, *PhD Student*, FEUP
11h00 – 11h15	**KEYNOTE LECTURE** *Pioneering CCUS Technologies at Net4CO2: The Strategic Role of PhDs in Research and Development* **Marcelo Costa**, *Chief Technology Officer*, CoLAB Net4CO2
11h15 – 11h45	**ORAL COMMUNICATIONS**
8 min	**OC 12.** *Photocatalytic Nitrite Reduction in Aqueous Solution using MOF-Based Catalysts for Sustainable Ammonia and Hydrogen Production* **Fabiane Lira**, *PhD Student,* FEUP
8 min	**OC 13.** *Optimizing Semi-Transparent Ta3Na5 Photoelectrodes: A Path for Stabilization* **Filipe Moisés M. Francisco**, *PhD Student,* FEUP
8 min	**OC 14.** *Use of Low-Cost Sensors for Indoor $PM_{2.5}$ Monitoring during a Severe Wildfire Event in Portugal* **H. Chojer**, *PhD Student,* FEUP
6 min	**Discussion**
11h45 - 12h30 *Auditorium B032*	***SESSION VI: SUSTAINABILITY AND INNOVATION: SEEKING A NEW FUTURE*** *Chairs:* **Helena Soares**, *Associate Professor*, FEUP **Ana Silva**, *PhD Student*, FEUP
11h45 - 12h00	**KEYNOTE LECTURE** *Centre for Life Cycle Assessment and Sustainability (CLICAS): Supporting the Packaging Sector Through Practical Solutions* **Judite Vieira**, *Professor and Researcher*, PRR Embalagem do Futuro
12h00 – 12h30	**ORAL COMMUNICATIONS**
8 min	**OC 15.** *A Comprehensive Life Cycle Assessment and Costing of Ozone Generation Systems with O_2/O_3 Separation and Oxygen Recovery* **Inês Rodrigues**, *PhD Student,* FEUP
8 min	**OC 16.** *Optimising Carbon Capture and Utilisation Supply Chains for National-Scale Energy System Modelling – Preliminary Insights* **Gustavo P. Rangel**, *PhD Student,* FEUP
8 min	**OC 17.** *Sustainability Assessment of Aquaculture Production Using Optimal Diets: The Case of Mediterranean Fish Production* **Cristóvão Rocha**, *PhD Student,* FEUP

Tuesday, July 1st, 2025

6 min	**Discussion**
	CLOSING SESSION **Sofia Sousa,** *Chair of the Symposium on Environmental Engineering-DCE25, Assistant Researcher*, FEUP
12h30 – 14h00 *FEUP Central Garden*	**LUNCH BREAK**
	DCE 25 General Program
14h00 – 14h20 *Main Auditorium**	**SCIENCE COMMUNICATION** *Chair:* **António Coelho**, *Associate Professor*, DEI/FEUP
14h00 – 14h05	*Hackathon Program* **António Coelho,** *Associate Professor*, DEI/FEUP
	Five-Minute Pitch for 3 teams of PhD Students
14h05 – 14h10	**Team 1 –** *Dino e a Cadeia da Vida* **Ana Camarinha**, Idea and Sketching **Jorge Ferreira**, Game Development **Raushan Mukhamejanova**, Idea and Sketching **Rosana Oliveira**, Narrative
14h10 – 14h15	**Team 2 –** *Time Travelers* **Ana Cristina,** Organization and Creation **Bárbara Bender**, Organization and Creation **Diana Sousa**, Website and App **Jadna da Cruz**, Website, App, Gps, and Image Recognition **Miguel Guimarães**, Website, App, Gps, and Image Recognition
14h15 – 14h20	**Team 3 –** *God Save the Carbon* **Elizaveta Osipovskaya**, Storytelling Wizard **Fernando Osório**, Calculations **Mariam Conceição**, Sparkler **Priscila Reinaldo**, PR Developer **Sebastião Ventura**, Researcher **Safa Vakili**, UI Magician
14h20 – 15h40 *Main Auditorium**	**VENTURE SCIENTISTS** *Chair*: **Liliana Antão**, *PhD Student (PRODEI)*, FEUP
14h20 – 14h30	*What is Conception X?* **Carrie Baptist**, *Chief Strategy Officer*, ConceptionX
14h30 – 14h35	*FTNanoAD-Targeted-Nanocarriers for Brain Diseases* **Joana Loureiro**, *Assistant Professor*, FEUP
14h35 – 14h45	*School of Startups at UPTEC* **Raphael Stanzani,** *Entrepreneurship Programs Manager*, UPTEC
14h45 – 14h55	*A Success Case of a Spin-Off FEUP: AddVolt* **Bruno Azevedo,** *CEO*, AddVolt

Tuesday, July 1st, 2025

14h55 – 14h40	***Five-Minute Pitch for PhD Students***
	LogloTrix, Smart Inventory Management **Amir Hossein Farzamiyan**, *PhD Student, Doctoral Program in Telecommunications*, FEUP
	FertiGo – Wastewater in. Fertilizer out. **Luiza Sena**, *PhD Student, Doctoral Program in Environmental Engineering*, FEUP
	EcoWires – Plastic-free smart packaging **Rita Martins**, *PhD Student, Doctoral Program in Chemical and Biological Engineering*, FEUP **Inês Freitas**, *PhD Student, Doctoral Program in Chemical and Biological Engineering*, FEUP
	MyKneeRecovery – Precision Monitoring for Better Rehabilitation **Joana Cerqueira**, *PhD Student, Doctoral Program in Biomedical Engineering*, FEUP
	UPWIND – Portable, Clean and Affordable Electrical Energy for All **Manuel Fernandes**, *PhD Student, Doctoral Program in Electrical and Computer Engineering*, FEUP
	BodyBoost – Stop Injuries Before They Stop You **Ana Teixeira**, *PhD Student, Doctoral Program in Informatics Engineering*, FEUP
	Triple-Action Cutaneous Device for Skin Cancer Treatment **Rita Barros**, *PhD Student, Doctoral Program in Chemical and Biological Engineering*, FEUP
15h40 – 16h10 *FEUP Central Garden*	**COFFEE BREAK & POSTER SESSION & EXHIBITION**
16h10 - 17h00 *Main Auditorium**	**PLENARY LECTURE** *Chair*: **Miguel Madeira**, *Full Professor*, LEPABE/ALiCE, FEUP
	Leadership at the Intersection of Academia, Policy, and Development: Bridging Knowledge to Impact Society **Margarida Mano,** *Vice-Rector*, Universidade Católica Portuguesa (Former Minister of Education and Science, Portugal, 2015)
17h00 - 17h30 *Main Auditorium**	**AWARDS** *Chairs:* **Jaime Cardoso**, *Vice-Dean for Research and Doctoral Affairs*, FEUP **Francisco Vasques**, *Coordinator of FEUP's Special Project to Upgrade Doctoral Education*, FEUP
	Best Oral and Poster Communication (Per Symposium) *Science Communication* *Venture Scientists*

Tuesday, July 1st, 2025

	Sponsors
17h30 - 18h00 *Main Auditorium**	**CLOSING CEREMONY** *Chair:* **Jaime Cardoso**, *Vice-Dean for Research and Doctoral Affairs*, FEUP **Ana Maria Camanho**, *Vice-Rector*, University of Porto **Rui Calçada**, *Dean*, FEUP
18h00 – 21h00 *FEUP Central Garden*	**SOCIAL EVENT** **SUNSET**

**Main Auditorium: Auditorium Prof. Dr. José Marques dos Santos*

INVITED SPEAKERS

DCE25 General Programme

KEYNOTE LECTURE

Kay Tancock

*Executive Publisher, Chemical Engi*neering, Elsevier

Author Workshop: A Whistlestop Tour of Common Ethical Pitfalls of Well-Intentioned Researchers

The talk will walk the audience through the 'Top 10 Ethics Pitfalls of Well-Intentioned Researchers'. We will consider a number of typical items that honest researchers often get wrong, and how you can avoid them. The session looks beyond plagiarism and other intentional breaches in publishing ethics and examines some of the key pitfalls you may not have considered. The aim is to assist new authors by making their publishing journey as straightforward as possible and helping them to submit articles that will appeal to journal editors and reviewers. Join us for a half-hour countdown of everything you must *not* do if you want to get published!

Biography

Kay Tancock is the Executive Publisher overseeing a prestigious portfolio of Chemical and Environmental Engineering journals at Elsevier, including the *Journal of Environmental Chemical Engineering*, *Chemical Engineering Journal*, and *Chemical Engineering Science*. With 12 years of experience at Elsevier, she has managed journals across diverse subject areas, from geography to control engineering. Based in the UK office in Oxford, Kay is dedicated to supporting early career researchers and will be available at DCE25 to engage with attendees about their publishing aspirations. Her presentation will focus on essential best practices for ethically sound publishing, and she welcomes further discussions on all publishing and journal-related topics during the conference. Attendees are more than welcome to plan conversations with Kay regarding their research publication plans.

LIFE AFTER A PHD: WHAT CAN YOU DO?

Bruno Béu
Advisor to FCT's Board of Directors, FCT

Rui Munhá
Science Officer, FCT

Career Horizons for Early-Stage Researchers

Fostering high-quality research careers and broadening the diversity of career pathways – including through integrated approaches to collaborative, disciplinary, geographical and intersectoral mobilities – are key priorities for strengthening the competitiveness of research systems. Public policy has a critical role in shaping more inclusive, collaborative, and internationalised research ecosystems, and FCT has been translating these objectives into new and innovative approaches, in view of establishing an effective continuum between national and European frameworks. The relevance of career planning, investment in networking, or horizontal skills development and other capacity building initiatives, gains new momentum with the ongoing transformation of how research is assessed and the transition to a new paradigm of evaluation models. This presentation explores the present and future national, European and international funding schemes with particular emphasis on structured career planning and progression, mobility, and cross-sectoral collaboration. It also highlights models that support talent circulation, engagement with non-academic sectors, and institutional capacity-building to attract and retain researchers.

Biography

Bruno Béu holds a PhD in Philosophy from the University of Lisbon. His academic work focused on philosophy of language, literature, aesthetics and linguistics, and he has taught in several of these fields at the School of Arts and Humanities of the University of Lisbon. He was the principal investigator of an interdisciplinary research line in comparative studies, developed in collaboration with national institutions, and is the author or editor of two books and numerous articles and book chapters.

He has held various roles in science and research policy, including senior scientific officer for the Humanities and Social Sciences at the Evaluation Office of the Fundação para a Ciência e a Tecnologia (FCT), advisor to the Lisbon City Council in the field of education, and executive coordinator of the academic open access publishing house Imprensa de História Contemporânea.

He currently serves as advisor to the FCT Board of Directors in the areas of strategy and evaluation and is director of the ERC-Portugal programme. He is the national delegate to the ERC Programme Committee and to the OECD's Committee for Scientific and Technological Policy (CSTP), and the designated focal point for the Portuguese delegation to all OECD bodies in the field of STI. He also co-chairs the Portuguese National Chapter of the Coalition for Advancing Research Assessment (CNP-CoARA).

LIFE AFTER A PHD: WHAT CAN YOU DO?

Rui Munhá has been a Science Officer in the Department of International Relations of the Portuguese Foundation for Science and Technology (FCT) since 2014. He is currently Co-Coordinator of the National Contact Points of the European Programme for Research and Innovation Horizon Europe, and he also represents FCT and Portugal in different governing bodies in the context of the European Union or International Organisations. Rui Munhá obtained a PhD in Chemistry in 2011, and he developed his scientific activity at the University of Lisbon, University of British Columbia (Vancouver, Canada), University of California (Irvine, USA) and the University of Aveiro. Rui was born in Lisbon, in 1979.

João Lobo Ferreira

Head of Interface Mission, ANI

CoLABs and CTIs: A Catalyst for Doctorates and the Innovation Ecosystem

Collaborative Laboratories (CoLABs) and Centers for Technology and Innovation (CTIs) play a critical role in advancing doctoral research and fostering innovation. By bridging academia and industry, these institutions provide doctoral students with practical research opportunities, access to state-of-the-art infrastructures, and collaborative networks that drive knowledge transfer and economic growth. This presentation explores their impact, challenges, and future potential in the innovation ecosystem.

Biography

João Lobo Ferreira has been part of ANI since 2007. Since 2023, he has led the Interface Mission sub-unit, which focuses on supporting institutions that bridge academia and companies. Throughout his career, he has played a key role in monitoring the implementation of public policy measures to support R&D, business innovation, and capacity building of interface institutions. He holds a degree in Economics.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

REN's challenges of Energy Transition and Climate Change

REN – Redes Energéticas Nacionais is an exclusive TSO (Transmission System Operator) in Electricity and Gas Systems and 2sd largest gas DSO in Portugal, with 70-year track record as a leading energy infrastructure operator, with international presence. REN acts in accordance with the energy goals of the European Union and Portugal, helping the planet combat climate change to enable energy transition, without forgetting the security and quality of energy supply, the digitalization and innovation, and integrating new renewable capacity such as wind, solar and renewable gases. REN have a significant investment plan for 2024-27 1,5-1.7 B€ investment.

REN Award, specifically in the context of academia, is indeed one of the oldest scientific awards in Portugal. It was established in 1995 to recognize and encourage excellence in energy-related research among Master's and Doctoral theses in Portuguese higher education. REN will continue to foster internal people excellence, attract and retain talent.

Biography

Pedro Ávila
Director of Operational Sustainability, REN

Pedro Ávila is a seasoned executive with extensive experience in the energy sector, having worked at the three largest energy companies in Portugal. He currently serves as Director of Operational Sustainability at REN. With a degree in Mechanical Engineering, has strengthened his academic background with top-tier executive education, including an MBA from Porto Business School and the Advanced Management Program at AESE.

Throughout his career, he has led multiple national and international projects in both the gas and electricity sectors, consistently demonstrating strong expertise in project and operations management across various markets. His work is marked by a deep commitment to environmental responsibility and the mitigation of environmental impacts.

Beyond his professional life, Pedro is passionate about travel, music, design, and contemporary art. He strives to be an innovative leader, dedicated to team development and building a more sustainable future.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

Bridging knowledge and innovation: The role of the Alliance for the Energy Transition (ATE) Agenda in connecting industry, SMEs, and academia

This presentation explores the ATE Agenda's role in bridging industry, SMEs, and academia to accelerate the shift to sustainable energy. It focuses on how integrating highly qualified resources enhances innovation, research, knowledge transfer and the development of cutting-edge solutions. The presentation also addresses AAET's role in sustaining these partnerships after ATE funding.

Luís Seca

Director, AAET (Association Alliance for the Energy Transition)

Biography

Luís Seca is a senior researcher at the Centre for Power and Energy and member of the Board of Directors of INESC TEC. His research areas are distributed electrical resources integration (renewable based electricity generation, electric vehicles, storage, etc.) in distribution and transmission grids, dynamic analysis of electrical systems, smart grids and energy efficiency. Luís is also one of the Directors of AATE, an Association created to support the coordination, management and communication activities of the ATE Agenda, maximizing the value delivered and ensuring the success of ATE projects. AATE also aims to lay the foundations for an energy cluster, through a dynamic and competitive ecosystem for the energy transition.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

Bridging Science and Industry: Leading Upstream and Industrial Innovation at Galp

Galp's Upstream and Industrial Innovation Center focuses on developing new solutions to enhance Galp's core business, aiming to reduce carbon intensity in exploration and production activities. The center leverages advanced technologies to optimize operations and asset value, while also supporting the decarbonization of Galp's industrial assets by promoting low-carbon technologies. Collaboration with startups, academia, and technology partners ensures a market-oriented approach to innovation. Specific projects include the development of inspection tools for operations at depths greater than 2000 meters, intelligent well completion technologies, and advancements in low-carbon fuels, carbon capture, and carbon utilization.

Marco Ferraz
Head of Upstream and Industrial Innovation Center, Galp

Biography

After starting his career as a researcher in Portugal, **Marco Ferraz** moved to San Francisco to work as a visiting researcher at the USGS, in collaboration with NASA. In 2009, he relocated to Australia to pursue a PhD at the University of Sydney, where he also served as a lecturer at the School of Geosciences. Upon returning to Portugal in 2012, Marco joined Galp as a Geoscientist in Exploration and Production, contributing to some of the company's most prominent assets. Today, he leads the Upstream & Industrial Innovation Center at Galp, managing over 60 research, development, and innovation projects in Portugal and Brazil. These initiatives span oil and gas production, refining processes, and energy transition topics such as hydrogen, low-carbon fuels, carbon capture, utilization and storage (CCUS), and energy storage. Marco is also chairman of the board of the Net4CO2 collaborative laboratory and board member of Bioref.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

VORTEX-CoLAB: Turning Research into Impact

VORTEX-CoLAB bridges the gap between scientific research and real-world technology, focusing on cybersecurity, safety, and embedded systems — the core enablers of connected, autonomous technologies that shape how we live, move, and communicate. We bring together researchers, engineers, and industry partners to co-develop fast, practical solutions. Our projects combine applied research with hands-on prototyping, ensuring bold ideas are translated into tools companies can use. Students and PhD researchers are central to our work — not just observing, but contributing through thesis work, training, and active development. Through our affiliate program, companies gain early access to emerging technologies and help shape our innovation agenda. This model reduces risk, accelerates deployment, and keeps our work aligned with real-world needs. By advancing high-impact technologies, VORTEX is helping position Portugal as a relevant player in strategic sectors such as defense, semiconductors, and smart mobility — within Europe and beyond.

Biography

Joana Maria
Executive Director, Vortex-CoLAB

Joana Maria is Executive Director of VORTEX-CoLAB, a nonprofit collaborative laboratory focused on applied research in AI, cybersecurity, and embedded systems. With a PhD in Materials Science and Engineering from the University of Illinois at Urbana-Champaign, she brings over 20 years of experience across academia and industry, leading a team of nearly 40+ researchers and engineers developing safety and security solutions for next-generation cyber-physical systems in sectors such as mobility, aerospace, and critical infrastructure. Her career includes over a decade at IBM Research, where she co-founded the AI4Good Fellowship Program and led research initiatives spanning from fundamental science to commercial applications, including breakthrough work that contributed to the development of the world's first AI-designed fragrance. She holds 10 issued patents and has authored 27 peer-reviewed publications. A strong advocate for applied research with societal impact, she brings a systems-level perspective to building innovation ecosystems that connect science, industry, and policy.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

From Research to Innovation: Paralab Engineering as a Bridge Between Academia and Industry

Paralab Engineering has established itself as the partner of excellence in the development of customized, scalable and high-performance equipment. Over the last three decades, it has maintained a close and continuous collaboration with all research units, supporting researchers in the development of tailor-made solutions, from laboratory prototypes to semi-industrial equipment. This close link to research means not only the creation of technology adapted to the real needs of the academic and scientific world, but also success stories where the paths of the client and the company merge – as in the case of a researcher who, after completing his doctorate, joined the Paralab Engineering team.

Simão P. Cardoso
Product Manager, Paralab

Biography

Simão P. Cardoso holds an Integrated Master's Degree in Chemical Engineering (MIEQ) from FEUP (2005-2010) and a PhD in Chemical Engineering (Branch in Chemical Products and Processes Engineering) from the University of Aveiro. Since February 2021, he has been product manager at Paralab, a company that distributes scientific equipment for laboratory and industrial applications and is responsible for several international brands in this field in the North of Portugal.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

Águas do Douro e Paiva (AdDP) – a commitment to innovation, knowledge and transformative solutions

AdDP is the utility responsible for the bulk drinking water system that supplies 20 municipalities in the Porto region. The company foresees that present and future challenges require collaborative, innovative, and creative responses, which must also be anchored in knowledge. Having been created in 1995 – and celebrating its 30th anniversary – AdDP is a place of continuous evolution, where water continues to be an engine of progress, equity, and hope for future generations.

Jaime Gabriel Silva

Head of innovation area, Águas do Douro e Paiva S.A. and SimDouro S.A. (both AdP Group), Invited Teacher, ISEP

Biography

Born in Porto (1963). Civil engineer (FEUP / 1986); MSc (FEUP / 1997); currently, FEUP PhD student (PRODEC), in Asset Management field. He joined AdDP in 1998, where he was Engineering Director between 2000 and 2009, when he started management functions in the board of different Águas de Portugal Group companies, namely: Simlis (Leiria), Águas do Mondego (Coimbra), Simria (Aveiro), Águas do Centro Litoral (aggregated company of the former three) and Águas de Santo André. In 2020, he returned to AdDP, coordinating the innovation area for AdDP and SimDouro, as well as leading some enterprise projects. Before 1998, he worked at Fase (1991-98), at CICCOPN Laboratory (1991), at IBM (1989-90) and at Com. Coord. Região Norte (1987-89). Invited teacher at ISEP, since 1990.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

FIBRAN – What we do, challenges we face, and proximity with the academia

FIBRAN is a leading manufacturer of XPS insulation panels. In addition to standard products, we offer a wide range of custom shapes and tailor-made solutions to meet specific project needs. Our products are well-established in the construction industry, although some technical challenges remain due to the material's intrinsic characteristics. To address these, FIBRAN is actively collaborating with academic institutions to further study and improve its performance, while continuing to deliver effective solutions for specialized applications.

Luís Filipe Santos

Product Prescription and Technical Support, FIBRAN

Biography

Luís graduated in Civil Engineering from FEUP in 2013. He began his career as an Assistant Project Manager on construction sites, contributing to the development of a new school and the renovation of a luxury hotel. He then joined a furniture manufacturer, where he managed FF&E assembly teams in Belgium and Luxembourg. Within the same company, he later oversaw proposal management, coordinating with both technical and commercial departments. Moving on, he took on the role of supporting project prescribers—mainly architects—providing technical guidance throughout the design process. Currently at FIBRAN, Luís plays a key role in technical support for prescribers, closely aligned with marketing and production, contributing to the development of new products for new challenges.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

Ricardo Rato
Executive Director, HyLab

HyLab - Green Hydrogen Collaborative Laboratory

Presentation will introduce HyLab – the Collaborative Laboratory for Green Hydrogen – and its role in accelerating the development of innovative, science-based solutions for decarbonization. With a strong link between research and industry, HyLab contributes to the energy transition through applied R&D, technology integration, and support for industrial implementation.

Biography

Ricardo Rato is a Mechanical Engineer with a specialization in Energy from Instituto Superior Técnico (IST).
Passionate about Energy Transition and Innovation, he has built a career dedicated to helping companies navigate and lead in these transformative domains. His experience spans both national and international contexts, where he has successfully combined strategic consulting with hands-on research and development.
Over 15 years at the Welding and Quality Institute (ISQ), he progressed from Energy Consultant to Director of R&D and Innovation, leading high-impact projects and fostering cross-sector innovation.
Since September 2023, Ricardo has been serving as Executive Director of HyLab, where he continues to drive forward the hydrogen economy and clean energy solutions.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

Open Data, Open Innovation: The Experience of Creating E-REDES Open Data

The energy transition requires more than just technology — it demands collaboration. E-REDES Open Data was created as a sharing tool and serves as a mechanism for open innovation and collaboration between E-REDES and the community. In this pitch, I share the experience of developing this open data portal and real-world use cases by municipalities, mobility operators, and researchers. From planning charging networks to creating energy communities, data has become a tool for local action.

Luís Tiago Ferreira

Responsible for the Smart Cities, Public Lighting, and Open Data, E-REDES

Biography

With more than 20 years of experience, including the support office to the General and Supervisory Board of EDP, Regulation and Energy Policy, strategic consulting, and network engineering. Graduated in Electrical and Computer Engineering from Instituto Superior Técnico.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

Mónica Read

Projects and Works Engineer,
Águas e Energia do Porto

Room for PhDs in Companies? Here's what we think

At Águas e Energia do Porto, we believe PhDs bring unique value to the future of water management.
As we rise to the challenges of the green transition, we're turning our treatment plants into living labs. And we don't ask whether there's space for PhDs – we ask how far their knowledge can take us.
Innovation needs both generalists and deep specialists. And we welcome both.

Biography

Mónica Read works in the Wastewater Treatment Department at Águas e Energia do Porto, where she currently manages public works contracts and leads the department's involvement in R&D and innovation projects, including Horizon Europe initiatives.
With over 17 years of experience in process and electromechanical design for water and wastewater treatment plants, she has led or contributed to national and international projects across Europe and Africa during her time at Efacec.
She holds a pre-Bologna degree in Environmental Engineering from the University of Lisbon and an Executive MBA from the Católica Porto Business School.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

KPMG Incentives: What It's Like to Be a PhD in a Big4 Company

What happens when a researcher steps into the corporate world? In this talk, I'll share my journey from PhD to Consultant at KPMG Incentives, highlighting challenges, growth, and surprising overlaps. I'll also introduce KPMG and our R&D Incentives team, offering a glimpse into how academic skills can thrive—and drive impact—within a Big4 environment.

Joana Monte
R&D and Innovation Senior Consultant, KPMG

Biography

Joana Monte holds a PhD in Chemical and Biochemical Engineering from NOVA University Lisbon. She combines strong scientific knowledge with economic analysis skills. Following her PhD, Joana started her career pathway by working with companies, supporting them to obtain financial and tax incentives in Portugal. Specialized in guiding businesses to discover new growth opportunities, Joana supports companies in identifying and preparing applications for national funding programs. Over the past years, Joana accumulated expertise in the manufacturing industry, ICT, aerospace and automative sectors.

ROUND TABLE WITH COLABS, CTIS AND INDUSTRY: DRIVING INNOVATION, SHAPING THE FUTURE

Bridging Innovation Gaps: How INESC TEC Transforms PhD Excellence into Societal Impac

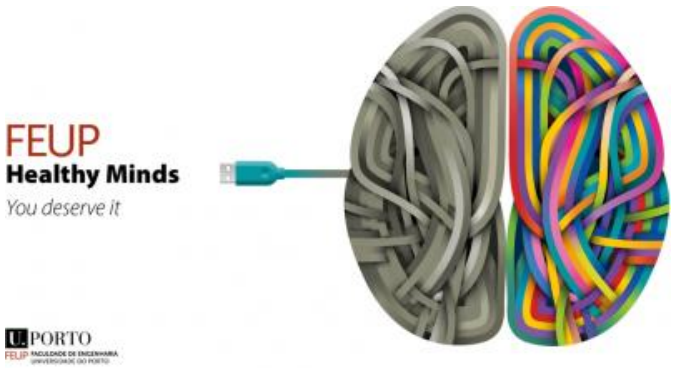
This presentation explores INESC TEC's core innovation challenges bridging our 8 research domains (AI, Computer Science, Communications, Power & Energy Systems, Robotics, Photonics, Bioengineering, Systems Engineering) with societal applications through TEC4 initiatives: TEC4INDUSTRY, TEC4ENERGY, TEC4HEALTH, TEC4AGRO-FOOD, and TEC4SEA. We showcase our collaborative academic model and comprehensive PhD integration strategy that develops tomorrow's leaders, demonstrating how our PhD graduates transition from university research to driving real-world societal impact.

Luís Seca
Member of the Executive Board,
INESC TEC

Biography

Luís Seca is a senior researcher at the Centre for Power and Energy and member of the Board of Directors of INESC TEC. His research areas are distributed electrical resources integration (renewable based electricity generation, electric vehicles, storage, etc.) in distribution and transmission grids, dynamic analysis of electrical systems, smart grids and energy efficiency. Luís is also one of the Directors of AATE, an Association created to support the coordination, management and communication activities of the ATE Agenda, maximizing the value delivered and ensuring the success of ATE projects. AATE also aims to lay the foundations for an energy cluster, through a dynamic and competitive ecosystem for the energy transition.

WORKSHOPS



Orientation and Integration Office – GOI

Fernanda Mendes and **Helena Lopes**

Psychologists, FEUPs GOI-Orientation and Integration Unit

Depression and Anxiety in PhD Students: Preventing Emotional Exhaustion and Burnout

Program:

1. Depression and anxiety: what is it and what are its most common issues
2. Mental Health and Well-Being: tips to deal with worry, rumination, distress and emotional exhaustion

Biography

Fernanda Mendes is Psychologist at Faculdade de Engenharia da Universidade do Porto – Orientation and Integration Office Master Degree and First Degree in Psychology (Faculdade de Psicologia e de Ciências da Educação da Universidade do Porto). Full Member of the Portuguese Board of Psychologists. Specialty College of the Portuguese Board of Psychologists: General Specialty in Clinical and Health Psychology; Advanced Specialty in Psychotherapy.

Helena Lopes is Psychologist at Faculdade de Engenharia da Universidade do Porto – Orientation and Integration Office. PhD in Educational Sciences (Faculdade de Psicologia e de Ciências da Educação da Universidade do Porto). First Degree in Psychology (Faculdade de Psicologia e de Ciências da Educação da Universidade do Porto). Post-graduation studies: a) Motivation Psychology (Faculdade de Psicologia e de Ciências da Educação da Universidade de Coimbra); b)Training Systems Assessment (Faculdade de Psicologia e de Ciências da Educação da Universidade do Porto). Full Member of the Portuguese Board of Psychologists. Specialty College of the Portuguese Board of Psychologists: General Specialty in Educational Psychology.

WORKSHOPS

João Henrique Almeida

Psychologist, FEUP Talent Unit

My Carrer with a PhD: to Open UP or Close a Gap

Program: FEUP Talent Unit is responsible for promoting the interaction between students and companies at the academia and the management of Alumni relations. One of our main goals is to promote different projects and initiatives to help students and graduates develop or enhance their skills. With this session you'll have the opportunity to get to know some of the projects that are being held by FEUP Talent Unit, namely some specific projects specifically designed for PhD students. Also, at this session you will have the chance to have a moment to think about where your PhD is as part of your career path and life design.

- What can I do with it?
- Is this a step to open up, or am I looking to close a gap?
- Do I need a plan B?

Biography

João Henrique Almeida is Psychologist, 33 years old and born in Viseu – a small city in the heart of Portugal. Working at the Faculty of Engineering of University of Porto, certified in career management and holding a master in Clinical and Health Psychology from University of Aveiro as well as a specialization in advanced coaching from University of Porto. Experienced trainer in topics such as career design, personal and professional development, leadership, communication, among others.

WORKSHOPS

La Caixa: Funding Opportunities

The objectives of the session are to inform the audience about the different funding opportunities that the "la Caixa" Foundation offers through its various Fellowship Programmes, which cover the entire path of a researcher (undergraduate, postgraduate, PhD, and postdoctoral research) and highlight their main features. The workshop will focus on explaining the range of benefits that the programmes offer: financial support, training programmes on transversal skills, and networking opportunities. What does it mean to be a "la Caixa" Foundation fellow? One Doctoral INPhINIT fellow and one Junior Leader fellow will share their experiences with the audience.

Topics Covered:

- Postgraduate abroad fellowships programme
- Doctoral INPhINIT fellowships programme
- Postdoctoral Junior Leader fellowships programme
- Other funding opportunities
- Q&A.

Gisela Calders

Doctoral Fellowships Programme Manager, Fundació "la Caixa"

Biography

Gisela Coromines holds a bachelor's degree in Chemical Engineering (Universitat Politècnica de Catalunya, UPC), a bachelor's degree in Art History (Universitat de Barcelona, UB) and a master's degree in Humanities (Universitat Oberta de Catalunya, UOC). She has long experience in research management and funding. She joined the "la Caixa" Foundation in 2017 where she is part of the Research Fellowships programmes team.

WORKSHOPS

The ERC and the ERC-Portugal Programme: How Preparation Meets Opportunity

The European Research Council (ERC) plays a pivotal role in enabling breakthrough research and fostering scientific leadership across all fields. This session focuses on the career development opportunities provided by the various ERC funding schemes and illustrate how these contribute to establishing independent research trajectories. It will also present the ERC-Portugal programme, launched by FCT as a national initiative to strengthen Portugal's participation in the ERC. The programme offers targeted support to researchers at different career stages and is structured around three complementary pillars:

ERC-PT Pre-Assessment – an innovative initiative that offers peer-review services through an Annual College of Reviewers composed exclusively of former ERC panel members, aiming to improve the quality and success rate of ERC proposals;

ERC-PT A-Projects – a scheme that funds the early development of top-rated but unfunded proposals, helping prepare for future ERC resubmissions;

ERC-PT Careers – a programme that promotes the recruitment and long-term integration of ERC grantees in Portuguese institutions, through attract-and-retain mechanisms.

Together, these mechanisms create a coherent national strategy that enhances researcher competitiveness, reinforces institutional capacity, and aligns with broader goals for research excellence and talent attraction. The session will explore synergies between European and national instruments and offer practical guidance for navigating the ERC landscape.

Rui Munhá
Science Officer, FCT

Biography

Rui Munhá has been a Science Officer in the Department of International Relations of the Portuguese Foundation for Science and Technology (FCT) since 2014. He is currently Co-Coordinator of the National Contact Points of the European Programme for Research and Innovation Horizon Europe, and he also represents FCT and Portugal in different governing bodies in the context of the European Union or International Organisations. Rui Munhá obtained a PhD in Chemistry in 2011, and he developed his scientific activity at the University of Lisbon, University of British Columbia (Vancouver, Canada), University of California (Irvine, USA) and the University of Aveiro. Rui was born in Lisbon, in 1979.

WORKSHOPS

Bruno Béu

Advisor to FCT's Board of Directors, FCT

Biography

Bruno Béu holds a PhD in Philosophy from the University of Lisbon. His academic work focused on philosophy of language, literature, aesthetics and linguistics, and he has taught in several of these fields at the School of Arts and Humanities of the University of Lisbon. He was the principal investigator of an interdisciplinary research line in comparative studies, developed in collaboration with national institutions, and is the author or editor of two books and numerous articles and book chapters.

He has held various roles in science and research policy, including senior scientific officer for the Humanities and Social Sciences at the Evaluation Office of the Fundação para a Ciência e a Tecnologia (FCT), advisor to the Lisbon City Council in the field of education, and executive coordinator of the academic open access publishing house Imprensa de História Contemporânea.

He currently serves as advisor to the FCT Board of Directors in the areas of strategy and evaluation and is director of the ERC-Portugal programme. He is the national delegate to the ERC Programme Committee and to the OECD's Committee for Scientific and Technological Policy (CSTP), and the designated focal point for the Portuguese delegation to all OECD bodies in the field of STI. He also co-chairs the Portuguese National Chapter of the Coalition for Advancing Research Assessment (CNP-CoARA).

SCIENCE COMMUNICATION | Hackathon Program

António Coelho
Associate Professor, DEI/ FEUP

Hackathon Program

Goals: Science communication is a very relevant competence for researchers, promoting greater impact, relevance and innovation. More specifically:

- Develop Real Solutions: Create prototypes that help companies communicate effectively with different audiences, particularly at stands, fairs or events.
- Bringing the Academic Community and Companies Closer Together: Fostering collaboration between doctoral students and company professionals, establishing bridges for sharing knowledge and innovation.
- Train and Inspire: Provide an intensive learning, teamwork and networking experience where participants will have access to expert mentors who will support the development process.
- Promote the Doctoral Symposium: Integrate the best projects and teams into the Doctoral Symposium program, reinforcing the connection between academia, research and the business sector.

Biography

Associate Professor with Habilitation at the Department of Informatics Engineering, Faculty of Engineering (FEUP), University of Porto (UP), director of the Doctoral Program in Digital Media at the University of Porto and academic leader of the EUGLOH European University Alliance.
Senior Researcher at the Center for Human-Centered Computing and Information Science (HumanISE) of INESC TEC with research interests in the areas of Computer Graphics, Extended Reality, Serious Games, and Accessibility.

SCIENCE COMMUNICATION | Five-Minute for 3 Teams of PhD Students

Team 1 – ***Dino e a Cadeia da Vida***

Dino e a Cadeia da Vida is an educational game for children aged 8 to 12, designed to promote sustainable habits in a playful and effective way. Dino, a dinosaur who has traveled through time, discovers that the future of humanity is threatened by environmental destruction, caused by humans themselves! Determined to prevent life on Earth from suffering the same fate as his species – extinction – he mobilizes children to encourage sustainable habits on the planet. Through three interactive mini-games based on the 3 R's (Reduce, Reuse, Recycle), players face real environmental challenges. With the guidance of Dino and his friends Kiki (the turtle), Akua (the blue whale) and Vinee (the polar bear), each action transforms the the game and the planet itself. In the end, the positive impact of the children's choices makes it possible to divert the course of the meteor from extinction, reinforcing the message that small actions generate big changes.

– Project Description
– Logo
– Poster
– Team Photo

The Meteorite Busters

- Ana Camarinha – Idea and Sketching
- Jorge Ferreira – Game Development
- Raushan Mukhamejanova – Idea and Sketching
- Rosana Oliveira – Narrative

SCIENCE COMMUNICATION | Five-Minute for 3 Teams of PhD Students

Team 2 – ***Time Travelers***

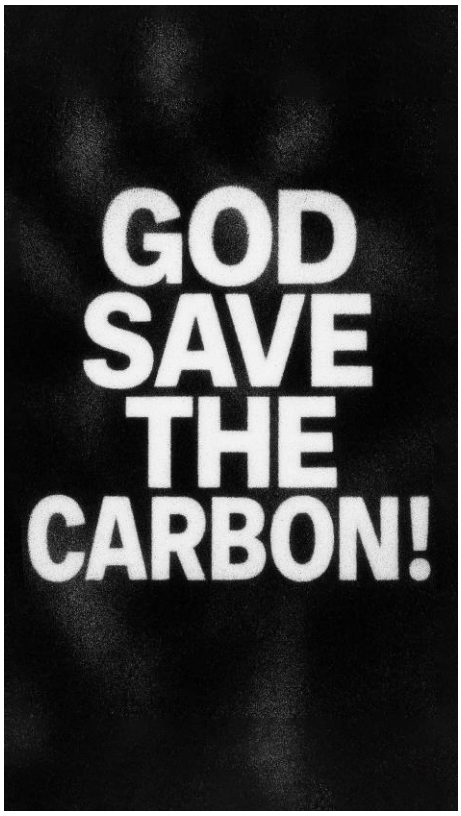
Time Travelers is a mobile application designed to transform the way tourists experience the city of Porto. It offers an immersive, user-centered journey through historical landmarks using geolocation, image recognition, and soundscapes. By simply pointing their phone at a monument or taking a selfie with it, users are instantly immersed in rich, verified historic
al content drawn from credible sources. With personalized routes and real-time notifications, the app enables users to explore at their own pace, avoiding crowded tours and unreliable information. It combines storytelling, cultural authenticity, and digital innovation to deliver a memorable and educational experience — ideal for tourists like Ashley, seeking depth, authenticity, and convenience.

– Project Description
– Logo

Team

- Ana Cristina (organization, creation)
- Bárbara Bender (organization, creation)
- Diana Sousa (website, app)
- Jadna da Cruz (website, app, gps, image recognition)
- Miguel Guimarães (website, app, gps, image recognition)

SCIENCE COMMUNICATION | Five-Minute for 3 Teams of PhD Students



Team 3 – ***God Save the Carbon***

Carbon emission levels are steadily rising, as is the average global temperature. Also, evidence shows that "greening education" and "green skills" are increasingly necessary. This project aims to encourage behavioral change among Gen Z FEUP students and raise awareness about sustainable transportation habits. Combining self-reported routines with gamified learning, we create a simple yet effective system to nudge users toward more eco-conscious decisions based on the Self-determination Theory and the Fogg Behavior Model. The "God Save the Carbon" app, designed with an eco-punk style, is simple, fast, shareable, educational, and career-worthy. Users can log their daily transportation eco-choice, take quick quizzes (learning through micro-challenges), and be awarded badges and LinkedIn certificates. There are two punctuation mechanisms. One is related to the user's transportation habits, where the points are measured in comparison to the CO2 emission of a standard fuel car, which is reflected in the user's avatar evolution. The other concerns the user's correct answers to the daily quizzes, allowing them to unlock new levels and gain badges and shareable certificates.

– Project Description
– Logo

Atomic

- Elizaveta Osipovskaya – Storytelling Wizard
- Fernando Osório – Calculations
- Mariam Conceição – Sparkler
- Priscila Reinaldo – PR Developer
- Sebastião Ventura – Researcher
- Safa Vakili – UI Magician

VENTURE SCIENTISTS

Carrie Baptist

Chief Strategy Officer, Conception X

What is Conception X?

Conception X empowers PhD students to become Venture Scientists – PhD founders who bridge the gap between academia and industry. Whether you're already working on a startup or interested in learning how to translate and commercialize your research, our program supports accelerating your understanding of entrepreneurship.

Biography

Carrie is Chief Strategy Officer of Conception X, Europe's largest PhD deeptech venture programme. Conception X works with PhD scientists from 65+ Universities across Europe, providing a large cross-University platform for PhD founders, unlocking innovations from the lab and accelerating early stage research commercialisation.

Joana Loureiro

Assistant Professor, LEPABE/ALiCE, FEUP

A Success Case: FTNanoAD-Targeted-Nanocarriers for Brain Diseases

BNanoTech, Inc. was founded on 02/03/2025 by Joana Loureiro and Maria do Carmo Pereira. The company's technology originated from research conducted at the Laboratory for Process Engineering, Environment, Biotechnology and Energy (LEPABE), thus reinforcing the company's strong connection with FEUP. The company develops controlled release systems for transporting drugs to the brain. The target market of BNanoTech, Ltd. includes pharmaceutical and biomedical industries interested in advanced therapies for neurodegenerative diseases, with potential for strategic partnerships and commercialization at national and international levels. Our participation in the Conception X program resulted directly in XTX Ventures proposing a £100,000 investment in our technology, which led to the faster creation of BNanoTech.

Biography

Joana A. Loureiro is an Assistant Professor at the Faculty of Engineering of the University of Porto (FEUP) and a senior researcher at the Laboratory for Process Engineering, Environment, Biotechnology, and Energy (LEPABE). She earned her Ph.D. in Chemical and Biological Engineering from the University of Porto. Her research focuses on nanotechnology, particularly the development of functionalized nano-drug delivery systems for therapeutic applications, studies on amyloidogenic peptides, and the design of nanoparticles targeting the blood-brain barrier. She is/was involved in several projects (>17) for developing nanoengineered structures for the controlled delivery of bioactive molecules and has been in active collaboration with several national and international research groups. Dr. Loureiro has contributed to numerous scientific publications in these fields and supervised over 25 PhD and Master's students.

VENTURE SCIENTISTS

Raphael Stanzani
Entrepreneurship Programs Manager, UPTEC

School of Startups at UPTEC

At the School of Startups, UPTEC – Science and Technology Park of the University of Porto offers dedicated programs that support different innovation pathways for entrepreneurs, researchers, students, and corporations. It's a 3-month business idea acceleration program that provides the boost your idea needs to thrive. With 90+ hours of intensive hands-on training and personalized mentorship from industry experts, this program will help you validate your idea within the market.

Biography

Raphael, the Entrepreneurship Programs Manager at UPTEC, designs and executes startup acceleration workshops to transform innovative ideas into sustainable businesses that can scale and attract investment. He graduated from UFSCar (Brazil) with an MBA from Quantic School of Business (US). Has experience as Supply Chain Projects Manager at Procter & Gamble in Brazil and Territory Sales Manager for the Oral-B brand at Procter & Gamble Portugal. He also co-founded Connect Robotics, a drone delivery startup that received funding from ESA and EU. The startup was incubated at UPTEC, accelerated by Carnegie Mellon University, and a spin-off from the University of Porto.

Bruno Azevedo
CEO, AddVolt

A Success Case of a Spin-Off FEUP: AddVolt

AddVolt is a technological company that developed the world's 1st plug-in electrical system targeted for transportation markets. With our technology, refrigeration trucks can perform their cold operation in electric mode, reducing diesel dependence, the level of noise, and CO2 emissions.

Biography

Bruno is the CEO and co-founder of AddVolt, the powerhouse that developed the world's first solution to replace the 4.5 million diesel engines used in refrigerated transport. He and his three co-founders have been dedicated to this innovative project since their university days. During the past ten years, he has also honed his commercial acumen, propelling Addvolt to the forefront of sustainable transport technology. Bruno holds a Master's in Electrical Engineering from FEUP – University of Porto. He further enhanced his expertise by completing a business and management program at Carnegie Mellon University. In recognition of his achievements, Bruno was honoured by Forbes in 2020, being named to the 30 Under 30 list in the Manufacturing & Industry category.

VENTURE SCIENTISTS | Five-Minute Pitch for PhD Students

Amir Hossein Farzamiyan

PhD Student, Doctoral Program in Telecommunications, FEUP

LogIoTrix, Smart Inventory Management

LogIoTrix is a smart inventory management system that uses connected sensors to monitor stock levels automatically. The data is sent to the cloud, where it's analyzed using AI to predict demand and optimize inventory. This allows businesses to make faster, data-driven decisions, reduce waste, and ensure the right products are always available—without relying on manual tracking.

Luiza Sena

PhD Student, Doctoral Program in Environmental Engineering, FEUP

FertiGo – Wastewater in. Fertilizer out.

Compact and automated system for the recovery of nutrients from wastewater. It works by mixing wastewater rich in nutrients with chemicals to produce solid fertilisers. The entire process takes place in a small (< 1 m3) transportable unit that can be moved between plants as needed. This portable unit incorporates patented technology characterised by an efficient mixing mechanism which significantly increases heat and mass transfer in continuous mode. This enables precise control of the physical and chemical properties of the resulting fertiliser.

VENTURE SCIENTISTS | Five-Minute Pitch for PhD Students

Rita Martins

PhD Student, Doctoral Program in Chemical and Biological Engineering, FEUP

Inês Freitas

PhD Student, Doctoral Program in Chemical and Biological Engineering, FEUP

EcoWires – Plastic-free smart packaging

EcoWires offers a new printing technology for flexible electronic circuits, taking advantage of abundant, affordable and renewable sources, unlike conventional electrical conductors. A conductive ink made of carbon nanoparticles is printed inside the final substrate, a transparent cellulose film, avoiding the need for an extra insulation layer deposition. Using EcoWires technology, we are developing plastic-free smart packages with chipless RFID antennas integrated during the manufacturing process. With EcoWires, businesses can embrace the IoT era sustainably, providing distributors and retailers the dual benefit of a reduced carbon footprint through plastic-free packaging and enhanced profitability by enabling advanced product tracing and improved consumer engagement.

Joana Cerqueira

PhD Student, Doctoral Program in Biomedical Engineering, FEUP

MyKneeRecovery – Precision Monitoring for Better Rehabilitation

MyKneeRecovery is an innovative system that helps to monitor a patient's knee recovery after surgery by providing accurate, real-time data on movement and muscle activity. It includes wearable sensor-embedded stockings equipped with motion sensors (IMUs), temperature sensors, and EMG sensors that track how the knee is moving and how the muscles are working during rehabilitation exercises. The system also features a 3D thermal imaging tool that captures the shape and temperature of the knee to assess inflammation and healing. All this information is sent to a mobile app, where patients and clinicians can easily view progress, detect problems early, and adjust recovery plans as needed. Unlike traditional systems, MyKneeRecovery is portable, affordable, and easy to use at home or in a clinic, making recovery monitoring more objective and available to more people.

VENTURE SCIENTISTS | Five-Minute Pitch for PhD Students

Manuel Fernandes

PhD Student, Doctoral Program in Electrical and Computer Engineering, FEUP

UPWIND – Portable, Clean and Affordable Electrical Energy for All

UPWIND is developing a portable wind-powered generator based on Airborne Wind Energy (AWE) technology. The core of the technology is a fixed-wing drone (resembling a kite) that is tethered to a ground station by a cable. This cable winds around a rotating drum connected to an electric generator. As the drone flies at high altitudes (200-300m) where winds are stronger and more consistent, it harnesses wind energy, causing the cable to unwind and turn the drum, thus generating electricity. Once the cable fully extends, the generator retracts it, and the cycle repeats. A key innovation of UPWIND is its unique automatic Circular Take-Off and Landing (CTOL) system, which allows for fully autonomous operation without sacrificing efficiency.

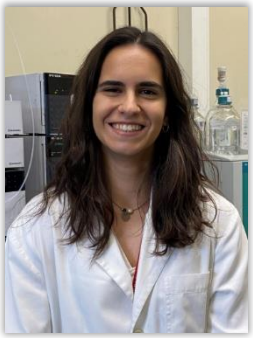
Ana Teixeira

PhD Student, Doctoral Program in Informatics Engineering, FEUP

BodyBoost – Stop Injuries Before They Stop You

BodyBoost is a discreet, smart wearable worn on the lower back that continuously monitors posture and movement throughout the day. It quietly detects when someone starts falling into poor postural habits and responds instantly with a gentle vibration, just enough to prompt a quick, natural correction without interrupting their work. What sets BodyBoost apart is how it turns these moments into meaningful insights. Workers can track their own progress through a simple mobile app, helping them build better habits over time. At the same time, employers can access anonymised team-level data that highlights broader trends and risks, allowing for safer work environments without compromising individual privacy. Designed to be practical for everyday use, BodyBoost fits seamlessly into any routine, offering real-time support and long-term improvement, without adding complexity.

VENTURE SCIENTISTS | Five-Minute Pitch for PhD Students



Rita Barros

PhD Student, Doctoral Program in Chemical and Biological Engineering, FEUP

Triple-Action Cutaneous Device for Skin Cancer Treatment

The proposed technology is a skin patch designed to treat skin cancer in a targeted and non-invasive way. It works like a glucose monitor, but instead of tracking blood sugar levels, it triggers photo and biocatalytic reactions that can harm the tumour cells when exposed to light. The patch is composed of three main components:

- Graphitic Carbon Nitride (GCN): A metal-free semiconductor activated by visible light that can generate toxic radicals to kill cancer cells.
- Glucose Oxidase (GOx): An enzyme that consumes glucose from the tumour microenvironment, starving the cancer cells of essential nutrients and producing hydrogen peroxide as a by-product.
- Haemoglobin (Hb): An iron-containing protein found in red blood cells that helps convert hydrogen peroxide into highly reactive species (through Fenton reactions) that can destroy cancer cells.

When the patch is applied to the skin and exposed to light, it simultaneously activates three powerful therapies, all at once: Photodynamic Therapy (PDT), Chemodynamic Therapy (CDT) and Starvation Therapy (ST). These therapies deliver precise, effective, and localised cancer treatment with minimal harm to healthy tissue.

PLENARY LECTURE

Margarida Mano
Vice-Rector, Universidade Católica Portuguesa

Leadership at the Intersection of Academia, Policy, and Development: Bridging Knowledge to Impact Society

In the fast-paced world we live in, where uncertainty and unpredictability make context and its complexity more evident, solving society's new (old) problems seems more challenging than ever. Yet, how is that so? It is true that the interconnections between problems are now clearer and denser. It's also true that the development of new approaches is always slower than reality. But something new is the awareness that, more than ever, solutions must respond to seemingly contradictory tensions. How can one, by specializing, strive to gain more breadth and still be a generalist? In society, as in the markets, how can we create space for fantasy and creativity in a world of hierarchies? To what extent does critical freedom strengthen scientific or political leadership?

In this lecture, we will look at some ways of helping to balance these tensions. This is the case with knowledge and the role of academic freedom in its development. This is the case of interdisciplinarity and the potential for effective dialog between fields and experts. It's the case of a liquid society where people, audiences, actors and influencers attract each other and move around. It's the case of researchers who, with their knowledge, determine scientific impacts and drive real changes in society.

Biography

Margarida Mano with a PhD in Management from the University of Southampton, she is currently Vice-Rector for Continuous Improvement and Development at the Universidade Católica Portuguesa and President of the Board of TI-Portugal, the Transparency and Integrity Association. She is also Chairwoman of the General Assembly of FORGES (https://aforges.org/) and a member of the Supervisory Board of the Order of Engineers. Minister of Education and Science in the XX Government of the Republic (2015) and Member of the Portuguese Parliament, in the XIII Legislature, with responsibilities in the areas of Education, Higher Education, Science, Culture, Communication, Youth and Sport, and represented the Portuguese Parliament in the Parliamentary Assembly of the Union for the Mediterranean, where she chaired the Committee on Economy, Finance, Social Affairs and Education. She has been Vice-Rector of the Portuguese Catholic University since 2020. Until 2015 has held management positions in Banking and at the University of Coimbra as Vice-Rector, Pro-Rector and Administrator. Professor at the Faculty of Economics of the University of Coimbra since 1986 in the areas of Economics and Management. Strategic Management (prospective analysis, scenario), Change Management, Quality and Governance Models stand out as areas of scientific interest.

Symposium on Environmental Engineering

SESSION I | ROUND TABLE

Ruben Jorge
Co-Founder & Chief Scientist, AST | WeDoTech | CarbonBlue

AST - Our Journey through the Treatment of Complex Waters and Future Challenges on Water-Reuse, Contaminants of High Concern and Nutrient Recovery

At AST, we've focused on engineered solutions for complex waters, with special emphasis on leachate treatment units that combine multiple membrane technologies. This presentation highlights our progress in tackling micropollutants, particularly pharmaceuticals, water reuse strategies, nutrient recovery and PFAS removal together with enabling critical partnerships and skilled human resources, which reflects AST's commitment to anticipating the next generation of environmental challenges.

Biography

Ruben's portfolio includes several technology-based business projects he has founded and currently leads, whose common goal is to provide the market with innovative solutions/technologies capable of responding to increasingly current sustainability trends: Circularity, Digitalisation & Neutrality. After graduating in Microbiology from ESB-UCP (1996), he continued his academic training in London at Imperial College, where he obtained a PhD in Chemical Engineering (2000), focusing on the optimisation of biotechnologies under dynamic treatment conditions. He pursued his research career through postdoctoral work (2001–2006) carried out between London (Imperial College) and Porto (ESB-UCP). In 2006, he founded WEDOTECH – a specialised technical consultancy company nationally recognised for its Research, Development and Innovation activities in the Agro-Food, Water and Environment, and Blue Economy sectors, among others. In 2023, he co-founded CarbonBlue, an impact-driven blue economy company developing innovative solutions focused on the conservation and sustainable use of wild macroalgal resources.

SESSION I | ROUND TABLE

António Rodrigues
R&D Manager, VentilAQUA

Challenges in the Water Sector: Wastewater, Innovation, and Technology

The presentation "Challenges in the Water Sector: Wastewater, Innovation, and Technology" will address the key challenges facing the water sector, from increasing pressure on water resources to tightening regulatory and environmental requirements. It will explore the evolution of innovative technological solutions, with particular focus on the complementary roles of industry and academia in developing effective responses. Drawing on the experience of VentilAQUA and its national and international academic collaborations, the presentation will showcase concrete examples of how knowledge transfer and collaborative innovation can transform research into applied and industrialized solutions with tangible, measurable impact.

Biography

António Rodrigues holds a degree in Chemical Engineering from the University of Coimbra and joined VentilAQUA at the end of 2006, a company operating in the field of industrial wastewater treatment and valorization. Initially working in a technical on-site role, he gained experience and insights that enabled him to develop new products and processes aimed at addressing gaps in the water sector market. He is currently the Innovation Manager at VentilAQUA, leading innovation projects with a strong focus on balancing fundamental research with industrial application, thereby driving value creation.

SESSION I | ROUND TABLE

Miguel Leal

Senior Technician (Biologist, M.Sc.),
Direcção de Águas Pluviais e Ambiente de Águas de Gaia, E.M.S.A.

Closing the Loop: Intelligent Water Use Across Urban and Natural Systems

This presentation explores intelligent water use within the urban and natural water cycles, with a focus on rainwater harvesting and sustainable management. It highlights the challenges and opportunities of integrating stormwater into city systems through nature-based solutions. Using Vila Nova de Gaia as a case study, it showcases real-world applications that enhance resilience and resource efficiency. The approach aligns with circular economy principles and climate adaptation strategies. It advocates for cities that work with, not against, the natural water cycle.

Biography

Biologist with a B.Sc. in Aquatic Sciences by the Instituto de Ciências Biomédicas de Abel Salazar, University of Porto, post-graduated in Spatial Planning by Fernando Pessoa University; and M.Sc. in Forestry Resources Management by the University of Trás-os-Montes e Alto Douro. Did scientific research at the University of British Columbia, Vancouver, Canada, and worked for Parks Canada (Glacier National Park, British Columbia, Canada). Environmental Educator at the Centro de Educação Ambiental das Ribeiras de Gaia, Vila Nova de Gaia.

SESSION I | ROUND TABLE

Vincenzo Rocca

Areas Sales Manager, Lutz-Jesco

Legislation in Portugal, and Best in Class Solutions to Disinfect Lowering Operational Cost and Bioproducts in Drinking Water System

Legislation in EU has now become more demanding, Portugal is adapting to new legislation (69/2023) and aim of this presentation is to explain key point of disinfection, biocides, and technologies. Thus, allow consultants and user to design and operate in respect of 69/2023, in the best possible way (securely, safely, economically).

Biography

Graduated in Process Chemical Engineering in Italy, member of the Engineering Order association in Portugal (OE, 51231), specialist in water treatment and disinfection solutions. He is involved in several training sessions related to water treatment, and Legionella, in OE among others, in the new CS04 (next press release is expected by end of 2025), others. After a long experience in R&D and process in industrial groups as Pirelli, Tupperware, and others, since 2010 he is experienced the water treatment sector: Regional responsible for disinfection in Grundfos, coordinating Europe, Africa, the Middle East and Russia; Regional responsible for on-line spectrometry in drinking water quality in s::can, for Portugal, Baltic, Balkans, Central-Eastern Europe, Russia, Brazil, Israel. Since 2023, responsible for Lutz-Jesco in Portugal. A German group with cutting-edge technology for chemical pumping and water disinfection systems. He is consolidating group presence in Portugal and Spain, sharing innovative solutions and technologies.

SESSION II | KEYNOTE LECTURES

Nuno Brôco
Chairman & CEO, Águas do Tejo Atlântico

Urban Wastewater Directive Revision: Evolution or revolution?

The new revision of the Urban Wastewater Directive aims to strengthen the regulation of wastewater treatment across the EU by setting stricter limits on pollutant discharge and expanding the scope to cover more urban areas and sensitive ecosystems. This revision presents significant challenges for wastewater utilities, including the need for upgrading infrastructure to meet tighter standards, increased operational costs, and the integration of advanced treatment technologies. Additionally, utilities must improve monitoring and reporting systems while balancing sustainability goals and regulatory compliance, all within often limited budgets and evolving climate conditions.

Biography

Nuno Brôco is the Executive Chairman of Águas do Tejo Atlântico, the AdP group largest company on wastewater management. He´s also Vice President of Water Europe. Previously he was Chairman and CEO of AdP VALOR, the AdP Group company responsible to foster innovation, digital transition and circular economy. During 11 years he has been Head of the Engineering Department of Águas de Portugal Group shared Services Company, promoting partnerships with academia, public utilities and the private sector, applications to both national and international founding instruments and coordinating several R&D projects. He starts his career with SUEZ Group, as specialist in water and wastewater treatment processes, then as Head of the Degrémont Portugal Production Department and finally as Degrémont Iberia Country Manager for Portugal.

SESSION II | KEYNOTE LECTURE

Daniel Ettlin

General Manager - CEO, Unicam Sistemas Analíticos

Advanced Environmental Control Technologies: State of the Art Integrated Analytical Solutions for Emerging Contaminants

We will outline state-of-the-art technologies to enable the detection, characterization, and quantification of both known and unknown pollutants, in order to empower regulators, researchers, and industries with actionable data to support protection and remediation. About Microplastics, utilizing Micro-FTIR (Fourier Transform Infrared) imaging technology, we provide a powerful solution for the automated identification, classification, and quantification of microplastic particles down to 10 µm in size, on a simple to use designed workflow.

In parallel, we address the global concern surrounding PFAS, referred to as "forever chemicals". Using triple quadrupole LC-MS/MS, we instroduce a validated workflow for the targeted analysis of regulated PFAS compounds in complex environmental matrices. But beyond regulated pollutants, environmental systems are being contaminated with unknown or new-generation chemicals. To confront this challenge, we leverage Orbitrap-based high-resolution mass spectrometry for non-targeted screening and suspect analysis. The Orbitrap platform provides exceptional mass accuracy, resolution, and dynamic range, allowing researchers to discover and characterize previously unmonitored contaminants. This includes the identification of transformation products, new industrial chemicals, and emerging threats before they become widespread. Furthermore, we address Persistent Organic Pollutants (POPs) such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and dioxins, which continue to pose environmental and health risks decades after their use has ceased. Advanced GC- and LC-Orbitrap methods are employed to ensure both targeted and non-targeted detection of these highly toxic compounds, supporting both retrospective analysis and real-time surveillance of contamination hotspots. Finally, the role of heavy metals and metalloid pollutants in environmental degradation and human health risks is analyzed through Inductively Coupled Plasma Mass Spectrometry (ICP-MS). This includes applications in remediation research, where ICP-MS is employed for trace metal quantification, isotopic fingerprinting, and source tracking in soil, sediment, and groundwater. Our approach supports the evaluation of remediation strategies by delivering accurate, high-throughput metal data necessary for risk assessment and regulatory compliance. This holistic presentation integrates these technologies into a unified environmental control strategy, tailored for both academic research and regulatory implementation. By combining targeted and non-targeted approaches, high-throughput analysis, and molecular-level detection, we present a vision for the future of environmental monitoring—one that is proactive, data-rich, and capable of keeping pace with the evolving landscape of chemical pollution.

Biography

Currently CEO of UNICAM PORTUGAL, he has over 35 years of experience in analytical instrumentation, leading strategic expansion in Portugal, Spain, and Latin America. Known for promoting innovation and operational excellence, he collaborates closely with academia and industry. His deep technical expertise supports consistent growth and a strong company reputation. Passionate about new technologies, he focuses on creating sustainable opportunities across the scientific, academic, and industrial sectors.

SESSION II | KEYNOTE LECTURE

Félix Hernandez

Full Professor, Research Institute for Pesticides and Water, University Jaume I, Castellón, Spain

Mass Spectrometry-Based Strategies for Monitoring Organic Micropollutants in Wastewater. Essential Role of Analytical Chemistry in Wastewater Treatment & Regulation

The occurrence of organic micropollutants (OMPs) in the aquatic environment is a well-established and extensively documented issue. The vast diversity of OMPs, with a broad range of physicochemical properties, together with the presence of numerous transformation products (TPs) and metabolites in environmental matrices, poses a significant analytical challenge for effective monitoring. In this context, chromatography coupled with mass spectrometry (MS) plays a crucial role, offering the sensitivity, selectivity, and structural information required for accurate identification and quantification of these compounds at trace concentration levels.

This lecture will present an overview of MS-based analytical strategies for the investigation of OMPs in wastewater, with a particular focus on contaminants of emerging concern (CECs), especially pharmaceuticals and antibiotics. The discussed approaches range from targeted quantitative analysis—typically performed using LC-MS/MS with triple quadrupole instruments—to wide-scope screening strategies involving thousands of OMPs, based on high-resolution mass spectrometry (HRMS) using Orbitrap or QTOF analyzers.

Key methodological aspects will be briefly addressed, including the collection of 24-hour composite influent and effluent wastewater samples, as well as the estimation of removal efficiencies in WWTPs, in the context of Directive (EU) 2024/3019 concerning urban wastewater treatment. Furthermore, the importance of applying suitable analytical methodologies in degradation studies—such as those employing advanced oxidation processes (AOPs)—will be highlighted, as they are essential for comprehensive assessments that account for both the removal of parent compounds and the formation of degradation products during the treatment process.

Biography

Full Professor of Analytical Chemistry, coordinator of the Analytical Chemistry and Public Health research group (recognized as a research group of excellence by the Valencian Government), and Director of the Research Institute for Pesticides and Water at the University Jaume I, Castellón, Spain. He also leads the University's GLP-certified Laboratory of Pesticide Residue Analysis. His research focuses on advanced chromatography–mass spectrometry techniques applied to environmental science, food safety, and toxicology. This includes high-resolution mass spectrometry (HRMS) for wide-scope screening of organic pollutants in water and food, wastewater-based epidemiology, the investigation of metabolites and transformation products of organic micropollutants, illicit drugs and new psychoactive substances, and metabolomics. He has led approximately 60 research projects and numerous industry-funded contracts and has published around 420 ISI-indexed scientific papers (h-index = 81). He has supervised 26 PhD theses and has been invited speaker at over 20 national and international conferences. Among several distinctions, he received the Lifetime Research Achievement Award from the University Jaume I.

SESSION IV | KEYNOTE LECTURE

Marta Carvalho
Business Development Manager,
Ponto Verde Serviços - BCSD
Portugal

EPR to Emerging Waste Streams: The Case of RECAPS

This presentation explores the application of Extended Producer Responsibility (EPR) to new waste streams. It highlights the regulatory context and emerging obligations for producers under the evolving EPR framework. As a practical example, the RECAPS initiative is presented, showcasing effective practices in the collection and valorisation of used coffee capsules in Portugal.

Biography

With 25 years of experience in environmental and corporate sustainability and sustainable innovation, Marta has been responsible for leading and implementing strategies and projects aligned with international, European, and national commitments towards a more prosperous future for all. She holds a Master's degree in Hydraulics and Water Resources and a Bachelor's degree in Environmental Engineering from Instituto Superior Técnico, as well as advanced training in sustainable finance from Nova SBE and negotiation from Universidade Católica Portuguesa. She currently holds a management position at Ponto Verde Serviços, a consultancy firm specialising in sustainability and ESG, and is also a mentor and trainer in innovation for competitiveness within the Nova SBE Voice initiative.

SESSION V | KEYNOTE LECTURE

Marcelo Costa
Chief Technology Officer, CoLAB Net4CO2

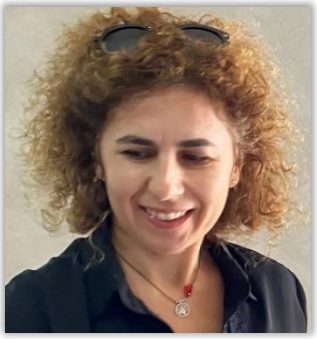
Pioneering CCUS Technologies at Net4CO2: The Strategic Role of PhDs in Research and Development

Net4CO2 is a Collaborative Laboratory and R&D organization committed to developing sustainable industrial solutions that support the European Green Deal's goal of climate neutrality by 2050. Our mission is to drive innovation from science to market by advancing competitive and disruptive technologies for CO2 capture, utilization, and storage. A core pillar of this mission is strengthening the connection between academic research and industrial application, ensuring that fundamental research translates into real-world impact. At Net4CO2, highly qualified PhD researchers play a pivotal role—not only conducting research but also leading the development of proprietary technologies. This approach stimulates innovation, accelerates technological breakthroughs, and strengthens the link between academic rigor and industrial applicability, positioning Net4CO2 as a key player in the sustainable transformation of energy and industrial systems.

Biography

Marcelo Costa is the Chief Technology Officer (CTO) at CoLAB Net4CO2, where he leads the development of cutting-edge decarbonization technologies. He holds a PhD in Chemical and Biological Engineering from the University of Porto (2017), with a thesis focused on carbon capture using hydrate-based and NetMIX technologies. Following a postdoctoral position at LSRE-LCM, he joined CoLAB Net4CO2 as Team Leader of the CO_2 Capture Team. After five years in that role, he was appointed CTO. Marcelo has authored peer-reviewed publications, presented his work at international conferences, holds international patents, and has supervised several graduate students.

SESSION VI | KEYNOTE LECTURE



Judite Vieira
Professor and Researcher, PRR Embalagem do Futuro

Centre for Life Cycle Assessment and Sustainability (CLICAS): Supporting the Packaging Sector Through Practical Solutions

The CLICAS project is designed to support companies in the packaging sector by providing practical tools and methodologies to meet current decarbonisation, environmental, and sustainability goals. Aligned with the objectives of the European Green Deal, CLICAS emphasises the importance of assessing the life cycle of packaging, considering environmental, economic and social dimensions, and the need to evaluate the environmental impacts associated with packaging products and processes, fostering innovation and informed decision-making across the sector.

Biography

Vieira, J.S., Professor and Researcher in Environmental Sciences and Technologies - wastewater treatment and reuse systems. Author of numerous scientific publications and conference presentations, and supervisor of research fellows, master's students, and undergraduate students. Active member of the Mobilising Agenda "Packaging of the Future" and the AlgaeTech project, co-promoted by LSRE-LCM, focusing on the monitoring and risk assessment of emerging contaminants in environmental matrices, as well as the life cycle assessment (LCA) of products and processes.

ORAL COMMUNICATIONS

List of Oral Communications

OC 1. Quaternary Treatment of Urban Wastewater: Pilot-Scale Evaluation of Ozone Injection via NETmix Technology

Carla S. Santos[1,2], Paulo H. Marrocos[1,2], Karolina Rodrigues[1,2], Alexandre Narcizo[1,2], Iago Riveiro[3], Rosa Montes[3], Rosario Rodil[3], Ana I. Gomes[1,2], Vítor J.P. Vilar[1,2]

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Abstract

Advanced treatment and reuse of urban wastewater (UWW) is crucial to combat pollution and water scarcity. In addition to encouraging water reuse, the revised UWW Treatment Directive (UWWTD, EU Directive 2024/3019 [1]) establishes guidelines for the removal of micropollutants in large wastewater treatment plants (WWTPs). This work proposes a sidestream ozone (O_3) injection system at the pilot scale, integrating a new design of the NETmix micro/mesostructured pressurized static mixer for the quaternary treatment of UWW after a membrane bioreactor (MBR), targeting the oxidation of micropollutants to comply with the new regulatory standards. A total of 26 micropollutants were identified in the tertiary-treated UWW, including 10 regulated by the new UWWTD. Ozonation tests were conducted at specific O_3 doses (SD) of 0.46, 0.66, and 0.86 g O_3 g DOC^{-1}. At the maximum SD tested (0.86 g O_3 g DOC^{-1}), 20 of the 26 OMPs were degraded by more than 80%, including all 10 compounds covered by the new legal requirements. Nevertheless, 0.66 g O_3 g DOC^{-1} was sufficient to achieve regulatory compliance. UV_{254} decay effectively tracked organic compound breakdown, serving as a surrogate for micropollutants removal. These findings highlight the efficacy of ozonation as a cutting-edge treatment for ensuring regulatory adherence. The addition of secondary oxidants (e.g., H_2O_2) to the ozonation process is under evaluation.

Acknowledgments

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OC 2. Three-dimensional electrosorption of a pharmaceutical mixture via pine cone-derived biochar: batch and continuous mode

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Abstract

Overexploitation and intensified forestry activities have led to the overproduction of residues that must be managed sustainably in order to prevent negative environmental impacts, such as soil degradation, loss of biodiversity and increased risk of forest fires. These waste materials offer valuable properties for producing adsorbent materials, which can be subsequently used in water decontamination treatments [1].

In this study, biochar was synthesized through the pyrolysis of pine cones and further characterized based on its physicochemical and electrochemical properties. The biochar was evaluated as an adsorbent material for the removal of three pharmaceuticals [2] commonly found in wastewater: fluoxetine (FLX), sulfamethoxazole (SMX) and sulfamethizole (SMZ). Following preliminary adsorption tests, process efficiency was enhanced by combining the use of biochar with the application of an electric field, resulting in a three-dimensional (3D) electrosorption system. The process was then optimized by analyzing different parameters, including particle size, adsorbent dosage and applied voltage. A kinetic study was also performed, revealing a better fit to pseudo-second order kinetic model, giving rise to a process governed by chemisorption phenomena. Among the main interactions involved, hydrogen bond formation, electron donor-acceptor interactions and hydrophobic interactions were found.

Based on the positive results obtained, the 3D electrosorption treatment was applied in a continuous system with a mixture of the three pollutants, simulating conditions closer to real environments. A reduction in the adsorption capacity was observed compared to single-component systems, verifying the interaction between the different compounds [3] and a stronger inhibitory effect from FLX. These results aligned with the Sheindorf-Rebuhn-Sheintuch multicomponent isotherm model fitting, which was used to explain the behavior of the pollutant mixture. A regeneration process using organic solvents, followed by a second use in continuous mode, confirmed the material's long-term reusability.

Finally, the efficiency of 3D electrosorption in a real water matrix with the pollutant mixture was evaluated, supporting the findings from previous tests and demonstrating the technique's efficiency in presence of coexisting ions.

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OC 3. Photo-Fenton Treatment of Ceramic Membrane Filtration Retentate for a Zero-Waste Process Chain in the Winery Industry

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Abstract

The adoption of circular economy principles and zero-waste strategies has become essential for addressing the challenges of climate change, especially in regions where water scarcity can have a high impact on the economy, such as the winery sector in the Douro Region of Portugal. In this context, filtration technologies using ceramic membranes have proven effective in treating winery wastewater after biological depuration, which can be subsequently reused in the winery activities. Ultrafiltration (UF) with a membrane pore size of 10 nm is one effective solution, achieving 76% reduction in the chemical oxygen demand (COD) and completely eliminating *E. coli*, thus ensuring compliance with Portuguese water reuse standards [1]. However, separation technologies generate a concentrated retentate, creating financial and regulatory challenges for its disposal or reuse. Therefore, advanced treatment of this retentate is crucial to enable sustainable water reuse and support closed-loop systems. This study investigates, for the first time, the application of a UV-A LED photo-Fenton process using ferrous iron (Fe^{2+}) as a catalyst for the treatment and possible reuse of this stream. A Box-Behnken design under the response surface methodology (RSM) framework is employed to optimize operational parameters – hydrogen peroxide (H_2O_2) and iron (Fe^{2+}) concentrations, and reaction time. Treatment performance is assessed through reductions in the total organic carbon (TOC), COD, and turbidity. In addition, the economic feasibility of the process is evaluated to determine its applicability within sustainable water management practices.

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OC 4. Optimization of Urban Wastewater Hydroponics for Ornamental Plant Production and Pollutant Removal

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Abstract

Challenges for traditional agriculture are heightened by climate change, soil depletion, and inefficient water use (which accounts for 72% of global freshwater) [1]. Meanwhile, 80% of wastewater is discharged untreated, contributing to water pollution [2]. Reusing wastewater in soilless production systems offers a potential solution to reduce freshwater usage, minimize pollution, and promote sustainable water management and agricultural practices [3]. In this study, a small-scale hydroponic system was employed to investigate the viability of growing ornamental plants using urban wastewater (after primary treatment) and a nutrient solution as a positive control. The experiments were conducted in a greenhouse at the Polytechnic Institute of Leiria. Crop growth parameters (*e.g.*, plant height, number of flowers) and overall health were assessed weekly. Water physical and chemical parameters (temperature, pH, electrical conductivity, BOD_5, COD, $P\text{-}PO_4$, $N\text{-}NH_4$, $N\text{-}NO_3$, Mg, Ca, Fe, K, and Cr, Cu, and Li) were monitored daily or weekly using a multiparameter probe and through laboratory analysis. The system was optimized for pH range (5.5-6.5), nutrient requirements, and crop adaptability. Results showed that while pretreated wastewater alone yielded good results, pH adjustment significantly enhanced flower yield and visually improved plant characteristics. During plant growth, notable nutrient deficiencies were observed. Therefore, periodic wastewater replacement or supplementation was necessary to maintain optimal nutrient levels. Of the eight tested species, five, *Petunia, Tagetes, Antirrhinum, Calendula,* and *Dianthus,* were the most adaptable. Overall, wastewater reuse in these systems presents a promising solution for producing economically viable crops while simultaneously removing nutrients, organic matter, and microorganisms from urban wastewater. However, the complex chemical composition of wastewater challenges crop yield and poses risks to health and the environment, requiring a more comprehensive approach, particularly addressing the issue of emerging contaminants.

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OC 5. Effect of Sludge Retention Time on Bacterial Community Dynamics and Antibiotic Resistance in Conventional Activated Sludge Treatment

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Abstract

Conventional activated sludge (CAS) is the most widely used method for secondary treatment of municipal wastewater. Although effective at reducing overall bacterial loads, CAS effluents often retain antibiotic-resistant bacteria and associated resistance genes (ARGs), posing environmental and public health risks. Sludge retention time (SRT) is a critical operational parameter that may influence bacterial survival, community structure, and horizontal gene transfer. This study aimed to investigate how SRT modulates the fate of ARGs, as well as the composition of the bacterial community, during wastewater treatment. To this end, two laboratory-scale CAS systems were continuously operated for 85 days using influent from an urban wastewater treatment plant (UWWTP). The systems were maintained under identical operational conditions, with the only difference being SRT: one unit operated at 7 d and the other at 30 d. Weekly samples of final treated effluent and sludge were collected to quantify ARG abundance and prevalence and to characterize bacterial community composition using 16S rRNA gene sequencing. Standard water quality parameters (chemical and biological oxygen demand, total phosphorus, nitrogen, and suspended solids) were also measured weekly to assess system performance. SRT at 30 d favoured the relative abundance of several bacterial groups, including *Chlamydiales*, and *Acinetobacter* in the final effluent and *Saprospiraceae* in the sludge when compared with operation at 7 d. Understanding the trade-offs associated with SRT is essential for optimizing CAS operations to improve treatment performance while minimizing the dissemination of antimicrobial resistance. This study provides insights into the complex interplay between operational parameters, microbial ecology, and resistance dynamics, contributing to the development of more effective and safer wastewater treatment strategies.

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OC 6. Innovative Use of Chestnut Shell Tannins for Efficient Wastewater Treatment in Aquaculture

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Abstract

The increasing global population poses major challenges in meeting food production. As an emerging and rapidly growing sector, aquaculture plays a crucial role in supplying protein for human consumption. However, some researchers warn that future growth in aquaculture may be hindered by some drawbacks, such as the limited availability and accessibility of clean water [1]. Conventional wastewater treatment techniques employed in aquaculture operations are often expensive and require substantial energy, and more sustainable solutions are needed. One common treatment method involves coagulation/flocculation, where natural tannin-based coagulants have shown to be particularly effective [2]. Portugal ranks among the leading producers of chestnuts, resulting in the generation of large amounts of chestnut shell (CS) waste. In this research, tannins were extracted from CS and chemically modified through the Mannich reaction to enhance their cationic characteristics to be applied as coagulants. The effectiveness of the coagulant derived from chestnut shells was evaluated in comparison with conventional coagulants ($Al_2(SO_4)_3$ and $FeCl_3$) through both batch and continuous flow systems. The assessment targeted the removal of color and nutrients. The optimal dosage and pH conditions were determined during the batch experiments (10 $mg \cdot L^{-1}$ for CS, 20 $mg \cdot L^{-1}$ for Al, and 25 $mg \cdot L^{-1}$ for Fe at pH 8). Under these conditions, the CS-based coagulant outperformed chemical coagulants in removing color and P, achieving removal efficiencies of 43% and 81%, respectively, while nitrogen levels remained unchanged. Between chemical coagulants only $FeCl_3$ achieved color reduction (14%). In continuous mode, the CS-based coagulant maintained strong color removal (34%) and achieved a 36% reduction in nitrogen, although phosphorus removal decreased to 9%. In comparison, Fe- and Al-based coagulants achieved color removal efficiencies in the range of 30%. By that, it is possible to conclude that the CS-based coagulant is a good option to be applied in aquaculture systems.

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OC 7. Enhancing Aerobic Granular Sludge Systems for Leachate Co-treatment: Impact of Saline Stress, Fill-Draw Operation, and Biomedia Incorporation

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Abstract

Aerobic granular sludge (AGS) is a promising technology for landfill leachate treatment due to its capacity for simultaneous nutrient removal and enhanced biomass retention. However, nutrient removal and granule stability challenges persist [1]. This work evaluates the influence of simultaneous fill-draw operation mode (F/D mode), intermittent saline feeding, and the incorporation of high-performance biomedia on the operation of AGS sequencing batch reactors (SBR) co-treating synthetic wastewater (SWW) and landfill leachate. Three AGS-SBRs were operated over 161 days: two conventional (R1 and R2) and one biomedia-modified (R3). During periods I (days 0-26) and II (days 27-107), all reactors operated at a 50% volumetric exchange ratio (VER) with SWW containing 5% leachate, except for R2, which alternated between this influent and saline wastewater (2.5 g/L NaCl). In Period III (days 108-161), the systems transitioned to the F/D mode, with R1 receiving only SWW, whereas R2 and R3 were fed with SWW containing 10% leachate. All systems achieved granulation within 20 days. R1 and R3 formed larger granules, while R2 exhibited extensive disintegration during Period II, likely due to excessive EPS production induced by intermittent saline feeding. The F/D mode improved biomass retention, increasing suspended solids concentrations across all reactors. Organic matter removal was high during F/D mode, with chemical oxygen demand (COD) reaching efficiencies >87%. However, effluent COD remained >250 mg/L, likely reflecting leachate recalcitrance. Increasing the leachate ratio to 10% in Period III led to a noticeable nitrate accumulation in R2 (22 ± 19 mgN/L) and R3 (39 ± 16 mgN/L), compromising total nitrogen removal efficiency. Phosphorus removal declined over time, reaching a maximum of 54%, possibly due to competition from glycogen-accumulating organisms. The biomedia layer in R3 enhanced microbial attachment/retention, reduced biomass washout, and improved both granule integrity and effluent quality during landfill leachate co-treatment with SWW.

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OC 8. Kinetics of the continuous struvite crystallization from sidestream digestate in a planar Oscillatory Flow Crystallizer: optimization at lab-scale

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Abstract

Europe currently leads the world in full-scale struvite ($MgNH_4PO_4 \cdot 6H_2O$) recovery units, primarily installed at Municipal Wastewater Treatment Plants (MWWTP), using sidestream digestate. The market is led by commercial technologies (e.g., NuReSys®, ANPHOS®, Airprex®), which rely on continuously stirred tank reactors (CSTR) [1]. However, this configuration suffers from key limitations, including insufficient mass and heat transfer, broad residence time distribution, and challenges in scale-up [2]. To overcome these drawbacks, the present work explores an Oscillatory Flow Crystallizer (OFC) for continuous struvite precipitation from sidestream digestate. The lab-scale planar-OFC system features four access points: sidestream and magnesium dosing (inlet), NaOH dosing (two middle inlets), and solid-liquid mixture collection (outlet) [3]. Experimental variables included feeding scheme, reactants dose, temperature, pH, and ionic composition. Sidestream samples were collected at Ave and Freixo MWWTPs (Porto, Portugal). The results revealed that the rate of consumption of PO_4^{3-} in the substrate followed a first-order kinetic model, with rate constants >14 h^{-1}, following previous studies [4]. Despite the ionic composition, phosphorus (P) recovery efficiencies above 80% were achieved at pH = 9. Higher magnesium dosing and extended residence time enhanced P-recovery, while temperatures ≥30°C hindered crystallization. In conclusion, the OFC reactor offers a promising, scalable alternative to CSTRs, enhancing nutrient recovery in MWWTPs and supporting circular economy and sustainability goals.

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OC 9. Spent Printed Circuit Boards: Selective Leaching

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Abstract

The high demand for electronic devices is drastically increasing the generation of spent printed circuit boards (PCBs). All electronic devices contain PCBs, representing 30.3% of mobile phones, 11.6% of televisions and 13.7% of laptops [1–2]. The so-called digital and energy transition stresses the supply chain, requiring innovative approaches to extract critical raw materials from this waste. The innovative concept of this research is to present a hydrometallurgical process that allows the selective extraction of metals using reagents with lower environmental impact compared to traditional reagents used in the industry. The selective leaching process consists of three leaching steps: i) 1st leaching step - iron (Fe) extraction; ii) 2nd leaching step - copper (Cu) extraction; iii) 3rd leaching step - gold (Au) and silver (Ag) extraction. The optimized leaching procedure enables the extraction of 90% of Fe in the 1st step, along with 35% of Zinc (Zn) and 28% of Cu, using sulphuric acid (H_2SO_4) and hydrogen peroxide (H_2O_2). In the 2nd step, 92% of the remaining Cu and 92% of Zn were extracted, corresponding to a global extraction of 94% and 95%. The same reagents were used as in the 1st, but under different operating conditions. In the 3rd leaching step, 69% of Au and 79% and Ag were dissolved using thiourea. This approach achieves high Au extraction efficiencies, particularly for Ag, at room temperature and within shorter leaching times. Hence, the hydrometallurgical process studied is viable and effective. The selective leaching enables the initial extraction of iron (Fe) which is considered a contaminant, followed by a substantial extraction of the remaining copper (Cu). In the 3rdstep, a high content of both Au and Ag was dissolved. Despite Au being more valuable, Ag is considered a critical metal due to its scarcity in the Earth's crust.

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OC 10. Closing the Gold Loop: An innovative and sustainable approach to recover precious metals from integrated circuits

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Abstract

With the increasing scarcity of gold (Au) and its vital role in advanced technologies, the pursuit of sustainable alternatives to mining has become essential. Among the most promising waste streams for metal recovery are electronic waste materials, particularly integrated circuits (ICs), which are crucial components of electronic devices. This study presents a combined methodology for Au recovery from ICs, incorporating physical, mechanical, and chemical techniques. The ICs analyzed typically consist of 62% of silica (SiO_2), 14% of brominated epoxy resin, and a metallic fraction including copper (Cu, 22%), iron (Fe, 1%), silver (Ag, 0.7%), and Au (0.3%) [1]. The process began with a two-step physical pre-treatment: controlled fragmentation using a hydraulic press followed by magnetic separation. The non-magnetic fraction—enriched in Au—underwent hydrometallurgical leaching using 2.5 M HCl and 0.34 M NaClO at 40°C for three hours, with a liquid-to-solid ratio of 40 mL/g. This stage enabled the extraction of 88.6% of Au. Subsequently, Au was purified from the resulting multi-metal solution containing Au, Ag, chromium (Cr) , Cu, Fe, aluminum (Al), nickel (Ni), lead (Pb), tin (Sn), and zinc (Zn) through continuous ion exchange using Purogold™ A194 resin, which presents high capacity and selectivity for Au. The Au elution from the resin was carried out using a 0.5 M H_2SO_4 and 0.25 M thiourea solution for 120 minutes, resulting a high Au recovery rate (91%) and purity (85%). Sn (7.5%) and Pb (4.3%) were identified as the primary contaminants due to the partial adsorption of their anionic chloride complexes. In conclusion, the proposed methodology is simple, effective, and scalable, offering a viable solution for reclaiming Au from ICs and contributing to the circular economy.

Acknowledgments

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OC 11. Sustainability Challenges and Opportunities of Solid-State Batteries in EV Applications

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Abstract

Solid-state batteries (SSBs) represent the next generation of battery technology for electric vehicles [1]. SSBs offer improved driving range and safety through solid electrolytes that enhance energy density and stability [2]. Despite significant variation in SSB cell designs driven by ongoing research, these technologies' sustainability impacts are still poorly understood [3]. This work presents a comprehensive literature analysis of the environmental, economic, and social impacts of current batteries and SSBs used in electric vehicle applications throughout their full life cycle. Results showed that SSBs have potentially larger global warming impacts than current batteries per kWh provided (88–130 kg CO_2 eq. versus 58–92 kg CO_2 eq.) and costs ($116-543 versus $115). Specific values vary significantly according to the battery chemistry. The environmental hotspots are mostly due to the lithium-metal anode, followed by the solid electrolyte and cathode. In the social dimension, impacts vary largely according to the materials and their geographical origin. These impacts are to remain similar between both battery generations, as the current material supply chain is expected to remain unchanged, particularly for cobalt. These preliminary findings aim to later support the development of recommendations for battery design to efficiently reduce the environmental, cost, and social impacts of SSB designs and support a more sustainable battery supply chain.

Acknowledgments

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OC 12. Photocatalytic Nitrite Reduction in Aqueous Solution using MOF-Based Catalysts for Sustainable Ammonia and Hydrogen Production

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Abstract

Ammonia (NH_3) and hydrogen (H_2) are strategic chemicals with growing relevance in the transition to a low-carbon economy. NH_3, traditionally used as a fertilizer precursor (with global production exceeding 240 million metric tons annually), is increasingly regarded as a potential energy carrier. Meanwhile, H_2 is widely recognized as a clean energy vector [1]. However, conventional production processes, such as Haber-Bosch (100-200 atm; 400-500 °C) and steam methane reforming (3-25 atm; 700-1000 °C), are energy-intensive and significant sources of CO_2 emissions. In this context, heterogeneous photocatalysis emerges as a more sustainable alternative, offering dual potential for NH_3 and H_2 synthesis under mild conditions. This study explores the use of metal-organic frameworks (MOFs) as catalysts for NH_3 and H_2 synthesis via photocatalytic reduction of nitrite (NO_2^-), a water-soluble intermediate commonly generated from the oxidation of nitrogen oxides (NOx) in industrial emissions, particularly in wet scrubbing systems. Two types of MOFs, MIL-125 and UiO-66, were tested in their pristine form and after copper (Cu) impregnation (2-5 wt.%). The photocatalytic performance of each material (10 mg) was assessed in suspension within a batch photoreactor (20 mL; 100 mg NO_2^- L^{-1}) under UV-visible irradiation (300 mW cm^{-2}) for 24 h. Product formation was monitored via colorimetry (NH_3) and gas chromatography (H_2). MIL-125 outperformed UiO-66 in both NH_3 (1.4-fold) and H_2 production (2.1-fold). The highest NH_3 yield was obtained with pristine MIL-125, reaching ~900 µmol g^{-1} alongside 130 µmol g^{-1} of H_2. In contrast, Cu-MIL-125 catalysts showed reduced NH_3 yields (23% and 86% for 2 and 5 wt.% Cu, respectively) but enhanced H_2 production (46% and 131%, respectively), indicating that Cu incorporation favors the hydrogen evolution reaction over ammonia synthesis. Compared to benchmark TiO_2, MIL-125-based catalysts (pristine and 5 wt.% Cu) demonstrated superior photocatalytic activity (by factors of 3.6 for NH_3 and 1.7 for H_2), underscoring their potential for waste nitrogen valorization towards sustainable energy production.

Acknowledgments

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OC 13. Optimizing Semi-Transparent Ta_3N_5 Photoelectrodes: A Path for stabilization

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Abstract

Solar redox flow cells (SRFCs) are a promising technology for storing solar energy as electrochemical fuels. The charged electrolytes produced during illumination can later be discharged in a redox flow cell (RFC) to generate electricity.(da Silva Lopes et al., 2021) The development of stable, abundant, and cost-effective semiconductors is crucial for the advancement of the PEC field. Tantalum nitride (Ta_3N_5, bandgap of *ca.* 2.1 eV) has emerged as a promising semiconductor material due to the high efficiencies reported so far.(Francisco et al., 2025) However, its long-term stability is still a challenge. This study develops semi-transparent Ta_3N_5 photoelectrodes and explores the effects of underlayers and dopants (tungsten and lanthanum) on their performance. Semi-transparent Ta_3N_5 photoelectrodes were fabricated using electrophoretic deposition on a 20 nm Al:TiO_2 underlayer. Their PEC performance was assessed through *J-E* measurements, stability tests, photoluminescence analysis, and PEIS. The optimal performance was achieved with 2.8 % La-doped Ta_3N_5, yielding a photocurrent density of *ca.* 4.0 mA·cm^{-2} at 1.3 V_{RHE} and a maximum power density of *ca.* 1.8 mW·cm^{-2} (Figure 1a). Remarkably, this material was stable over 90 h in potassium ferrocyanide solution (pH 14) (Figure 1b), the longest operational lifetime reported to date for Ta_3N_5. The material was subsequently upscaled, assembled into the SolarFlow25 SRFC device, and tested with $K_4Fe(CN)_6$|1,5-DHAQ redox chemistry. 12 photocharge and discharge cycles were demonstrated, reaching a coulombic efficiency of *ca.* 55 % (Figure 1c).

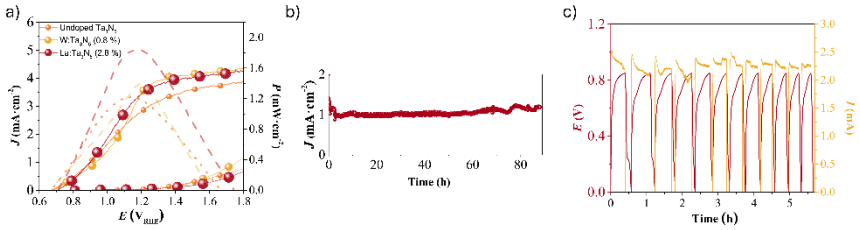

Figure 1: a) *J-E* and power density (*P*) curves obtained for Ta_3N_5 photoelectrodes: undoped, W-doped (W:Ta_3N_5), and La-doped (La:Ta_3N_5); b) Stability period of La:Ta_3N_5 sample; c) Photocharge/discharge cycles of redox pairs 1,5-DHAQ|$K_4Fe(CN)_6$.

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OC 14. Use of low-cost sensors for indoor $PM_{2.5}$ monitoring during a severe wildfire event in Portugal

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Abstract

Wildfires are extreme air pollution events that have seen consistent increase in frequency and intensity due to climate change [1]. They emit several pollutants including fine particulate matter ($PM_{2.5}$), which degrades the air quality. While it is generally advised to remain indoors for protection, indoor air quality (IAQ) might also be significantly impacted due to pollutant infiltration. Low-cost sensors (LCS) can be potentially used to monitor and manage IAQ, however, their accuracy still remains a challenge [2]. Hence, this study aimed to use LCS alongside research-grade instruments used as reference in collocation experiments in an office in Porto during the widespread wildfire episode of September 2024. A novel low-cost monitor (LCM), Sensinair Monitor, developed by the authors was deployed to compare with a commercially available LCM, AirVisual Pro [3]. The results showed that daily indoor average $PM_{2.5}$ concentration, as recorded by the reference, reached as high as 100 $\mu g/m^3$, considerably exceeding the WHO guidelines. This showed that even indoor environments can have highly degraded air quality during wildfire episodes. The LCMs showed a very strong linear correlation with reference measurements ($r \geq 0.98$). Sensinair Monitor showed far better performance than AirVisual Pro as it had much lower error values when compared to the reference.

Acknowledgments

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OC 15. A Comprehensive Life Cycle Assessment and Costing of Ozone Generation Systems with O_2/O_3 Separation and Oxygen Recovery

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Abstract

The reactive nature of ozone (O_3) typically limits the ability of O_3 generators to achieve concentrations above 15 wt.%, resulting in low yields and elevated production costs [1]. O_2/O_3 membrane separation technology offers a promising approach to increase ozone concentration and enable oxygen recycling back into the generator. This study presents a comparative assessment of ozone generation systems with and without O_2/O_3 separation, using Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) methodologies. Three configurations were evaluated: conventional ozone generation (System A), ozone generation with O_2/O_3 membrane separation (System B), and a similar setup incorporating oxygen recovery (System C). Life cycle inventory data were derived from laboratory experiments, the Ecoinvent database, and literature sources, and subsequently scaled to reflect industrial conditions. Environmental impacts were assessed using the ReCiPe 2016 Midpoint (H) method in SimaPro v9.5, covering 18 impact categories, while total costs were calculated for all systems. In the laboratory setup, Systems B and C demonstrated superior environmental performance compared to System A, with System B achieving a 60–70% reduction in impacts. However, System A remained more cost-effective due to the high membrane replacement costs in Systems B and C. When scaled to industrial conditions, System C outperformed System A in most environmental categories (by 4–29%) and also achieved the lowest total cost and Levelized Cost of Ozone (LCOO), highlighting the combined environmental and economic benefits of integrating O_2/O_3 gas separation and oxygen recovery.

Acknowledgments

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OC 16. Optimising Carbon Capture and Utilisation Supply Chains for National-Scale Energy System Modelling – Preliminary Insights

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Abstract

Carbon Capture and Utilisation (CCU) may assist to achieve net-zero greenhouse gas emissions by 2050. In Portugal, recent studies report potential CO_2 capture capacities of 1 Mt/year of CO_2 by 2030 to be used in synthetic fuel production [1]. However, details are lacking regarding the costs and life cycle impacts of these fuels. In this work, this knowledge gap is addressed by an optimisation of an hypothetical CCU network in Portugal. This network is optimised to obtain the lowest "true" cost of fuel, consisting of the sum of economic and monetised life cycle environmental costs, from raw material extraction to the use of the fuel. The optimised system consists of 1) CO_2 capture plants, where CO_2 is separated from flue gas streams of the pulp and paper and refining sectors; 2) CO_2 transport network, where CO_2 is transported by pipelines to a centralized methanation plant; 3) H_2 production hubs, located in the Sines region, where H_2 is produced by renewable-powered electrolysis in dedicated production plants; and 4) the methanation plant, where H_2 and CO_2 are combined to produce e-methane, later injected in the natural gas grid. Results show potential reductions of fossil gas demand of 31% by 2030 (9.3 TWh/year), life cycle impacts reduced by up to 73% in five impact categories, and a recycling of 50% of industrial CO_2 emissions by 2040 (up to 2 Mt CO_2 / year). However, for the costs of e-methane to break even, the network operators would require a yearly subsidy of at least 0.9 – 2.1 B€/year (5^{th} and 95^{th} percentiles, respectively), due to the high e-methane production costs (25 – 43 €ct / kWh). Still, this subsidy may have a considerable payback after the project's economic lifetime, presenting the opportunity for the establishment of a large-scale, renewable fuel production capacity in the long-term. This will be evaluated in future work, wherein the optimised CCU network will be included within a stochastic energy system modelling approach for Portugal until 2070.

Acknowledgments

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OC 17. Sustainability Assessment of Aquaculture Production Using Optimal Diets: The Case of Mediterranean Fish Production

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Abstract

Aquaculture is the fastest-growing animal production sector, recently surpassing capture fisheries in producing global aquatic animals [1]. With the global population projected to grow while increasing its consumption of fish products [1], aquaculture needs to expand to avoid the overexploitation of capture fisheries. Concurrently, aquaculture still depends on depleted wild fish stocks as feed ingredients [1], with feed production being the largest contributor to the environmental impacts of aquaculture [2]. The goal of the PhD project is to help support a sustainable expansion of aquaculture by analysing two of the main fish species produced in the Mediterranean: gilthead seabream (*Sparus aurata*) and European seabass (*Dicentrarchus labrax*). This will be accomplished by identifying optimal alternative aquafeeds that meet the nutritional requirements of these species at a lower environmental impact and minimum cost. The economic, social, and environmental impacts of fish production with the best optimal diet will be assessed. The main phases of the project are the life cycle assessment (LCA) of traditional and emergent aquafeed ingredients and current commercial diets, followed by the formulation of optimal diets by combining costs, nutritional composition, and environmental impacts. An LCA of the commercial diet *versus* the optimal diets formulated will be performed in this phase. Later, growth trials will take place to test the *in vivo* performance of commercial and optimal aquafeeds, and a social LCA of fish production using the best optimal diet will be carried out. An LCA and a life cycle costing of fish production using the best optimal diet will follow. The life cycle sustainability assessment of fish production using an optimal diet will comprehensively evaluate the impacts of aquaculture production, helping to identify hotspots and potential trade-offs between sustainability pillars. Its implications for Mediterranean aquaculture will be highlighted, and valuable insights for the aquaculture sector will be drawn.

Acknowledgments

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POSTER COMMUNICATIONS

List of Poster Communications

PC 1. Improving Visible-Light Photocatalytic Activity of GCN via Copper Nanoparticles Functionalization

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Abstract

The rise in water pollution due to climate change and ongoing human activity has increased the demand for effective strategies to eliminate persistent organic contaminants [1]. Among the most promising are advanced oxidation processes, particularly photocatalysis, which degrade pollutants through the in situ generation of reactive oxidative species under light irradiation. Graphitic carbon nitride (GCN) is widely studied as a photocatalyst thanks to its suitable bandgap, stability, low toxicity, and easy synthesis [2]. However, its performance is limited by low surface area, weak absorption in the visible range, and rapid charge recombination [2]. To enhance its photocatalytic activity, metallic nanoparticles such as copper (CuNPs) have been incorporated, as they improve charge separation, expand light absorption, and facilitate electron transfer [3]. This work synthesized GCN-CuNP composites using ultrasonication and thermal treatment, mixing GCN with CuNPs produced by laser ablation in liquid to ensure a surfactant-free and stable solution. Different CuNP loadings (0.1 wt% to 1.1 wt%) were introduced in the GCN composite. Photocatalytic capability tests were conducted under LED ultraviolet A and visible light (365, 395 & 417 nm). The material showed stable performance across wavelengths, with slightly better results at 417 nm, consistent with the role of GCN as the primary photoactive component. The best results were attained using the composite with a load of 0.12 wt% Cu-NPs, achieving around 80% degradation of Rhodamine B in 60 minutes using 0.5 mg/mL catalyst. To improve handling and reusability, the optimized material was embedded in a hydrogel of 10 wt% polyvinyl alcohol and 2 wt% sodium alginate. This formulation was used as printable ink to coat 3D-printed polylactic acid structures, enabling easy recovery and integration of the photocatalyst into practical water treatment systems.

Acknowledgments

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PC 2. Assess the impact of water impurities in recycled urban wastewater on AEM electrolyzers

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Abstract

Green hydrogen (H_2) production in Europe is vital for energy security, industrial decarbonization, and meeting climate goals under the European Green Deal and the Paris Agreement. However, large-scale green H_2 production via electrolysis requires large volumes of high-purity water – posing a challenge amid increasing water scarcity, currently affecting 11% of the EU population and projected to reach 30% by 2030. Addressing this calls for the integration of circular water reuse strategies and new business models within wastewater treatment plants (WWTPs), in line with the new EU Urban Wastewater Directive (2024/3019) [1]. In this context, a pilot-scale prototype will be tested and optimized at Freixo WWTP (Porto) to evaluate its feasibility of supplying high-quality water for electrolyzers. The system integrates ultrafiltration (UF), reverse osmosis (RO), and electrodeionization (EDI) and aims to produce water with conductivity <1 µS/cm for H_2 production using an anionic exchange membrane (AEM) electrolyzer. Water quality will be evaluated at multiple stages - prototype inlet, post-UF/RO, and post-EDI - considering conductivity, resistivity, pH, temperature, ionic composition and concentration, and trace metals. H_2 production tests using a AEM electrolyzer will benchmark the performance of reclaimed water against ultra-pure water. This work intends to establish optimal UF/RO+EDI operating conditions to ensure a stable flux of high-quality recycled water over time and investigate the impact of water impurities on AEM performance and durability, particularly the potential of trace metals in RO permeate plating onto electrodes.

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PC 3. Multi-Barrier Strategy for Urban Wastewater Treatment: Nanofiltration and UVC/Persulfate for Micropollutants Removal and Disinfection

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Abstract

Urban wastewater (UWW) treatment and reuse are essential for reducing pollution and addressing water scarcity, especially in agriculture. However, conventional wastewater treatment plants (WWTPs) struggle to effectively remove micropollutants. The EU introduced a revised UWW Treatment Directive (EU Directive 2024/3019)[1] to tackle these challenges, mandating 80% removal of selected micropollutants. A promising solution is a multi-barrier approach combining nanofiltration (NF) with advanced oxidation processes (AOPs). While NF produces a high-quality permeate (NF_P) that meets the quality standards for agricultural irrigation (EU Regulation 2020/741 [2]), its concentrate (NF_C) still requires further treatment before discharge. This study focuses on removing micropollutants from secondary-treated UWW and NF_C with a UVC/Persulfate AOP using a pilot-scale tubular membrane photoreactor in continuous mode operation alongside microbiological analyses to evaluate microbial contamination reduction. The AOP provided removals above 80% for 12 and 14 out of 18 micropollutants detected in UWW and NF_C, respectively, with 2.4 and 3.6 mM of persulfate. Microbiological analyses supported the effectiveness of the proposed system, showing a reduction of approximately 2.5 log and 6.5 log for both Enterobacteria and *E. coli* for UWW after secondary and NF_C, respectively.

Acknowledgments

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[2] Regulation (EU) 2020/741 of the European Parliament and of the Council of 25 May 2020 on minimum requirements for water reuse.

PC 4. Enhanced pharmaceutical pollutants removal by electro-assisted adsorption and biosorbent regeneration

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Abstract

The inefficiency of conventional treatment methods in removing recalcitrant pollutants has led to their release into aquatic environments, posing a global environmental concern. Within this context, the reduction and/or removal of these pollutants, such as pharmaceutical compounds, has become the focus of extensive research. Adsorption is considered one of the most sustainable and promising treatment methods, though its efficiency is conditioned by the adsorbents and their surface properties, such as porosity and presence of functional groups. In this work, the adsorption capacity of a biochar obtained from pine wood residues was evaluated for two model pollutants: fluoxetine (FLX) and sulfamethizole (SMZ) [1]. The material was initially subjected to physico-chemical analysis to assessits morphology and chemical properties, including Fourier transform infrared spectroscopy, and determination of thepoint of zero charge, among others. The material's adsorption capability was then ascertained with a cationic pollutant, FLX, achieving complete removal. However, when applied to an anionic pollutant, SMZ, the removal rate declined and stabilized at values below 20%. Therefore, different treatments were performed on the material to increase its adsorption capacity for SMZ. These modifications included: acid treatment with sulphuric acid, basic treatment with sodium hydroxide, addition of functional groups by doping with nitrogen, and an electrochemical treatment by application of an electric field to biochar dispersed in the medium (electrosorption). Among them, the most effective results were achieved with the electrosorption treatment, reaching over 70% removal due to a synergistic effect between biochar and the applied electric field. Additionally, the effect of parameters such as adsorbent dose and type of electrodes used was also evaluated, as well as the kinetic study of the process, showing a better fit to a pseudo-second order kinetic model. Finally, the material was subjected to an electroregeneration process to evaluate its reusability, maintaining a constant efficiency after consecutive treatment cycles. These results demonstrated that biochar derived from pine wood is suitable for environmental applications, with the potential for regenerative processes to extend its useful life.

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PC 5. Enantioselective liquid chromatography method for the simultaneous determination of chiral and achiral fungicides in aqueous matrices

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Abstract

Fungicides are organic compounds, many of them chiral, used in a diversity of applications. Although they have beneficial effects in controlling fungal plagues and treating diseases, their widespread use has led to their detection in the environment [1,2]. As a result, fungicide contamination is increasingly a global environmental concern, due to the risks it poses to non-target organisms and human health [3]. In this study, an enantioselective analytical method was developed using the chiral polysaccharide column Lux® i-cellulose 5 in reverse elution mode on a liquid chromatograph with diode array detector. The method was developed to analyze a group of five chiral azole fungicides (ipconazole, metconazole, penconazole, tebuconazole, and tetraconazole), as well as another achiral azole fungicide (fluconazole) in aqueous matrices. Preliminary solid phase extraction experiments were carried out to obtain good extraction recoveries of these fungicides. Work is still ongoing, but an SPE-LC-MS/MS method will be optimized and validated for monitoring fungicides and their enantiomers, where applicable, in water samples.

Acknowledgments

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PC 6. Study of the Effect of Salt Concentration on the Performance of an Air-Cathode Microbial Desalination Cell

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Abstract

The growing world population is increasing the demand for natural resources, contributing to higher levels of waste generation and intensifying climate change. These changes are leading to alterations in the natural hydrological cycle, and so water scarcity has become a pressing global issue, requiring sustainable technologies aligned with the United Nations' 2030 Agenda. Conventional desalination technologies, while effective, are characterised by high energy re- quirements and environmental impacts. Microbial Desalination Cells (MDCs) have emerged as a promising alternative, capable of desalinating water, generating electricity, and treating wastewater, without the need for external energy input [1]. The integration of microbial fuel cells (MFCs) with electrodialysis (ED) processes has resulted in the development of MDCs, which have the capacity to operate as standalone systems or in combination with other tech- nologies. Despite their potential, large-scale implementation faces challenges such as membrane fouling and internal resistance [2]. The present study evaluates the performance of an air-cathode MDC, with a cross-sectional area of 12.6 cm^2 and operating at atmospheric pres- sure and temperature, using different salt concentrations, ranging from 14 to 35 g/L, on the desalination chamber (25.1 cm^3). A pure culture of *Lactobacillus pentosus* in a nutrient-rich medium was used in the anode chamber (50.3 cm^3). The separation of the chambers was achievied using a Nafion 212 (CEM) and a Fumasep FAA-3-50 (AEM) membrane. Each experi- ment was conducted over a period of 15 days, with polarization measurements being per- formed at every 48 hours, after which 20 mL of the anode solution was replaced by fresh medium. The MDC performance was evaluated by polarization curves, power output and de- salination rate. Results showed a maximum salt removal rate of 78% and a maximum power density of 28.3 mW/m^2 using the highest salt concentration tested, 35 g/L, which is analogous to the salt concentration found in seawater. This demonstrates that MDCs are a sustainable, energy-efficient solution for water desalination with promising potential for real-world application, although further development is needed to improve performance and reduce costs.

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PC 7. PhotoBioValue project: Microalgal-bacterial bioremediation of urban wastewaters in innovative pilot-scale photobioreactors

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Abstract

Microalgal-bacterial consortia have been used to remove pollutants from wastewaters such as nitrogen, phosphorus, and carbon [1]. Furthermore, microalgae systems have been used to promote wastewater disinfection through physiological characteristics and operational conditions which can be harmful to some pathogens [2]. The development of efficient photobioreactors for this purpose is crucial for optimizing treatment systems using these consortia. In the present study, two innovative pilot-scale channel photobioreactors (PBRs) were used to culture an autochthonous microalgae-bacteria consortium in 120 L of primary urban wastewater for 8 days, in batch mode. Each reactor consisted of four channels with different widths and illumination inside the walls, but with different flow connectivity between them. The first reactor (PBR 1) was operated using an open configuration with unrestricted flow and culture exchange between the channels. The second reactor (PBR 2) was operated in a partitioned configuration, allowing flow and culture exchange exclusively between a small opening at the channel base, simulating four semi-isolated reactors: sections 1.1, 1.2, 1.3, and 1.4. The concentration of microalgal cells, nitrogen, phosphorus and carbon, and the abundance of total heterotrophs and faecal coliforms were evaluated. Microalgae grew successfully in these disruptive PBRs with specific growth rates between 0.132 and 0.223 d^{-1}. Total nitrogen and phosphorus removal efficiencies above 81% and 73% were achieved, respectively. The abundance of total cultivable heterotrophs decreased by roughly 1.2 and 1.5 log in sections 1.3 and 1.4, respectively, after 8 days. A significant decrease in the abundance of cultivable faecal coliforms was observed in all sections of PBR 1 and PBR 2. Therefore, these results show the efficiency of these PBRs for microalgal growth and wastewater treatment, highlighting a possible negative correlation between the first and the abundance of faecal coliforms.

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PC 8. Evaluation of QuEChERS-based Extraction Protocols for Micropollutant Analysis in Blue-Green Infrastructure Matrices

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Abstract

Despite their increasing implementation, the role of blue-green infrastructures (BGIs) in retaining urban micropollutants remains largely unaddressed[1]. In the *SPRINGINESS* project, three QuEChERS-based extraction protocols were evaluated for both soil and vegetation (pine needles) matrices. Recovery assays were initially performed for all methods, targeting polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), hexachlorobenzene (HCB), volatile methylsiloxanes (VMSs), and synthetic musks (SMs). One protocol, originally developed for sewage sludge, was adapted for soil and pine needles and included three sequential extraction steps with *n*-hexane, *n*-hexane:dichlorometane (1:1), and *n*-hexane:ethyl acetate (1:1). Additionally, two QuEChERS methods were tested: one using acetone:dichloromethane (1:1) for soil, and another using *n*-hexane:dichloromethane (2:1) for vegetation. Each was tested with up to three consecutive extractions to evaluate accuracy (through recovery assays) and precision. Based on the results, the QuEChERS methods were selected. The method for vegetation was then also validated in plant samples of *Mentha spp*., *Pelargonium spp*., and *Iris pseudacorus* to reflect some of the vegetation that can be used in the BGIs of *SPRINGINESS*. The validated protocols were finally used for an initial screening of the target contaminants on environmental samples from pilot BGIs in the Czech Republic and Poland, including: roof substrate, gravel from pond and wetland, raw substrate material, and *Mentha*, *Hyssopus*, and *Iris pseudacorus* plants. The results revealed the presence of several micropollutants including PAHs (range 1.8-34403 ng/g), PCBs (n.d.-0.60 ng/g), HCB (n.d.-992 ng/g), VMSs (n.d.-13 ng/g), and SMs (0.4-14 ng/g), which underline that although BGIs are relevant to protect the environment, there is an urgent need to assess the potential human exposure to the contaminants from these infrastructures.

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PC 9. Ecotoxicity of Nadifloxacin in Daphnia magna: Preliminary Insights into Acute and Sub-chronic effects

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Abstract

Nadifloxacin (NAD) is a chiral fluoroquinolone commonly used as a topical agent for treating inflammatory acne lesions [1]. Its widespread use, combined with human metabolism and enantioselective degradation during wastewater treatment processes, raises concerns about its environmental fate [2]. However, the lack of toxicity data for non-target aquatic organisms such as *Daphnia magna* highlights the need to assess its ecological and potential human health risks [2]. This study aimed to evaluate the sub-lethal and potential sub-chronic effects of racemic NAD (*rac*-NAD) and its isolated enantiomers on *D. magna*, focusing on reproductive features and survival. Acute toxicity assays were performed on neonates (<24 h), assessing immobilisation after 48 h of exposure to *rac*-NAD concentrations (2.5 to 60 mg L^{-1}). Sub-chronic exposure was carried out at a concentration of 100 µg L^{-1} of *rac*-NAD and each isolated enantiomer for 9 days. Each treatment, including the control, was tested in 5 replicates with 20 organisms per replicate. Survival and reproduction were monitored throughout the exposure period. The 48-h immobilisation test yielded a median effective concentration (EC_{50}) above the highest tested concentration (> 60 mg L^{-1}), indicating low acute toxicity. Regarding sub-chronic effects, no significant alterations were observed in reproductive parameters (*e.g.*, number of eggs per daphnid) nor in survival for either racemate or individual enantiomers. These preliminary results suggest that exposure to 100 µg L^{-1} of NAD does not impair the reproductive or survival capacity of *D. magna* over a 9-day exposure. Ongoing assessments will provide a comprehensive understanding of the ecological impact of NAD exposure.

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PC 10. Development of an analytical method for the determination of fluoroquinolones in sediments

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Abstract

Fluoroquinolones (FQs) are broad-spectrum antibiotics widely used in human and veterinary medicine, and as feed additives to support livestock growth. However, once administered, they may be metabolized and excreted as parent drugs or metabolites. As a result, FQs have been detected in the effluents of wastewater treatment plants and, consequently, in the environment [1,2]. Indeed, these antibiotics have been found in aquatic and sediment compartments at concentrations ranging from ng/L to µg/L and from µg/kg to mg/kg, respectively, raising increasing concern mainly due to the spread of antibiotic-resistant bacteria through ecosystems and human exposure [3]. Given the need to detect FQs in environmental matrices, particularly those adsorbed onto solid matrices, this work aims to develop and optimise analytical methods for analysing FQs in sediments. Analytical methodologies that allow their extraction and quantification, namely the Quick, Easy, Cheap, Effective, Rugged and Safe (QuEChERS) method and liquid chromatography (LC) coupled to fluorescence detection, are being studied for subsequent analysis in sediment samples. This research is ongoing and will contribute for expanding knowledge about the presence of FQs in solid matrices, particularly in Portuguese territory.

Acknowledgments

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PC 11. Sustainable Tannin-Based Coagulants: A Glyoxal Alternative for Wastewater Treatment

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Abstract

The increasing demand for quality water has intensified due to the pollution-driven decline of clean water sources. Coagulation plays an important role in wastewater treatment by removing contaminants present in the water [1]. However, conventional coagulants derived from aluminum and ferric salts have their disadvantages, including the production of toxic sludge and are potentially linked to neurogenerative diseases [2]. As a safer, more renewable solution, there is the tannin-based coagulants (TBC). TBC are typically produced through the Mannich reaction, which converts the anionic tannin structure into a cationic form using a aldehyde, usually formaldehyde reacting with an amine [1]. Despite its use, formaldehyde poses risks to human health and the environment [3]. This study explores the development, characterization, and evaluation of two tannin-based coagulants synthesized with glyoxal (G3 and G7) as a safer option for formaldehyde. The synthesis process varied in reaction time. Characterization involved the determinations of solid content, charge density and zeta potential analysis. Coagulants performance was evaluated in synthetic textile effluent, and compared with chemical coagulants ($Al_2(SO_4)_3$ and $FeCl_3$). Color removal, dissolved organic carbon, UV_{254}, final pH and conductivity were measured. Compared to conventional coagulants, the TBCs demonstrated effective color removal at pH 5 and 6, achieving color removals close to 80%. This study highlights the potential of glyoxal as a more eco-friendly alternative in the production of natural coagulants.

Acknowledgments

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PC 12. Towards Sustainable Treatment of Sidestream Digestate: A Comparative Study with NETmix-assisted Ozonation

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Abstract

Wastewater treatment plants (WWTPs) safeguard aquatic ecosystems and public health. The new Directive (EU) 2024/3019 [1] imposes stricter requirements on urban wastewater (UWW) treatment, mandating tertiary treatment for nitrogen (N) and phosphorus (P) removal by 2039 and quaternary treatment for ≥80% removal of selected micropollutants (MPs) by 2045. Among WWTP residual streams, the sidestream digestate from anaerobic digestion is particularly pollutant-rich, containing high levels of ammonia, phosphates, and MPs. Due to its high pollutant load, direct discharge into water bodies is not feasible, requiring internal recirculation to the plant's inlet. Despite representing only ~1% of daily flow, sidestream digestate can contribute 15-50% of total N, P, and micropollutants loads, therefore increasing energy and operational costs of secondary, tertiary, and quaternary treatments needed to ensure compliance with effluent quality standards. To address this, efficient and sustainable treatment solutions are required. Ozonation is effective for micropollutant removal, but improving its efficiency and reducing operational costs is crucial. While Venturi injectors are common for ozone dissolution, NETmix micro/mesostructured static mixer offers superior gas-liquid transfer [2]. This study evaluates ozonation using NETmix technology to treat sidestream digester under two scenarios: i) direct ozonation and ii) pre-treatment via struvite precipitation to remove ammonia and phosphate (allows nutrient recovery). By comparing these two treatment approaches, this study seeks to provide practical insights that can help WWTPs adopt optimized, cost-effective solutions to comply with EU regulatory requirements.

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PC 13. Magnesium Recovery from Desalination Brine for Sustainable Struvite Production in Wastewater Treatment Plants

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Abstract

Geopolitical conflicts have increasingly disrupted global supply chains, limiting access to essential nutrients and prompting Wastewater Treatment Plants (WWTP) to shift from solely improving water quality to recovering valuable resources. A key output from WWTP is the digestate sidestream, rich in ammonia and phosphate [1]. Struvite ($MgNH_4PO_4 \cdot 6H_2O$) crystallisation has emerged as an effective strategy for recovering nitrogen and phosphorus while producing a slow-release fertiliser for agricultural use [1]. However, this process depends on magnesium (Mg), which the European Union classifies as a critical raw material due to its heavy import dependency [2]. To overcome this limitation, alternative Mg sources, such as seawater desalination brines, are being explored. Preliminary work using a planar continuous oscillatory flow crystallizer (OFC) with synthetic brine confirmed the potential for Mg^{2+} and Ca^{2+} recovery as hydroxides. This study assesses the recovery efficiency and purity of $Mg(OH)_2$ and $Ca(OH)_2$ from synthetic and real desalination brines using a single-stage crystallizer. It examines various factors, including drying methods, pH control, and brine feed rates. The research also compares the yield and purity of struvite produced from sidestream digestate using different magnesium sources: $Mg(OH)_2$ from both types of brines and analytical-grade magnesium chloride ($MgCl_2$). The goal is to understand how these low-cost Mg sources affect product quality and recovery performance, ultimately evaluating the potential for using brine-derived Mg in nutrient recovery systems.

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PC 14. Evaluation of Water Reuse by Ozonation Technology in Batch and Continuous Reactors for The Textile Industry

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Abstract

The textile industry is one of the largest consumers of water and a significant contributor to industrial wastewater pollution. Developing efficient and sustainable treatment technologies is crucial to mitigating environmental impacts and promoting water reuse. This study evaluates the performance of ozonation technology in treating industrial textile wastewater, comparing its application in batch and continuous reactors. A comprehensive experimental investigation was conducted to assess the efficiency of ozone in degrading organic pollutants and improving water quality parameters, such as color, Total Organic Carbon (TOC) and Chemical Oxygen Demand (COD) reduction. The study highlights the influence of operating parameters, including ozone dosage, ozone combined with UV or H_2O_2, reaction time, and reactor configuration, on the overall treatment efficiency. Results indicate that while batch reactors offer high pollutant removal rates due to controlled reaction conditions, continuous systems present advantages in scalability and process automation, making them more suitable for industrial applications.

After determining the most efficient and cost-effective treatment conditions with the batch reactor demonstrating the highest overall performance, the treated effluent was tested for reuse in conventional textile dyeing processes using different effluent (EFF)/tap water (TW) mixtures: 75% TW+ 25% EFF, 50% TW+ 50% EFF, and 25% TW+ 75% EFF. The dyed textile samples were evaluated based on their CIELab color coordinates and compared to conventional dyeing with 100% TW. The findings confirm the potential for reutilization of the treated effluent in textile finishing processes, reinforcing the role of ozonation as a viable and sustainable strategy for water recycling in the textile industry.

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PC 15. Development of MOR-40 Adsorbent for O_2/O_3 Gas Separation

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Abstract

Ozone is an effective oxidant widely used in water and wastewater treatment. However, ozone generators have a low efficiency, enabling the production of an ozone stream with less than 15 wt.% [1]. Implementing O_2/O_3 gas separation using adsorption technology is a feasible solution to concentrate the ozone stream while recycling oxygen back into the ozone generator. Therefore, this study aims to develop an adsorbent resistant to ozone capable of separating oxygen and ozone. Pellets were synthesized using zeolite MOR-40 (ratio SiO_2/Al_2O_3 of 40) as raw material, colloidal silica (25 wt.%) as the binder, and distilled water. The pellet production process involves four main steps: i) first, the liquid binder (10 wt.%) and distilled water are added drop by drop to powdered zeolite and mixed by hand to create an extrudable paste; ii) this paste is then fed into an extruder, where it is compressed using an extrusion screw and a 2 mm diameter die plate; iii) subsequently, spheronization shapes the pellets into more spherical and uniform ones and iv) finally, the material is heated in a muffle furnace at 80 °C for 2 hours, followed by 120 °C overnight, and then calcined at 450 °C for 4 hours. The zeolite (powder and pellets) and the binder were characterized using N_2 adsorption/desorption at 77 K, mercury intrusion porosimetry, helium pycnometry, X-ray diffraction, and mechanical strength tests. The adsorption equilibrium isotherms of O_2 were measured using a magnetic suspension microbalance at 280, 303, and 323 K up to 5 bar. Breakthrough curve experiments will be conducted in a lab-scale fixed-bed system, feeding the column (2.15 cm internal diameter and 10 cm length) with a mixture of O_2/O_3 and analyzing the outlet stream with an ozone analyzer. Two scenarios will be studied at the beginning of the experiments: a clean column saturated with an inert gas (e.g., nitrogen) and a preloaded column partially or fully saturated with a component from the feed (oxygen).

Acknowledgments

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PC 16. Waste-activated sludge pre-treatment through solar-thermal AOP in a raceway pond reactor

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Abstract

Modern wastewater treatment plants (WWTPs) are increasingly adopting advanced technologies to reduce sludge volume and enhance biogas production, aligning with the energy neutrality targets and the updated requirements of the new EU Urban Wastewater Treatment Directive [1]. A key strategy to boost biogas output is improving the hydrolysis stage of anaerobic digestion, which can be effectively achieved through pre-treatment of waste-activated sludge (WAS). In a previous study by our group, an increment of 131% in methane production was achieved by combining solar radiation and thermal pre-treatment at 70 ºC using a raceway pond reactor (RPR) after five hours of treatment [2]. Building on these promising results, the present work aims to optimise this process by reducing residence time and the required temperature and, potentially, improving methane production. To further enhance efficiency, we propose integrating advanced oxidation processes (AOPs), specifically hydrogen peroxide (H_2O_2) with solar UV radiation, known for their effectiveness in degrading organic pollutants and disinfecting effluents sustainably [3]. Various H_2O_2 doses, solar radiation power, and temperature ranges will be evaluated in batch mode. Following optimisation, the most effective conditions will be tested in continuous mode. The performance of the pre-treatment system will be assessed by analyzing key sludge characteristics before and after treatment (e.g., chemical oxygen demand, biochemical oxygen demand, total organic carbon, and solids content) to validate its potential to improve WAS valorisation and contribute to more energy-efficient WWTP operations.

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PC 17. Validation of a SPE-UHPLC-MS/MS Method for the Determination of EU-relevant Organic Micropollutants in Drinking Water Matrices

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Abstract

Safe and clean drinking water is a human right (Nations, 2010). However, water scarcity and adequate water quality remain major worldwide issues. In recent years, increased attention has been drawn to the occurrence of micropollutants (MPs) in aquatic environments, typically detected at low concentration levels ranging from μg L^{-1} to ng L^{-1} (Barbosa et al., 2016). Conventional wastewater treatment plants (WWTPs) and drinking water treatment plants (DWTPs) are generally unable to completely remove these MPs (Barbosa et al., 2016), which contributes to a higher likelihood of their presence in drinking water (DW). MPs in DW can pose risks to both animal and public health (Wang et al., 2024). Therefore, highly sensitive and reliable analytical methods able to determine their concentrations are crucial to deepen our knowledge on the topic, which still has much to be explored. In this work, an offline solid-phase extraction methodology followed by ultra-high-performance liquid chromatoghraphy coupled to tandem mass spectrometry (SPE-UHPLC-MS/MS) was validated for the multi-class determination of a wide range of MPs identified in EU guidelines for water quality preservation. These include pharmaceuticals, pesticides, industrial chemicals and organic UV-filters, listed in Decisions 2022/1307/EU and 2025/ 439/EU, and in the new Urban Wastewater Treatment Directive 2024/3019/EU. The validated method will be applied to analyse tap water samples collected from various water distribution networks in Portugal.

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PC 18. Activated Carbon Immobilisation onto 3D-Alumina Structures for Adsorption of Pollutants and in-situ Regeneration by Catalytic Wet Peroxide Oxidation

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Abstract

Nowadays, the world is facing many challenges owing to intense environmental contamination by the presence of organic pollutants. Conventional wastewater treatment plants are not able to remove them efficiently, and these contaminants have been found in surface water and even in drinking water [1]. Therefore, more effective water and wastewater treatment technologies are needed. In this work, we immobilised activated carbon onto 3D-alumina supports by using an innovative urea-based method with thermal treatment. The aim is to facilitate continuous flow mode water/wastewater treatment with the immobilised materials (avoiding separation of powdered catalysts from the treated water) while presenting catalytic properties for *in-situ* regeneration. These materials were tested as adsorbents and catalysts in batch (without immobilisation onto alumina) and continuous flow mode (immobilised onto alumina) in the presence and absence of H_2O_2. Venlafaxine was used as one model pollutant, which is included in the new EU Directive for urban wastewater treatment [2] and in the EU watch lists (3rd and 4th) for surface water monitoring - now being under consideration for possible classification as a priority substance [3]. The innovative material achieved high removals of venlafaxine in batch and continuous flow mode, and these materials showed high catalytic activity for H_2O_2 decomposition. It was demonstrated that the spent adsorbent can be easily regenerated by catalytic wet peroxide oxidation in cyclic adsorption experiments.

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PC 19. GC–MS/MS method for determining pesticides and endocrine disruptors in drinking water

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Abstract

A sensitive gas chromatography–tandem mass spectrometry (GC–MS/MS) method was established for the quantitative screening of a specific group of pesticides (alachlor, atrazine, chlorofenvinphos, isoproturon, pentachlorophenol, methiocarb, and simazine) and endocrine disruptors (bisphenol A, estradiol, estrone, ethynylestradiol, nonylphenol, and octylphenol) in drinking water. Sample preparation involved solid-phase extraction (SPE) using hydrophilic-lipophilic balance (HLB) cartridges (500 mg / 6 cc). The SPE procedure was thoroughly optimised, including selecting the most effective solvents for the targeted compound groups, ensuring maximum recovery and selectivity. The method is being validated according to ICH guidelines parameters, including linearity, accuracy, precision, limit of detection (LOD), and limit of quantification (LOQ). This method will be applied to routinely monitoring trace-level contaminants in water matrices.

Acknowledgments

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PC 20. Efficient Color Removal from Textile Wastewater Using a Tannin based-Modified Pine Bark Coagulant

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Abstract

This study presents the development and evaluation of a tannin-based biocoagulant derived from powdered pine bark, a lignocellulosic byproduct rich in polyphenolic compounds and tannins [1]. The coagulant was produced via a two-step process: initially, an aqueous extraction at 90 °C and 250 rpm for 10 min to extract the bioactive compounds; followed by the functionalization through the Mannich reaction using formaldehyde and an amine to enhance its coagulation efficiency[2]. The biocoagulant was applied to a synthetic effluent designed to simulate real textile wastewater, with a focus on color removal. Performance was compared against Tanfloc, a commercial tannin-based coagulant, and two conventional chemical coagulants—aluminum sulfate and ferric chloride. At an optimal dose of 10 mg/L and pH 5, the pine bark coagulant achieved a color removal efficiency of approximately 93%, closely matching Tanfloc (95%) and significantly outperforming traditional coagulants, which required 3–4 times higher dosages. All coagulants also reduced turbidity by 60–70%, conductivity by 15–25%, and had minimal impact on final solution pH. The effluent treated with the tannin based pine bark coagulant exhibited a total organic carbon (TOC) of 30 mg/L, reduced from 39 mg/L in the untreated solution. These findings highlight the potential of valorizing pine bark waste into an effective, eco-friendly alternative for wastewater treatment, particularly in the textile industry. The process offers a sustainable approach to pollutant removal, exploiting natural compounds and minimizing the environmental footprint associated with conventional chemical treatment methods.

Acknowledgments

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PC 21. Sustainable Material for Antibiotic Removal via Electrosorption and Photocatalytic Regeneration

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Abstract

The presence of pharmaceutical residues in aquatic environments, especially sulfonamide antibiotics like sulfamethizole (SMZ), has raised increasing concern due to their persistence and ecotoxicological impact [1]. Conventional wastewater treatments often fail to eliminate these contaminants, calling for more effective and sustainable remediation methods [1,2]. Among emerging technologies, electroadsorption has gained attention as a promising, low-energy process that enhances contaminant removal by applying an external electric field to adsorptive materials, boosting interaction with target molecules [2]. In this context, a green, multifunctional composite material based on graphitic carbon nitride (GCN) and hydrochar (HC) was synthesized via a metal- and solvent-free method. Various biomass-derived hydrochars were evaluated, and the coffee-derived hydrochar (HCC) exhibited the highest performance. The optimal composite, containing 10 wt% HCC and designated as GCN-HCC10, was selected for further study. The material functioned both as an adsorbent and a photocatalyst. Under electroadsorption conditions at 1.2 V, GCN-HCC10 achieved up to 95% removal of SMZ within 120 minutes. For practical applications, the material was immobilized on carbon felt (GCN-HCC10/CF), allowing for reuse over five consecutive cycles with a performance loss below 8% after photocatalytic regeneration under visible LED light. High SMZ removal efficiencies were maintained in both tap and river water, despite the presence of competing ions. This study demonstrates the potential of biomass waste valorization into advanced functional materials for water purification. The integrated system, combining pollutant removal and material regeneration, provides a sustainable and cost-effective strategy for addressing pharmaceutical contamination in aquatic environments.

Acknowledgments

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PC 22. Coupling Ozonation and Aerobic Granular Sludge Processes for Landfill Leachate Treatment: Towards Safe Environmental Discharge

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Abstract

The complexity and recalcitrant nature of landfill leachates pose significant challenges to standalone conventional treatment processes. When applied as pre-treatment, ozonation can improve the biodegradability of leachates, enabling the use of downstream biological systems capable of achieving treatment levels that comply with stringent discharge standards established for municipal wastewater treatment plants (MWWTPs) and direct release into surface waters [1]. This study evaluates the effectiveness of coupling ozonation with aerobic granular sludge sequencing batch reactors (AGS-SBRs), focusing on two treatment strategies: (I) co-treatment of leachate with municipal wastewater (MWW) and (II) full leachate treatment – both aiming to meet regulatory limits for safe environmental discharge. Leachate samples (with a chemical oxygen demand (COD) of ca. 433 mg O_2/L) were collected at the outlet of a full-scale leachate treatment plant that employs biological oxidation (BO) in activated sludge tanks, followed by coagulation-flocculation in a dissolved air flotation unit. Preliminary trials were conducted to determine the minimum ozone (O_3) dose required for each strategy. Using the Zahn-Wellens test, the ozonated leachate samples, treated with different transferred O_3 dosages, were subsequently assessed for biodegradability. In Strategy I (co-treatment), the O_3 dosage was set at the minimum level required to remove leachate color (111 mg O_3/L; COD ≈ 374 mg O_2/L). After ozonation, 10% of the pre-treated leachate is mixed with MWW and fed into an AGS-SBR, targeting effluent quality compatible with MWWTPs discharge standards (COD < 125 mg O_2/L). In Strategy II (full leachate treatment), the selected O_3 dosage (396 mg O_3/L; COD ≈ 300 mg O_2/L) corresponded to the point at which the effluent, after a final BO, met the COD limit defined by European Directive 2024/3019 for direct discharge into water bodies (COD < 125 mg O_2/L). After ozonation, the pre-treated leachate is entirely subjected to BO in an AGS-SBR, aiming for compliance with direct discharge regulations.

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PC 23. A Circular Approach: Utilizing Basil Residue Biochar to Control Micropollutants in Wastewater

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Abstract

The presence of emerging contaminants, including pharmaceutical and cosmetic products, has become an environmental concern due to their hazardous chronic effects on ecosystems. To mitigate this issue, the European Union has published a new directive requiring the implementation of a quaternary treatment with at least 80% efficiency for harmful organic micropollutants in large-scale wastewater treatment plants [1-3]. This study explores the potential of biochar derived from agro-industrial basil (*Ocimum basilicum*) residues as an effective solution for removing pharmaceuticals from contaminated water through adsorption. Achieving more than 80% removal, the pyrolyzed material effectively adsorbed antidepressants in batch. Additionally, the study investigates the use of biochar as a catalyst in electrochemical techniques such as electro-Fenton process to antibiotics degradation in wastewater, showing a high effectiveness.The dual role of biochar as adsorbent and catalyst offers a sustainable approach for mitigating pharmaceutical contamination in wastewater, contributing to circular economy with zero waste production.

Acknowledgments

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PC 24. Ofloxacin degradation by activated sludge microbiota: chiral antibiotic bioremediation

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Abstract

Water is one of the most important habitats and propagation routes for bacteria, playing a major role in the dissemination of antimicrobial resistance (AMR), which can be promoted by the discharge of antibiotic residues into the environment (1). Fluoroquinolones (FQs) are among the most widely prescribed antibiotics against both Gram-negative and Gram-positive bacteria in human and veterinary medicine. However, they are highly recalcitrant in the environment (2,3). Due to concerns about AMR, some antibiotics, namely FQs, have been included in priority and Watch Lists, as is the case with ofloxacin (OFL) (4). Since OFL is a chiral FQ, it can display different bioactivity depending on their enantiomers, further complicating this environmental problem (5). This work aims to find a bacterium or bacterial consortium, isolated from activated sludge collected at a wastewater treatment plant, able to degrade OFL, and to understand the enantioselective mechanisms involved in its degradation. Enrichment cultures were used to promote the selection of OFL-degrading bacteria. The work is still ongoing, with OFL degradation being monitored by high-performance liquid chromatography with fluorescence detection as of 6 weeks ago. The results obtained showed a slight decrease in OFL concentration for enrichments supplemented with yeast extract. Monitoring will continue, and in the case of satisfactory degradation results, the OFL-degrading bacteria will be isolated for further enantioselective experiments.

Acknowledgments

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PC 25. ZnO/g-C_3N_4 Composites Prepared Via Deep Eutectic Solvents: A Green Strategy for Dye-Contaminated Water Treatment

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Abstract

Recently, growing environmental concerns have increased the demand for sustainable and clean technologies. Researchers worldwide are actively working to create greener methods for catalyst synthesis. Their efforts focus on minimizing the use of hazardous solvents during synthesis and purification, avoiding toxic substances and reducing energy consumption. In this context, Deep Eutectic Solvents (DES) have emerged as promising alternatives. DES are liquid systems formed by the interaction of two or more components, usually a hydrogen bond donor and a hydrogen bond acceptor, in specific molar ratios to form a eutectic mixture. DES represent a novel class of low-cost, environmentally friendly solvents with great potential to replace traditional catalysts and solvents [1]. For this reason, DES have recently gained attention in the synthesis of catalytic materials, especially in combination with Advanced Oxidation Processes (AOPs) for water treatment, offering a sustainable alternative to conventional methods. This research focuses on the synthesis of ZnO/g-C_3N_4 composites obtained via pyrolysis of DES and evaluate their application as efficient green catalysts for treating dye-contaminated water. The synthesis was performed in two stages, the ternary DES was prepared from a mixture of melamine, urea and $ZnCl_2$ and then the mixture was calcined in a muffle furnace at 550 °C to obtain ZnO/g-C_3N_4 composites. Photocatalytic, photo-Fenton and electro-Fenton like experiments were conducted using Rhodamine B as a model contaminant to evaluate the catalytic performance, reusability and stability of the synthesized material. The results showed that the ZnO/g-C_3N_4 composites achieved a remarkable photocatalytic activity, achieving a dye removal of around 59% in 90 min. The combination of the designed catalyst and the Fenton-like process, photo-Fenton-like process, significantly improved this performance, achieving a removal close to 95% in 60 min due to the synergistic effects of irradiation and H_2O_2 activation. In the case of the electro-Fenton-like process, the efficiency was higher, reaching 90% removal in 45 min. Moreover, both materials presented remarkable reusability. These findings highlight the potential of ZnO/g-C_3N_4 composites synthesized via DES as a sustainable and cost-effective alternative for water remediation technologies.

Acknowledgments

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PC 26. Biochar Derived from Argan Nut Shells for Ciprofloxacin Removal from Water: Adsorption and Electrochemical Degradation Approaches

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Abstract

Pharmaceutical substances, such as ciprofloxacin (CIP), have been detected in aquatic environments and pose a growing threat to both human health and ecosystems. Therefore, more efficient water and wastewater treatment technologies must be implemented to tackle this issue. In this sense, this work focuses on the valorisation of argan nut shells, an abundant agricultural by-product in Morocco, for the production of carbon-based materials intended for water and wastewater treatment. Biochars were prepared via pyrolysis under a nitrogen atmosphere with a heating rate of 10 °C/min at different temperatures (400, 500, 600, 700 and 800 °C). Chemical activation was performed simultaneously during pyrolysis, following impregnation of the biomass with potassium hydroxide (KOH) at various biomass:KOH mass ratios (1:1, 1:2, 1:3, 2:1 and 3:1). The synthesized materials were characterised using FTIR, Raman, SEM, XRD, zeta potential and surface area analyses. Their performance was evaluated through two approaches: (i) adsorption and (ii) electrochemical degradation of CIP using modified electrodes. Operating parameters were investigated to assess the adsorptive and oxidative mechanisms for CIP removal, such as contact time, initial concentration, pH and ionic strength. Therefore, this study highlights the potential of argan nut shells as a sustainable feedstock for the development of efficient carbon-based materials for advanced treatment of water or wastewater contaminated with pharmaceutical compounds.

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PC 27. Zn-MIL53(Fe)-based MOFs for venlafaxine removal from water via adsorption and photocatalysis

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Abstract

Six different Zn-MIL53(Fe)-based Metal Organic Frameworks (MOFs) [1], ranging from ratio 1:1 to 1:3 and 1:1 to 3:1 (Fe:Zn molar ratio), were sinthesized (Figure 1). These materials were tested as adsorbents and photocatalysts to remove from water the pharmaceutical compound venlafaxine (VFX), which has been considered by the European Commission as a target substance for monitoring of surface water and, more recently, urban wastewater according to Directive (EU) 2024/3019. The best adsorption performance was obtained by using the MOF prepared with a 1:2 Fe:Zn ratio (25% VFX removal within 5 minutes), and the same MOF achieved 70% VFX removal in 60 minutes by photocatalysis with a 414 nm LED. Better photocatalytic performances were observed with increased Fe contents (2:1 and 3:1 Fe:Zn ratios), reaching over 99% VFX degradation within 30 minutes. The results were also good in terms of total organic carbon removal (>90% in 60 minutes). Moreover, several assays were conducted to optimize the working conditions, such as MOF dosage, contact time, and molar ratio, using a central composite design. Finally, the best-performing MOF was tested in cyclic adsorption-photocatalytic runs, without losing its photocatalytic ability after the reuse assays. Experiments were also performed using different VFX-spiked water matrices with promising results, making it a good candidate for an efficient adsorption-photocatalytic process to remove organic micropollutants (such as VFX) from water or wastewater.

Figure 1. Different Zn-MIL53(Fe)-based MOFs, from left to right (ratio Fe:Zn): 2:3, 3:1, 1:3, 1:1, 1:2 and 2:1.

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PC 28. Novel carboxymethylcellulose-coated metal organic framework composite for enhanced peroxymonosulfate activation in wastewater Treatment

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Abstract

A novel bio-based hydrogel catalyst was developed by successfully embedding the bimetallic Metal-Organic Framework (MOF) Zn-MIL-53(Fe) [1] into a carboxymethyl cellulose (CMC) polymer matrix, so-called CMC-Zn-MIL53(Fe), as seen in Figure 1. The hydrogel's catalytic performance and stability were evaluated for the activation of peroxymonosulfate (PMS), leading to the generation of sulfate radicals ($SO_4^{\cdot-}$). Several optimization experiments were conducted using Rhodamine B as a model organic pollutant. This system achieved 100 % removal of 10 mg/L Rhodamine B from wastewater within 1 hour and 30 minutes. Under optimal conditions—10 g/L of hydrogel (comprising 4.32 g/L of MOF and 50 g/L of CMC) and 0.11 mM PMS—pharmaceutical contaminants such as Fluoxetine and Sulfamethoxazole were removed by over 99 % and 95 %, respectively, within 2 hours. Additionally, the hydrogel demonstrated effective antimicrobial activity, achieving 100 % inactivation of 1×10^{10} CFU for both gram-positive and gram-negative bacteria in 1 hour of treatment. The material also showed excellent reusability, maintaining its performance over six consecutive PMS activation cycles without the need to regenerate the material between them. For all the reasons mentioned above, this material is highlighted due to its potential for efficient and sustainable wastewater treatment applications.

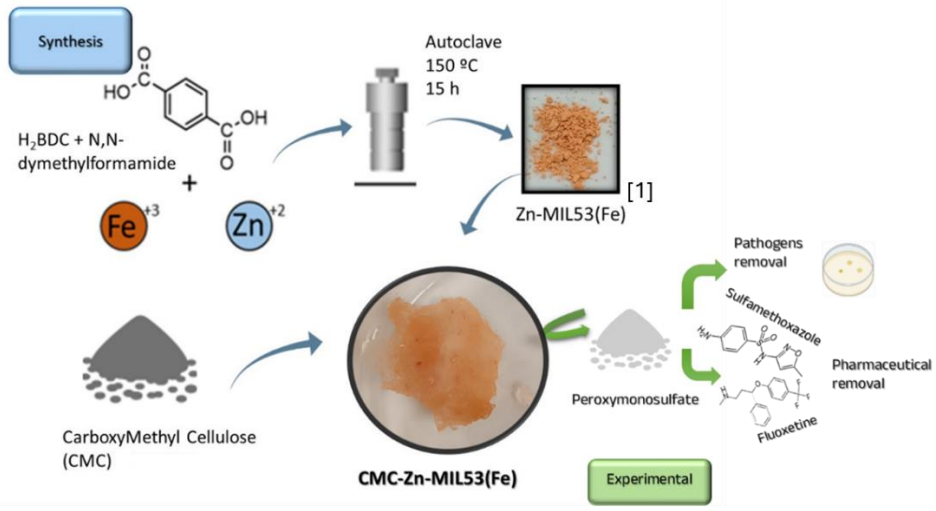

Figure 1. Synthesis and treatment scheme of the CMC-Zn-MIL53(Fe) coated with CMC

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PC 29. Photocatalytic removal of emerging pollutants by environmentally friendly carbon nitride modified photocatalysts in water bodies

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Abstract

The widespread presence of pollutants in aquatic environments has led to ongoing research on the occurrence, fate and impact of known and new pollutants in the environment as well as the development of effective technologies for the remediation of this contamination. Emerging pollutants (EPs) such as pharmaceuticals, and pesticides, pose a significant threat to ecosystems and public health. Among the different technologies, photocatalytic processes have emerged as a powerful strategy for removing these contaminants from water bodies [1,2]. This study focuses on the development of photocatalyst based on graphitic carbon nitride (gCN), offering an environmentally friendly and efficient alternative to conventional photocatalysts. This approach aligns with the principles of Green Chemistry, aiming to improve properties such as charge carrier separation, surface area, and band gap narrowing, while reducing environmental impact. For this purpose, several surface modifications (treatment with acid) and functionalization of gCN (N vacancies generation, doping with O and S) were carried out. The photodegradative capacities of the synthesized material were evaluated using a model compound, Rhodamine B dye, and the most suitable one selected based on their photodegradation kinetics improvement in comparison with the raw gCN. Then, a comprehensive characterization of the selected material was performed including porosity, surface area, band gap, and other relevant properties, revealing significant changes in its photolytic behavior. The effects of different operational parameters, such as visible LED intensity and catalyst dosage were ascertained. To identify the main reactive species involved in the photocatalytic process, scavenger-based experiments were conducted. These confirmed the participation of key radicals in the degradation pathway. The reusability of the photocatalyst was successfully demonstrated, confirming its potential for practical applications with sustained efficiency. Finally, the photodegradation of two different EPs (pharmaceutical and a pesticide) was carried out, showing promising results. The results demonstrate that the developed photocatalyst is a sustainable and feasible alternative for the treatment of the different pollutants contained in water bodies.

Acknowledgments

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PC 30. A Machine Learning Approach to Effluent Quality Analysis: Artificial Neural Networks and Genetic Algorithm Optimization

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Abstract

Wastewater Treatment Plants (WWTPs) play a critical role in safeguarding public health by reducing contaminants in urban wastewater discharges. Understanding the typical behaviour of the pollutants and performing accurate predictions makes it possible to improve resource management, optimise treatment processes, anticipate the need for interventions and establish warning mechanisms [1]. Artificial Neural Networks (ANNs) are machine learning models capable of modelling nonlinear relationships and recognizing patterns in complex datasets [2]. Additionally, Genetic Algorithm (GA) may be applied to optimize ANN structure and parameters for better performance [3]. The aim of this study is to evaluate the predictive performance of an Artificial Neural Network-Genetic Algorithm (ANN-GA) model in forecasting effluent quality in terms of total suspended solids (TSS), total nitrogen (TN), total phosphorus (TP), chemical oxygen demand (COD), and biochemical oxygen demand (BOD), and identifying key input variables influencing effluent composition. Results showed that aeration was the selected threshold variable for the prediction of final TSS and BOD, emphasizing the role of operational conditions. The ANN structure varied by pollutant, highlighting the need for GA optimization. Initial TN was an explanatory variable considered relevant in the prediction of all the selected output variables, with initial TSS, BOD and COD and seasonality index also frequently selected. The models showed high accuracy for final TSS and TN, while final BOD had low performance, likely due to unmeasured or highly variable factors. Overall, the findings underscore the strong potential of ANN-GA models to support WWTP decision-making and enhance treatment efficiency.

Acknowledgments

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PC 31. Microplastic Degradation Via Peroxymonosulfate Activation: Catalyst Design and Synthesis

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Abstract

In recent years, plastics have become indispensable materials in modern life. Mainly due to their lightness, strength, and durability, they are widely used across various sectors, but their growing consumption has led to significant environmental problems. In particular, the continuous release of microplastics, particles smaller than 5 mm, represents a global threat to ecosystems and human health due to their widespread occurrence and the physical and chemical transformations they undergo upon environmental exposure. Although wastewater treatment plants can partially remove these pollutants, the lack of standardized analytical methods and the limited effectiveness of conventional treatments highlight the need for innovative technologies [1]. In this sense, the use of peroxymonosulfate (PMS) in combination with metal catalysts emerges as a promising strategy. During this treatment, PMS is activated by transition metals, generating sulfate and hydroxyl radicals that attack the microplastics and degrade them [2]. This research focuses on the synthesis of materials containing transition metals (Co, Fe and Zn) to be used as catalysts together with PMS in the treatment of different types of microplastics present in wastewater. Three different materials were synthesized and tested performing degradation experiments with three types of microplastics. In addition, different amounts of PMS were tested to observe their influence on the process. The best results showed that degradation higher than 70% was achieved, these results were confirmed by the spectra obtained by FTIR characterization. Finally, the joint degradation of the microplastics and a mixture of drugs was studied achieving total degradation of the drugs without losing effectiveness in the degradation of the microplastics. These results highlight the potential of this technique as an efficient and promising alternative for the treatment of microplastics in aquatic ecosystems and wastewater plants.

Acknowledgments

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PC 32. Wastewater bacteria response to chiral fluoroquinolones: evaluating enantioselectivity and biotransformation potential

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Abstract

Conventional wastewater treatment plants (WWTPs) poorly degrade most pharmaceutically active compounds, leading to their persistent release into the environment [1], while also providing favorable conditions for the accelerated evolution of antimicrobial resistance (AMR) [2]. Fluoroquinolones (FQs), widely used in human and veterinary medicine due to their broad-spectrum activity, are particularly concerning. The chiral nature of many of them further complicates risks, as enantiomers exhibit distinct toxicodynamic and toxicokinetic properties, potentially increasing ecological hazards [3,4]. Thus, this study aimed to investigate the potential enantioselective antibacterial activity induced by the enantiomers of two FQs used in human and veterinary medicine, ofloxacin and flumequine, respectively. To achieve this, filtered bacterial biomass collected from a WWTP were exposed to Minimum Inhibitory Concentration (MIC) levels of both individual enantiomers and the racemic mixture of each target antibiotics. Isolation and purification of bacterial strains will be performed using Chromogenic Coliform Agar (CCA) and Plate Count Agar (PCA), followed by taxonomic identification (16S rRNA gene sequencing) of the isolates. The obtained results will provide deeper knowledge regarding the enantioselectivity of the enantiomers of the target FQs, as well as a foundation for future studies on the biotransformation of the selected FQs and their metabolites.

Acknowledgments

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PC 33. Kinetics of struvite precipitation in sidestream digestate: determination of induction time and precipitation rates at different initial Mg:P molar ratios

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Abstract

Struvite ($MgNH_4PO_4 \cdot 6H_2O$) crystallization from sludge dewatering liquors rich in PO_4^{3-} and NH_4^+ offers a sustainable and economical method for nutrient recovery, transforming waste into a valuable slow-release fertilizer [1]. As a magnesium (Mg) supply is required to enhance the process's effectiveness, detailed knowledge of the struvite crystallization kinetics in these liquors is crucial to optimize conditions and improve yields [2]. Hence, the kinetics of struvite's precipitation was investigated in aqueous supersaturated solutions of sidestream digestate samples (WWTP Freixo) at 20°C in a 250 mL stirred reactor at 300 rpm. The pH was adjusted to 9.0 with a 0.23 M NaOH solution. The initial Mg concentration was adjusted to 2.55 mM, 2.75 mM, 2.94 mM, and 3.13 mM using an $MgCl_2$ solution to achieve initial Mg:P molar ratios of 1.3, 1.4, 1.5, and 1.6. Results showed that the rate of PO_4^{3-} consumption followed a first-order kinetic model. All experiments demonstrated good P recovery efficiencies (>90%), and the rate constants exhibited a trend where an increase in the initial $[Mg^{2+}]$ corresponded to a faster precipitation process. Changes in the pH solution signaled the onset of struvite precipitation and were used to determine the induction time (τ_{ind}) for different initial molar ratios [3,4]. The plots of tangents to the pH curves showed that the τ_{ind} decreased as the initial supersaturation increased. The induction time remained below 45 seconds, indicating that a residence time greater than that is required to ensure nucleation and growth of crystals within the crystallizer when shifting from batch to continuous crystallization. The results confirmed that the control of the initial magnesium dose is a key factor that influences the rate of crystallization process.

Acknowledgments

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PC 34. Production of battery grade materials from End-of-Life Lithium-Ion Batteries through hydrometallurgy and direct recycling approaches

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Abstract

Greenhouse gas emissions and climate change mitigation have create a direct causal effect on the high demand for raw materials essential in electric vehicles production, specifically lithium (Li), cobalt (Co), and nickel (Ni) [1]. In response, Directive EU Battery regulation defined a strict recovery targets: a recycling efficiency of 70% by 2030, recovery goals of 95% for Co and copper, and 80% for Li by 2031 [2]. Therefore, it is imperative to prioritize recycling, contributing to the circular economy and reducing the need on new resources extraction. End-of-life lithium-ion batteries (LiBs) and battery manufacturing scraps are the primary feedstocks for battery recycling. The recycling process involves several stages: discharging, disassembling, mechanical separation and sorting of battery components [3]. These steps enable the recovery and separation of black mass (BM), ensuring efficiency and effectiveness in the recycling process. This is followed by a hydrometallurgical approach which depends on the type of LiBs, due to the wide range of batteries cathode chemistriesto convert BM into battery-grade materials. The major challenges lies in the use of environmentally friendly reagents, minimizing waste and toxic effluents, and exploring ways to reintegrate waste streams or process water into earlier stages, enhancing process circularity. The research aims to develop an advanced hydrometallurgical process based on a new technological strategy, capable of processing end-of-life LIBs and production scrap, to overcome standard processes while minimizing environmental impact and aligning with the EU's 2030 sustainable development targets.

Acknowledgments

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PC 35. Efficient Recovery of the Main Major Raw Materials from Waste Light-Emitting Diodes

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Abstract

This work presents an efficient methodology for the recovery of the major raw materials, such as, copper (Cu), aluminium (Al), and fiberglass from the waste light emitting diodes (LEDs). Unlike existing methods, this process emphasizes both environmental and economic viability by recovering the most important raw materials that constitute the LEDs. Our approach optimizes the total delamination of LED frames through the use of Hansen solubility parameters to select the most effective solvents. The total delamination of the LED frame represents a noteworthy achievement since it promotes the separation of all the main raw materials allowing their further recovery. Subsequently, a effective two-stage air-flow separation process was implemented, which resulted in the selective recovery of Al (100%), Cu (80.9%) and fibreglass (88.4%), surpassing recovery rates obtained with the traditional methods [1]. The quality of the final products recovered (**Figure 1**) showed good thermal and chemical properties, evidencing that they can be reused for other applications. Moreover, this innovation not only maximizes material recovery but also minimizes environmental impacts, such as dust and wastewater generation.

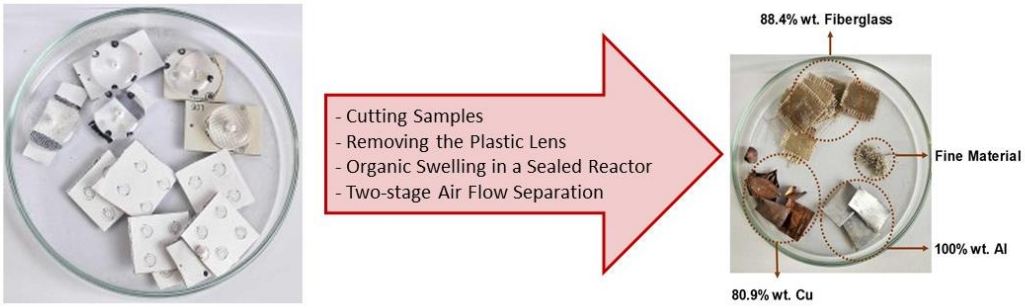

Figure 1. Original LEDs frames treated and the outputs raw products and their recovery rate after applying the proposed methodology.

The proposed method offers a faster and sustainable recycling strategy to LED waste, highlighting its potential for large-scale industrial practices due to its simplicity and scability.

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PC 36. A New Flight for Plastic Waste: Catalytic Conversion of LDPE Powder Into Sustainable Aviation Fuel

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Abstract

The aviation sector was responsible for 2.5 % of all energy-related CO_2 emissions in 2023, with its emissions increasing more rapidly than rail, road, or maritime transport sectors since 2000 [1], yet current technologies for Sustainable Aviation Fuels (SAF) remain underdeveloped [2]. Simultaneously, plastic waste production is ever-increasing, but plastic waste management solutions remain insufficient [3]. This study aims to develop a possible synergetic solution for both issues by developing heterogeneous catalysts for producing aviation fuels from commercial low-density polyethylene (LDPE) powder. Firstly, 2.5 wt.% of Ru was impregnated on oxidised carbon nanotubes (CNT_{ox}). In addition, two zeolites were calcined at 600 °C to obtain their acid forms (H-Y and H-ZSM-5). The catalytic cracking tests were performed in a 100 mL stainless steel Parr batch reactor. In a typical run, 5 g of LDPE and 0.5 g of each catalyst were loaded into the reactor. The initial H_2 pressure was adjusted to 40 bar. The reactions were performed at 300 °C and 400 rpm of stirring rate for 4 h. The liquid products were analysed by gas chromatography-mass spectrometry (GC-MS), and the gaseous products were analysed using a GC-flame ionisation detector (GC-FID). Among the different catalysts tested, a mixture of Ru/CNT_{ox} and H-Y presented the best combination, taking into consideration the highest selectivity (65.4 %) in terms of SAF hydrocarbons (C_8-C_{16}) as well as the conversion (96.8 %). This combination presented better results when compared to either the Ru/CNT catalyst or the H-ZSM-5, suggesting that the acidity of the Ru/CNT_{ox} and H-Y favoured the required cracking reactions.

Acknowledgments

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PC 37. Valorization of Textile Waste through Thermal Processes to Produce Adsorbent Materials

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Abstract

Dyes, widely used by the textile industry, are harmful to aquatic ecosystems when discharged without treatment. They modify the color of water, altering photosynthetic cycles [1]. Therefore, the development of economical and environmentally sustainable treatment technologies is essential. In this study, adsorbent materials (AM) were produced from textile waste (TW) and their ability to remove color from synthetic textile effluents was evaluated. Five types of fabrics were analyzed: cotton (CO), modal (MO), lyocell (LY), polyester (PES), and polypropylene (PP). The fabrics underwent thermal treatment at 500-700 °C, maintained for 1 h under atmospheric N_2, and also physical activation (with CO_2) or chemical activation (using H_3PO_4, $ZnCl_2$ and K_2CO_3). The thermal stability of fabrics, yield from the thermal treatment, and the textural properties of the AM were assessed. The color removal assays were carried out through adsorption tests (adsorbent concentration of 2 g L^{-1}), where the influence of pH (4, 7, and 11) was evaluated. The synthetic effluent was prepared with Direct-Blue 85 (DB-85) or Basic Red 46 (BR-46) dyes (40 mg L^{-1}), NaCl (2.5 g L^{-1}), and $NaHCO_3$ (1.0 g L^{-1}). Preliminary results revealed that pure PES and PP were unsuitable for producing AM, while the other fabrics yielded between 15% and 20% in mass. Chemical activation improved yields, reaching between 30 and 43%. Adsorption tests at pH 7 showed the best color removal for DB-85. Without activation, the highest removals were 15% for CO and LY. With chemical activation, CO-$ZnCl_2$ and LY-$ZnCl_2$, achieved 34% removal. For BR-46, the best results were obtained at pH 11. Without activation, CO and LY showed removal efficiencies of 80% and 70%, respectively. With chemical activation LY-$ZnCl_2$ reached up to 99% removal. CO_2 activation did not increase color removal for both dyes. These findings suggest that TW appears as an alternative for the production of AM, contributing to the circularity of the textile industry. The results highlight the influence of fabric composition, contaminant characteristics, and activation methods to improve adsorption performance and dye removal efficiency.

Acknowledgments

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PC 38. Integration of Vermifiltration and Hydroponics for Sustainable Plant Production and Treatment of Swine Wastewater

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Abstract

Water scarcity and nutrient depletion are critical global challenges, threatening agricultural productivity and food security [1]. The reuse of agro-industrial wastewater, particularly from swine production, presents a sustainable strategy to address these issues. Due to their high nutrient load, swine effluents can cause significant environmental harm if mismanaged [2]. However, when appropriately treated using biological processes such as vermifiltration, which enables both contaminant removal and nutrient recovery [3], these effluents are a viable resource for plant cultivation systems, such as hydroponics [4], known for its highly efficient approach to water and nutrient use [5]. The integration of these technologies represents a promising pathway for advancing sustainable agricultural development and efficient wastewater treatment. This study evaluated a small-scale integrated system of vermifiltration and hydroponics using swine wastewater from facultative lagoons for plant production and generation of treated water for reuse in irrigation. Lettuce, chosen as a model culture, was grown hydroponically for 35 days using supplemented vermifiltered water (SVW), non-supplemented vermifiltered water (VW), and a nutrient solution (SN) as control. SVW showed better results in terms of plant productivity, light and water use efficiency, and nitrogen and phosphorus removal than VW. Nevertheless, an increase in coliform counts was observed, indicating the need for additional disinfection. Regarding water treatability, nitrogen, phosphorus, and other monitored parameters in all treatments complied with the legal limits for discharge, restricted irrigation, and certain urban uses. These findings suggest that vermifiltered swine wastewater from facultative lagoons is an effective medium for batch hydroponic lettuce cultivation, with or without nutrient supplementation, offering potential for application in other crops. An improved understanding of this wastewater treatment is expected to be the focus of future research.

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PC 39. Development of Electrocatalysts for Green Hydrogen Production via Sulfur Dioxide Depolarized Electrolysis

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Abstract

Green hydrogen (H_2) is crucial for the energy transition, providing a clean alternative to fossil fuels, which account for 75% of greenhouse gas emissions in the European Union (EU) [1]. Water electrolysis is a promising method for H_2 production, but its high energy demand increases costs, limiting large-scale applications. An alternative is sulfur dioxide (SO_2)-depolarized electrolysis (SDE), which lowers the energy requirement ($E°$ = 0.158 V) compared to conventional electrolysis ($E°$ = 1.23 V) [2]. To date, platinum (Pt) electrocatalysts have been the most widely employed for SDE due to their excellent electrocatalytic activity and stability under operational conditions [3]. Developing novel metal-based materials as electrocatalysts for SDE is urgently needed to reduce reliance on noble metals. This study aims to develop cost-effective electrocatalyst materials for SDE based on Pt and nickel (Ni) synthesized using co-precipitation. The electrocatalysts were prepared using different metal (Pt:Ni) ratios and deposited onto a gas diffusion layer (GDL) via spray coating. The resulting electrodes were characterized using electrochemical techniques, including cyclic voltammetry (CV), linear sweep voltammetry (LSV), electrochemical impedance spectroscopy (EIS), and chronoamperometry. All electrochemical measurements were performed in a batch electrochemical system using an H-cell. This work is part of WP05 - Solutions for H_2 Production Through the Westinghouse Process under the ATE Agenda.

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PC 40. Air Quality Characterisation in Public Transport: Preliminary Results from a Case Study in Trains

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Abstract

Citizens spend around 90% of their daily time indoors, exposed to harmful air pollutants' concentrations. While research has been focusing mostly on buildings, studies in public transport are scarce and scattered despite evidence of passengers significant exposure to poor indoor air quality (IAQ) in this environment [1,2]. To fill this gap, this study aimed to characterise IAQ inside trains during urban and suburban trips and at platforms. Data collection was performed on a summer day in 2024, covering a total of 8 trips (total of 496 min) and corresponding waiting time on platforms (total of 144 min). An urban/suburban train route in Portugal was selected for IAQ monitoring during rush and non-rush hours (between 6:00 am and 8:30 pm). Two research-grade instruments were used to continuously monitor (1-min log intervals) concentrations of particulate matter (PM_1, $PM_{2.5}$, and PM_{10}), carbon dioxide (CO_2), carbon monoxide (CO), and total volatile organic compounds (TVOC). The monitoring equipment was placed in the seating area of the central train carriage. The measured concentrations in the train and on platforms were compared with IAQ reference limit values from the Portuguese legislation for indoors (buildings) and outdoors, respectively. The results showed for PM_1, $PM_{2.5}$, PM_{10}, CO_2, CO, and TVOC, respectively, mean concentrations of: a) 22.7 µg/m^3, 23.1 µg/m^3, 25 µg/m^3, 1200 mg/m^3, 1.4 mg/m^3, and 307 µg/m^3 in trips; and b) 35.6 µg/m^3, 37.3 µg/m^3, 49.7 µg/m^3, 1040 mg/m^3, 1.4 mg/m^3, and 326 µg/m^3 on platforms. Exceedances to reference limit values were mostly found for $PM_{2.5}$, with concentrations surpassing 37% and 89% of the times the limit value for indoors (25 µg/m^3 for 8h) and outdoors (annual 20 µg/m^3), respectively. Overall, TVOC concentrations were higher during morning rush hours (commuting), while the other pollutants registered higher levels in non-rush hours due to increased touristic activity typical of this season. Moreover, PM concentrations were higher at platforms, while levels of CO_2 and TVOC were higher inside the train carriage. More studies are needed to aid public transport operators to develop and implement strategies to reduce users exposure to air pollution while travelling.

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PC 41. Effect of N_2 and CO_2 Gases on SO_2 Depolarized Electrolysis Performance for Green Hydrogen Production

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Abstract

Driven by decreasing fossil fuel consumption, rising energy demand, and environmental pollution, the search for clean and sustainable energy is attracting significant research interest. Hydrogen (H_2) has emerged as a promising energy carrier due to its high energy density and environmentally benign combustion, which yields only water as a by-product [1]. Among various H_2 production technologies, sulfur dioxide (SO_2)-depolarized electrolysis (SDE) has attracted growing interest as an energy-efficient alternative to conventional water electrolysis. SDE uses SO_2, a common industrial pollutant, as the anodic reactant, replacing the oxygen evolution reaction (OER). This substitution reduces the theoretical cell voltage required for water electrolysis from 1.23 V to 0.158 V *vs* RHE, resulting in substantially lower energy consumption [2]. Most existing studies focus on idealized systems using pure SO_2, which does not reflect the composition of actual industrial emissions. SO_2 gas is often accompanied by other gases such as nitrogen (N_2) and carbon dioxide (CO_2), which may impact electrolyzer performance. This study aims to address this existing knowledge gap by evaluating the operational performance of an SO_2 electrolyzer under conditions that mimic industrial flue gas environments. Specifically, the effect of introducing varying concentrations of N_2 and CO_2 into the SO_2 feed was assessed. Electrochemical characterization techniques, including polarization curves, electrochemical impedance spectroscopy (EIS), and chronoamperometry, were employed to evaluate cell efficiency, resistance, and long-term stability. The presence of N_2 and CO_2 was found to negatively affect the performance of the SDE system.

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PC 42. Green Hydrogen Generation via SO_2 Depolarized Electrolysis: Recent Advances, Challenges, and Prospects

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Abstract

The global transition to a low-carbon economy has positioned green hydrogen (H_2) as a keystone for achieving 2050 decarbonization targets [1]. Among various H_2 production methods, electrolysis powered by renewable energy stands out for its sustainability. Sulfur dioxide (SO_2)-depolarized electrolysis (SDE) has emerged as a promising approach for large-scale green H_2 production, offering significantly reduced cell voltage compared to conventional water electrolysis and lowering energy consumption [2,3]. Moreover, SDE enables the valorization of SO_2, a common industrial byproduct, thereby contributing to the reduction of greenhouse gas emissions, while also facilitating the simultaneous production of sulfuric acid (H_2SO_4), a valuable industrial commodity. This work presents a comprehensive review of recent advancements in SDE for the H_2 evolution reaction, focusing on progress in electrolyzer design, catalyst development, membrane performance, and overall system optimization. Key parameters influencing process efficiency, such as temperature, electrolyte composition, and current density, were critically analyzed. The review also offers critical insights and outlines potential strategies for achieving high-efficiency H_2 production through SDE, while assessing the scalability of the process for industrial applications.

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PC 43. Sustainable Hydrogen Production Using Biomass Waste

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Abstract

To reduce global dependence on fossil fuels and tackle the climate crisis, it is essential to invest in innovative solutions that enable the production of sustainable fuels, thereby contributing to carbon neutrality. Among these alternatives, hydrogen (H_2) stands out as a clean option with significant potential for applications in transportation and energy storage sectors. However, the most widely used method for its production, steam methane reforming, presents several limitations, including high carbon dioxide emissions and substantial energy consumption. Photocatalysis using biomass waste emerges as an innovative and promising approach, as biomass acts as a sacrificial agent, providing the electrons necessary for H_2 production [1]. To optimize the photocatalytic process, a low loading (1.0 %*w/w*) of platinum (Pt) was introduced onto the optical semiconductor graphitic carbon nitride (GCNT) via the incipient method. This material is particularly notable due to its ability to be photoactivated within the visible range of the electromagnetic spectrum [2]. Various types of biomass waste, including banana peel, orange peel, lemon peel, lemon tree leaves, daisy flowers, grass, corncob, and coffee, were evaluated to identify their potential for H_2 generation. Among the tested feedstocks, banana peel waste proved to be the most efficient, yielding approximately 76 µmol of H_2 after 170 min of reaction. Samples were collected before and after the photocatalytic process, and High-Performance Liquid Chromatography (HPLC) analysis indicated that the sugars consumed during the reaction were fructose and glucose. The results suggest that these sugars play a crucial role by acting as electron donors in the H_2 production process.

Acknowledgements

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PC 44. Low-Temperature CO_2 Methanation via Solar-Driven Photo-Thermal Catalysis over Ru/TiO_2 Supported on Carbon Nanotubes

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Abstract

Amid the global energy and climate crisis, the catalytic conversion of CO_2 into methane (CH_4) offers a promising pathway for energy storage and greenhouse gas mitigation. In this context, this work aimed to develop a ruthenium/titanium dioxide (Ru/TiO_2) catalyst supported in carbon nanotubes (CNTs) to foster photo-thermal CO_2 methanation at low temperatures, leveraging the synergistic effects of photonic and thermal activation [1], as well as increased surface area and charge transfer proprieties [2]. First, Ru/TiO_2 catalysts (10 wt.% Ru) were synthesized via a solvothermal route involving a: (i) two-stage sonication-mixing (30 min of TiO_2 suspension, followed by 30 min after Ru addition); (ii) in-autoclave reduction (180 °C); (iii) centrifugation/separation; and (iv) calcination (350 °C, 3 h). The photocatalytic activity was evaluated for different in-autoclave reduction times (5, 10, 15, and 30 h), in a batch photoreactor (40 mL) at 160 °C under simulated sunlight (1000 W m^{-2}, 280-3000 nm) using the stoichiometric [H_2]:[CO_2] molar ratio (4:1). All Ru/TiO_2 photocatalysts exhibited similar specific CH_4 production rates (Y_{CH4}), except the 5-h sample, which showed lower activity (17-23%). Thus, the 10-h material was selected as the base for CNTs incorporation, showing an average Y_{CH4} of 7.2 ± 0.8 mmol g_{cat}^{-1} h^{-1}. Afterwards, five different approaches were assessed to add 20 wt.% CNTs: (A) before Ru addition; (B) before reduction; (C) manual mixing before calcination; (D) mechanical mixing via ball milling with calcinated Ru/TiO_2; and (E) ultrasonic mixing with calcinated Ru/TiO_2. Among the Ru/TiO_2@CNTs composites, all strategies except ultrasonic mixing (E) improved CH_4 production. While methods A, B, and C showed no substantial differences, method D (ball milling) led to the best performance, with a 43% increase in Y_{CH4}. Additionally, all materials reached CO_2 conversion efficiencies above 45% within 20 min and remained stable for at least 6 consecutive cycles.

Acknowledgments

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PC 45. Reducing Noise from Low-Cost Ozone Sensors Signal for Accurate Real-Time Indoor Air Quality Monitoring

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Abstract

Low-cost sensors (LCS) have created a paradigm shift in air quality monitoring by providing an economical, real-time monitoring solution. However, there are several inherent issues that reduce their accuracy [1]. Sensor noise is usually neglected as researchers take hourly means while analyzing air quality data. As sensor noise is generally white noise, taking hourly means alleviates the issue. However, one of the biggest advantages of LCS is the ability to take reactive measures in real time to mitigate increasing pollutant concentrations and real-time monitoring of short temporal resolution suffers from noisy sensor readings. This study aimed to observe and rectify the noise in sensor response for electrochemical ozone LCS. Two low-cost air quality monitoring devices were developed using one Alphasense OX-A431 ozone sensor each. The sensors were interfaced with a custom-made printed circuit board via analog front-end board from Alphasense, and the sensor response was obtained by an analog to digital converter (ADC). A simplified Kalman Filter was used to model the sensor noise as it can be implemented in embedded devices for noise reduction in near real-time [2]. The Pearson's correlation coefficient (PCC) between the two LCS systems increased from 0.77 to 0.98 after sensor noise reduction. When compared to a research-grade instrument the linear correlation also increased (from PCC 0.80-0.85 to 0.94), thus, implying a strong increase in sensor reproducibility. Consequently, the strong linear sensor response ensured that the linear field calibration models showed high R^2 (0.88-0.89) and low error values when the two LCS systems were compared with the research-grade instrument. This improved the accuracy of the devices significantly from the relatively lower R^2 (0.64-0.72) before the noise filter was implemented.

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PC 46. Microbial Fuel Cells' Integration in Constructed Wetlands: A Mini-Review

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Abstract

Constructed wetlands (CW) are widely recognized as an effective nature-based solution for wastewater treatment with benefits that include low energy consumption, ecological enhancement, aesthetics, and carbon sequestration potential [1], [2]. As stated by [3] and [2], CW's performance could be enhanced through hybrid configurations, combining different hydraulic flows, macrophyte types, and hydrological regimes. In addition to their treatment capacity, CW are characterized by having organic matter in their substrate and surrounding wastewater, and hosting microbial communities capable of electricity generation through biocatalytic metabolism, under anaerobic conditions. This dual functionality of a CW has been demonstrated in several studies [4], and [5]. The electroactive bacteria oxidize organic matter and transfer electrons to the anode. The electrons are then transferred to the cathode region through an external resistance. This process results in the generation of bioelectricity while simultaneously treating wastewater. This is the basic principle of microbial fuel cells (MFC) operation. This study aims to critically review current research on the integration of MFCs into CW, focusing on electricity generated from the organic matter content present in the wastewater. The study proposes a systematic review of relevant scientific literature, with a particular focus on recent developments in MFC associated to CW [6]. Emphasis will be placed on decentralized wastewater treatment scenarios where influent quality and quantity fluctuate, as typically observed in rural tourism facilities. Implementation challenges such as system complexity, potential toxicity from electrode materials, and pollutants accumulation will also be assessed. The review will be carried out based on scientific databases such as ScienceDirect, SpringerLink, and Scopus to identify trends, technological frameworks, and knowledge gaps. The review provides insights into the current state of MFC application in CW, comparing their performance in treating wastewater and assessing their energy recovery potential. The findings will support the development of a conceptual framework for integrating MFC into CW, enabling more sustainable, decentralized water treatment systems. This contributes directly to SDG 6 by enhancing access to safe water, SDG 11 through support for resilient and sustainable community infrastructure, and SDG 13 by promoting low-carbon, energy-generating wastewater technologies that mitigate climate impact.

Acknowledgments

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PC 47. Valorization of Biomass Waste into Sustainable Aviation Fuels: A Life Cycle Assessment Perspective

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Abstract

The aviation sector faces increasing pressure to transition from fossil-derived fuels to more sustainable alternatives to meet global climate goals [1]. Sustainable Aviation Fuels (SAFs) offer a promising alternative, but their environmental performance depends on the nature of the feedstock, conversion pathway, and process design. This study aims to evaluate the potential of biomass waste valorization for SAF production, focusing on catalytic conversion routes. A Life Cycle Assessment (LCA) was carried out using SimaPro, a software platform that quantifies environmental impacts across a product's full life cycle, following the ISO 14044 guideline [2]. The assessment was based on the process described in a paper titled “Pilot study on production of aviation fuel from catalytic conversion of corn stover”, which utilizes corn stover as a representative lignocellulosic biomass [3]. The environmental results will be compared with conventional fossil-derived jet fuels and commercial SAF production routes like Hydroprocessed Esters and Fatty Acids (HEFA) and Fischer–Tropsch (FT) synthesis. The conversion system is currently being modeled in Julia to validate mass flows and assess process performance. Moreover, this study aims to explore optimization strategies to reduce steam energy demand in the steam stripping unit, increase water recirculation to minimize freshwater usage, and replace homogeneous acid catalysts with heterogeneous ones to enhance catalyst recovery and system sustainability. These results will contribute to a deeper understanding of low-impact SAF production pathways and support future efforts to decarbonize the aviation sector through advanced biomass conversion technologies.

Acknowledgments

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PC 48. Impact of indoor air pollution on children's health: a risk assessment

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Abstract

Poor indoor air quality (IAQ) in educational settings has often been reported and associated with adverse effects on children's health [1]. Thus, this study mainly aimed to assess the children's health risks from combined exposure to NO_2, O_3, formaldehyde and CO_2 in 11 nursery and 11 primary schools within the Porto district. A screening tool developed by World Health Organization (WHO) was used to assess the risks for respiratory, cardiovascular, neurological, carcinogenic, and irritation effects at three different tiers (Tier 0, Tier 1 Level 1 and Tier 1 Level 2), considering IAQ data collected over five years, and categorized by age group (infants, preschoolers, schoolers and lunchroom) and season (warm and cold) [2]. The results evidenced exceedances to the reference levels of CO_2 concentrations in all age groups (excepting lunchroom), predominantly during cold season. Therefore, CO_2 was the main contributor for exceedances to acceptable hazard index (HI>1) in Tier 0 and Tier 1 Level 1, namely for respiratory, cardiovascular, and neurological effects, with more evident risks for infants during the cold season. Although no exceedances of formaldehyde concentrations were previously detected, it was the primary contributor to the exceedances in respiratory effects in Tier 1 Level 2, mainly affecting children from infants age group (with an adjusted point of departure index up to 4.61). Overall, younger children (infants) seem to be subject to worse IAQ and, consequently, an increased health risk, most evident at the respiratory level, due to combined exposure to indoor air pollutants, in particular CO_2 and formaldehyde.

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PC 49. Assessment of Volatile Organic Compounds and Physical Parameters in Five Primary Schools in Oporto, Portugal

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Abstract

In recent years, indoor air quality (IAQ) has gained significant scientific attention, being linked to various adverse health outcomes, as well as the well-being and comfort of the respective occupants [1]. In that context, the negative effects of IAQ are even more relevant for children due to their greater vulnerability [2]. Thus, this study aimed to evaluate the levels of total volatile organic compounds (TVOCs) and physical parameters (temperature – T, relative humidity – RH) in child-relevant environments. The sampling campaigns were done in January–May 2024, in five primary schools (S1-S5) situated in Oporto, Portugal. At each school, IAQ monitoring was conducted continuously over 1 week (Monday–Friday) in 4 classrooms (n=20). Real-time TVOCs were monitored by VelociCalc® Multi-Function Ventilation (model 9565; TSI Inc., Shoreview, USA) while T and RH were assessed by IAQ Calc™ Indoor Air Quality Meters (models 7545; TSI Inc., Shoreview, USA); the logging interval of 1 min was used. The results showed that 24-h means of TVOCs (averaged across each school) ranged between 54.7 (at S2) and 339.8 μg m^{-3} (at S5). However, considering the occupied periods (i.e., specifically when students and teachers were present), 25% of the classrooms exceeded the legislative guideline of 600 μg m^{-3}, with respective mean concentrations ranging between 666 and 1850 μg m^{-3}. In general, these results emphasise the need for IAQ management strategies in schools in order to mitigate the potential health risks and ensure safe and comfortable learning environments. Finally, the analysis of thermal comfort showed that RH and T levels fulfilled the recommended levels, with observed ranges of 45.2-61.0% for RH and 20.6–22.2ºC for T.

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PC 50. A Hybrid Continuous-Flow Solar-to-Heat Photoreactor to Foster Photo-Thermocatalytic CO_2 Methanation

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Abstract

The rising concentration of atmospheric carbon dioxide (CO_2) has increased interest in carbon capture and utilisation (CCU) technologies as a strategy to mitigate climate change. By converting CO_2 into fuels, CCU supports a low-carbon energy transition and reduces reliance on fossil fuels [1]. The hydrogenation of CO_2 into methane (CH_4) via photo-thermal catalysis offers a sustainable alternative to conventional energy-intensive thermal catalysis (400-600 °C), leveraging solar energy and green hydrogen (H_2) [2]. This work presents the development of a pioneering continuous-flow tube-in-tube membrane photoreactor integrated with a medium-concentrating sunlight collector to promote photo-thermocatalytic CO_2 methanation without external heating. The reactor consists of (i) a tubular microporous ceramic membrane coated with a highly active and selective catalyst ($Ru_{10\%}/TiO_2$), concentrically inserted into a quartz glass tube, positioned above (ii) a medium-concentrating solar collector, designed to concentrate UV-Vis radiation and thermal energy evenly across the catalyst surface. The collector optics were optimized via ray-tracing analysis for a concentration factor of 2. The reactor was tested under simulated sunlight (1000 W m^{-2}, 280-3000 nm), and equipped with a gas chromatograph for $CO_2/H_2/CH_4$ quantification and real-time temperature and pressure monitoring. A CO_2/H_2 stream (0.54 mmol CO_2 h^{-1}/2.16 mmol H_2 h^{-1}) was fed through the annular space between the membrane and borosilicate tube and forced to permeate through the membrane pores, maximizing gas-catalyst contact. Under these conditions, the photo-thermocatalytic system achieved annular temperatures around 137 °C using only solar radiation, with a specific CH_4 production rate of 0.60 mmol h^{-1} g_{cat}^{-1}.

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PC 51. Air Quality and Health Benefits of Shore Side Electricity for Ships Calling at Major Iberian Ports

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Abstract

Shipping is responsible for around 80% of global trade by volume and over 70% of global trade by value [1]. In addition, cruise tourism carried 32 million passengers in 2024, becoming one of the most important segments of the tourism sector [2]. Shore Side Electricity (SSE) offers a way to reduce the environmental impact of ships while they are docked at port [3]. This study aims to study the potential air quality, health benefits and savings of the implementation of SSE in the major ports of the Iberian Peninsula (Leixões, Sines, Lisbon, Algeciras, Valencia and Barcelona) for containers, cruise, ferries, ro-ro, and bulk carriers ships. To assess the air quality and health benefits of SSE implementation, shipping emissions were derived from an AIS-based inventory using the STEAM model. The open-source EMEP/MSC-W chemistry transport model was applied to quantify the contribution of shipping emissions to NO_2, SO_2, PM and O_3 concentrations across the Iberian Peninsula. Two scenarios were simulated: i) a 2022 baseline (2022-SCN), and ii) a 2022 scenario with shore-side electricity (2022shore-SCN). The excess all-cause premature mortality due to long-term $PM_{2.5}$ exposure were assessed using log-linear functions based on WHO-HRAPIE relative risks (RRs). YLLs were calculated following WHO life-table methodology. The economic valuation of avoided premature deaths and YLLs was based on the Value of Statistical Life (VSL) and the Value of a Life Year (VOLY), respectively. The 2022shore-SCN scenario with SSE showed reductions in NO_2, SO_2, and PM concentrations near Iberian ports, especially Lisbon, Algeciras, Barcelona, and Valencia. PM reductions extended beyond port areas due to transport. A slight increase in O_3 was observed, likely from reduced NO_x and less ozone titration. SSE proves effective in improving air quality around ports. The SSE implementation in 2022 showed benefits, with 4 permature deaths avoided (95% CI 2 - 5), corresponding to savings of 9.0 million € (95% CI 6.0 - 13.0 million €), and 39 YLL avoided (95% CI 26 - 50), corresponding to savings of 2.0 million € (95% CI 1.3 - 2.6 million €).

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PC 52. Oxidative Potential: a tool to evaluate Particulate Matter toxicity

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Abstract

Exposure to particulate matter (PM), especially fine particles ($PM_{2.5}$), is linked to both nonaccidental and cause-specific mortality, posing a major health concern worldwide [1]. One of the possible PM toxicity mechanisms is the overproduction of reactive oxygen species (ROS). When ROS levels exceed the body's antioxidant defenses, oxidative stress occurs, contributing to diverse health complications [2]. Oxidative Potential (OP) measures the capacity of PM to induce the formation of ROS in the human body [3]. Due to its relevance in evaluating PM's health effects, OP, along with PM composition and sources, gained importance in the new Ambient Air Quality Directive [4]. However, the lack of a standardized method makes it difficult to compare results [5]. Among various assays, the dithiothreitol (DTT) assay is one of the most widely applied [6]. This method relies on the oxidation of DTT by redox-active PM species, concurrently reducing oxygen to superoxide. DTT concentration over time is measured colorimetrically: adding 5,5'-dithiobis-2-nitrobenzoic acid (DTNB) produces 5-mercapto-2-nitrobenzoic acid (TNB), a colored compound with a high extinction coefficient (ε=14 150 $M^{-1}.cm^{-1}$) at 412 nm [7]. This study aims to optimize the DTT method, using the reference material SRM 1648 (Urban Particulate - NIST, USA). The future steps of this project include the identification of key chemical drivers of OP in fine aerosols and the classification of pollution sources by health impact to improve mitigation strategies, as well as the validation of a model for the estimation of fine aerosols OP.

Acknowledgments

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PC 53. Using a portable air cleaner to reduce indoor PM in a kindergarten

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Abstract

Indoor air quality (IAQ) in kindergartens is a critical yet often overlooked determinant of children's health and well-being. Young children are particularly vulnerable to airborne pollutants, namely particulate matter (PM), due to their developing respiratory systems and higher breathing rates. Portable air cleaners have been emerging as a promising mitigation strategy to reduce indoor exposure to PM, particularly when the sources of air pollution cannot be removed and when ventilation is not sufficient or adequate. Despite their increasing availability, scientific evidence on their real-world effectiveness in early childhood education settings remains limited. Thus, this study aimed to quantify the impact of using a portable air cleaner in a kindergarten classroom. The study was conducted in one kindergarten classroom in an urban, traffic-exposed area in Porto, Portugal, for three consecutive days. The first day (Day 0) was intended to capture a representative typical day in the classroom. In the two following days (Day 1 and 2) a commercially available portable air cleaner (PHILIPS Serie 800, using HEPA filter, maximum CADR 190 m^3/h) was deployed and used continuously in the "Auto mode". Several PM size fractions (PM_1, $PM_{2.5}$, PM_{10} and TSP) were continuously monitored (1-min log) during three days using a professional-grade instrument (TSI DustTrak DRX 8533). The percentage reductions of PM concentrations were calculated by comparing each day of portable air cleaner use (Day 1 and 2) with the Day 0. The results showed a typical pattern, with PM concentrations increasing due to the occupants' (children's) activities, and an additional increase observed during room cleaning activities. The reductions in PM concentrations varied depending on the period of the day. The highest reduction (> 70% in all PM fractions) was observed in the non-occupancy period in the afternoon immediately after occupancy (15:30-19:00). During occupancy periods, reductions varied from 26% ($PM_{2.5}$) to 66% (TSP). The preliminary results from this study suggest that portable air cleaners could contribute to reduce children's exposure to indoor PM in kindergartens. More studies are needed to provide more insights to guide public health policies and practical interventions.

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PC 54. Cork-Based Electrokinetic System for Remediation of Diesel-Contaminated Soil

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Abstract

The in-situ removal of diesel from contaminated soil was investigated using cork-based permeable reactive barriers (PRBs) combined with electrokinetic remediation. A non-ionic surfactant, Triton X-100, enhanced diesel solubilization and mobilization from the soil to the barrier [1]. An electrokinetic test was conducted in an acrylic reactor filled with diesel-contaminated sandy loam soil (≈10 mg kg^{-1}) (Figure 1a). Triton X-100 solution (8 g L^{-1}) and Na_2SO_4 (0.05 mol L^{-1}) were used as anodic and cathodic electrolytes, respectively, under an applied electric field of 1 V cm^{-1}. The system achieved diesel retention of 0.56 mg_{TPH} in the PRB (8.65 mg kg^{-1} upper and 8.11 mg kg^{-1} bottom cork layer), corresponding to a removal of 21% of the total diesel content from the soil (Figure 1b). These results demonstrate the feasibility of using cork barriers in electrokinetic systems for in-situ diesel remediation. The surfactant likely promoted diesel mobilization via hydrophobic interactions and micelle-mediated solubilization, facilitating transport and adsorption within the PRB.

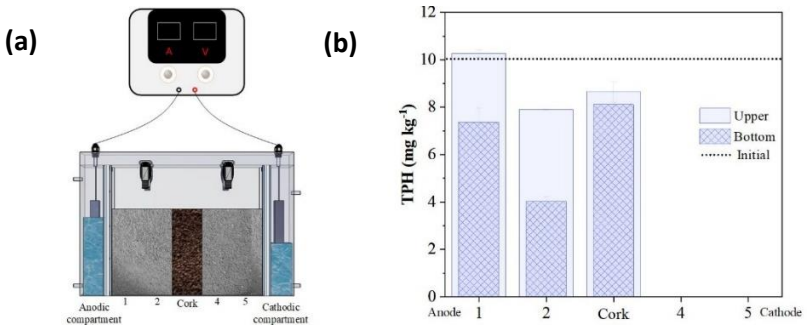

Figure 1 – (a) Scheme of the experimental setup and (b) distribution map of diesel after electrokinetic and PRB remediation.

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PC 55. The Role of Digital Battery Passports towards a Sustainable Battery Value Chain

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Abstract

The accelerating adoption of electric vehicles has underscored the urgent need for sustainable battery production, effective management, and robust traceability. The exponential growth in global electric vehicle sales has positioned the industry to confront challenges in managing the raw material extraction and end-of-life battery treatment [1]. Digital solutions are emerging to accelerate the transformation to a more sustainable economy [2], with the EU's regulations leading this green and digital transition. The digital battery passports support circular battery value chains by providing stakeholders with crucial data for informed decisions. They contain key information categories vital for sustainable product management [3], enabling stakeholders to optimise resource use, select lower-carbon suppliers, and enhance battery value chain sustainability [4]. This work outlines the ongoing project thesis, which aims to quantify the relevant environmental, economic, and social indicators to implement a robust digital battery passport. Phase 1 of the thesis highlights a review focused on the historical development of digital passports, including a list of current regulations supporting digital passport implementation, within the context of batteries.

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PC 56. Enantioselective Analytical Method for the Determination of Fluoroquinolone Antibiotics in Environmental Samples

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Abstract

Antibiotics (ABs) have been closely related to the spread of antimicrobial resistance (AMR) and have been frequently detected in aquatic compartments at concentrations ranging from ng/L to µg/L levels [1]. In recent European legislation, fluoroquinolones (FQs) are represented by ofloxacin, which has been included in the watchlists of Decisions (EU) 2022/1307 and 2025/439 [2,3], and by ciprofloxacin, which is expected to enter the next amended Directive [4]. Several FQs are chiral, so their monitoring should distinguish between enantiomers, as they may have different bioactivities and effects on AMR [5]. In fact, enantiomers may be detected at different levels in the environment due to the enantioselectivity of environmental processes [5]. In this work, after testing different chiral stationary phases, a cellulose-based chromatographic column was selected. Under optimal conditions, a stereoselective chromatographic method was obtained, allowing to separate 9 achiral FQs and 14 chiral FQs, 5 of which being enantioseparated (ofloxacin, N-oxide ofloxacin, desmethyl ofloxacin, nadifloxacin, and prulifloxacin). Furthermore, a solid-phase extraction (SPE) procedure was optimised to preconcentrate the targeted FQs and remove interferents from complex environmental samples. The SPE-LC-MS/MS method will be validated and applied to the monitoring of water samples.

Acknowledgments

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PC 57. Magnetic Nanoparticles Production by Co-precipitation: Optimising Synthesis Conditions

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Abstract

Magnetic nanoparticles (MNPs) have garnered significant attention owing to their distinctive properties, including high surface area, magnetic and sorption capacity, and low toxicity [1]. As a result, these particles smaller than 100 nm have been employed across diverse fields, including biology, medicine, and physics, serving as environmental remediation agents, adsorbents, magnetic sensors, and drug carriers [2]. Within this broad range of particles, magnetite (Fe_3O_4) NPs have been extensively studied, and various synthesis methods have been developed. Due to its simplicity, cost-effectiveness, and scalability, co-precipitation remains one of the most widely used synthesis methods. Nevertheless, the physical and magnetic characteristics of the resulting particles are greatly affected by the synthesis parameters [1,2]. This work assessed the impact of procedural variables (temperature, stirring duration, inert environment, and base type) on particle properties, aiming to achieve a reproducible and controllable synthesis of MNPs. The results demonstrate that by adjusting the synthesis parameters, more specifically, by increasing the temperature (80 °C) and the stirring time, it was possible to decrease the particle size by 2 orders of magnitude. Furthermore, the magnetic properties were improved by using NH_4OH as the base. These findings highlight the importance of optimising synthesis conditions to control nanoparticle characteristics, which is essential for enhancing their performance in targeted applications.

Acknowledgments

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PC 58. Electrochemical Characterization and Optimization of a Metformin Sensor

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Abstract

The presence of pollutants in the environment is a concern in terms of ecosystem and public health. Specifically, pharmaceutical compounds are a notable class of contaminants of emerging concern in need of attention due to their ubiquitous presence in the environment and lack of information and regulation [1]. As a result, the development of new sensing technologies is essential for monitoring the levels of these emerging pollutants [2]. The main objective of this work is the development of an electrochemical sensor capable of detecting the pharmaceutical pollutant metformin with high sensitivity and selectivity. In this sense, carbon paper (CP) was applied as the transducer due to its affordability, porous structure and easy of use, being modified with a copper-based metal organic framework (MOF) known as Cu-BTC, that forms a complex with the drug. This MOF can be produced directly on the transducer surface using the layer-by-layer method, an alternative approach that provides a controlled MOF growth without the need for high temperatures or complex equipment. The resulting sensor, CP/Cu-BTC, revealed a good voltametric signal for metformin at +0.9V (vs Ag/AgCl, KCl 3M) in buffered conditions. The analytical conditions were optimized in terms of electrolyte pH, differential pulse voltammetry parameters, and analyte deposition. The results confirmed that the developed sensor is a promising tool for determination of metformin in environmental samples.

Acknowledgments

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PC 59. Strategic Sunlight Management for Microalgal Biomass Valorisation: Combined Effect of Light Irradiance and Exposure Time

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Abstract

This study investigates the combined effect of light irradiation and exposure time (for three energy fluxes) on the *C. vulgaris* biomass concentration and biochemical composition. Different energy flux values (3120, 6240, and 9360 kJ m^{-2}), provided by a solar radiation simulator with a xenon lamp, were studied by adjusting light irradiance levels (300, 475, and 650 W m^{-2}) and exposure times (1.33-8.67 h). Biomass concentration and composition were evaluated. Results showed that both light irradiance and exposure time affected the biomass concentration. The MLR results indicated that increasing light irradiance and exposure time positively impacts microalgal growth up to 546 W m^{-2} for light irradiance and 5.17 h for exposure time, to a certain threshold, beyond which the effects become detrimental to the cells. Additionally, higher energy flux values were associated with reduced biomass concentrations. The most favourable results for carbohydrate accumulation (16-17% DCW) were obtained with medium and high energy fluxes applied at high light irradiances, while the highest lipid content (17% DCW) was achieved at lower irradiances 300 W m^{-2}. The maximum protein content increased 26% under 300 W m^{-2}, and the highest carotenoid content increase was under 300 W m^{-2} after 8.67 h (3120 kJ m^{-2}), reaching 0.68% DCW. The MLR analysis indicated that light irradiance initially did not impact carbohydrate accumulation, but beyond a certain threshold, it enhances carbohydrate production. The PCA results suggested optimal lipid accumulation occurred under lower light irradiance, longer exposure times, and lower energy flux. The greatest protein content variation was observed with low energy flux delivered at low and medium light irradiances. However, both PCA and MLR analyses suggest that other operational factors might play a more significant role than those tested. Carotenoid content was positively influenced by increased energy flux through extended exposure times.

Acknowledgments

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PC 60. Insights from the Application of Sustainability Indicators in Different Scientific Fields of Engineering Degrees

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Abstract

In recent years, engineering education has increasingly embraced sustainable development (SD), acknowledging the critical need to prepare future engineers for complex global challenges. While this shift marks significant progress, most degrees are still in the early stages of reorienting their education towards SD. This study presents insights from the application of indicators from an assessment tool to measure how SD is integrated into three Master's degrees from FEUP: Environmental, Mechanical and Informatics and Computing Engineering. Three indicators (normalized in a scale from 0 to 1) were selected: "SD Mandatory Curriculum Units (CUs)" (EO_1); "Approval Rate in SD" (EQ_2); and "Enrolment in SD Optional CUs" (ST_3). The EO_1 results revealed a significant variation across degrees. Environmental Engineering showed a strong mandatory offering ($EO_{1.1}$ and $EO_{1.2}$ = 1). Mechanical Engineering showed some offering ($EO_{1.1}$ = 0.42 and $EO_{1.2}$ = 0.36), while Informatics and Computing Engineering showed no SD Mandatory CUs ($EO_{1.1}$ and $EO_{1.2}$ = 0). Nonetheless, approval rates in SD CUs (mandatory or optional) remain high in all degrees (Environmental = 0.85; Mechanical= 0.91; Informatics and Computing = 0.81), reflecting high student performance when opportunities are available. Regarding ST_3, Environmental Engineering showed more enrolment in SD CUs than students enrolled in the degree, likely due to the wider variety of offering and the multiple enrolment possibilities (ST_3 = 1). In Informatics and Computing Engineering, despite limited SD options, some student engagement was observed (ST_3 = 0.21). In Mechanical Engineering, no enrolments were verified (ST_3 = 0), possibly due to the nature of the degree structure (only one optional CUs considered in the tool and a high number of CUs offered). Overall, the findings underscore the uneven integration of SD across degrees, but also highlight students' engagement with SD. The application of the indicators was beneficial in identifying both strengths and gaps, emphasizing the complex nature of the degree's structures and the need to expand SD integration across engineering curricula to reinforce the transformative role of engineers in achieving sustainability.

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PC 61. Slow release of oxidants via Carnauba wax immobilization for pirimicarb remotion by advanced oxidation processes

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Abstract

Pesticides are a group of pollutants, which arose a societal concern about their application and fate. They have been widely used in crop production, and the effects caused by these chemicals are of the utmost importance for ensuring the protection of water sources against any threats. *In situ* Chemical Oxidation (ISCO) is an economically viable technique that involves injecting chemical oxidants into contaminated soil and groundwater to degrade these kinds of organic pollutants. This method can be applied in various ways and is widely regarded as a safe and effective solution for removing contaminants from both water and soil. A key challenge in ISCO implementation is ensuring accurate oxidant dosing. Consequently, recent research has focused on developing methods to immobilize the oxidant, thereby regulating its release and controlling the reaction rate. The objective of this work is to immobilize an oxidant within Carnauba wax as solid matrix and evaluate the effectiveness of its application for the removal of pesticides. Initially, two alternative oxidants - potassium peroxymonosulfate (W-PMS) and potassium persulfate (W-PS) - were immobilized in the selected Carnauba wax. The release rates of the oxidants were studied, with W-PMS showing the most favourable profile characterized by a lower release rate and more controlated oxidant delivery. Then, various oxidant:wax loading ratios were prepared and tested. It was found that ratios exceeding 4:1 (oxidant:wax) were ineffective for successful immobilization. Another factor to consider was the size of the beads and its effect on the oxidant release, with a smooth release in those with smaller size. Based on the previous results and once the release was studied in a batch mode, the sustained release in a continuous system was assessed. On the other hand, several catalysts (iron alginate beads and nZVI alginate beads) were evaluated for the activation of W-PS in the treatment of a pesticide, pirimicarb, attaining significant removal levels. Finally, the removal of a pesticide in a continuous operating system with the W-PMS beads and the catalyst was successfully assayed. The feasibility of the developed system for the slow release of oxidant and removal of the selected pesticide was proved and represents a promising result for the treatment of this type of contaminants.

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PC 62. Assessment of Nature-Based Solutions Configuration in Biodiversity under Future Climate Change Scenarios

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Abstract

This study addresses the pressing global challenge posed by the interconnected crises of biodiversity loss, climate change, and the need for sustainable urban development. Cities like Porto are increasingly vulnerable to climate-related impacts such as heatwaves, flooding, and biodiversity decline. This study explores the potential of Nature-Based Solutions (NbS), focusing specifically on two urban parks—Asprela and Quinta de Lamas—as case studies to assess how such interventions can enhance biodiversity, mitigate climate change effects, and improve urban resilience. A central challenge lies in determining whether these parks, functioning as NbS, are achieving their intended goals under future climate change (CC) scenarios. Despite their adoption in urban planning, these parks currently face high flood and runoff risks and suffer from limited, inconsistent ecological monitoring. This raises uncertainty about their effectiveness in delivering key ecosystem services such as runoff control, carbon sequestration, and biodiversity enhancement—issues that are critically relevant as cities worldwide seek data-driven and cost-effective strategies for resilient development. To evaluate these concerns, the project introduces a robust, interdisciplinary framework that integrates various “technologies” and methodologies. These include:

Field surveys (e.g., seed dispersal analysis and invertebrate sampling); Greenhouse experiments on plant species' resilience to drought and flood; Hydrological modeling using TELEMAC and SWMM under IPCC climate scenarios (RCPs); Species Distribution Models (SDMs);GIS-based spatial analysis for mapping vegetation cover, ecological connectivity, and flood risk. The envisioned applications of this research are extensive and include: Supporting urban planning and policy-making in Porto and similar urban contexts globally; Guiding the design and optimization of NbS for biodiversity enhancement; climate change mitigation, flood/runoff management, and ecological connectivity; Conducting risk assessments, including invasive species trade-off analysis; Developing practical guidelines for species selection and NbS configuration under projected climate conditions; Promoting public awareness and enhancing the aesthetic and recreational value of urban green spaces. The innovation of this research lies in its integration of ecological and hydraulic analyses with biodiversity and climate data to improve NbS design. By addressing the NbS–biodiversity–climate change nexus, this work contributes to science-based, cost-effective solutions for sustainable urban development and resilience in a warming world.

PC 63. Digital Education Competence and Green Learning: A Transnational Training Action at U. Porto

André Torres-Pinto[1,2], Amanda Fujita[1,2], Cláudia G. Silva[1,2], Paqui Blánquez[3], Oksana Mulesa[4], Mihai Dan Caramihai[5], Nicoleta Radu[6,7], Adrián M.T. Silva[1,2]

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Abstract

The online workshop “Advanced IT Technologies to Assist Student’s Digital Education” was organized at FEUP (2024) as part of an Erasmus+ project advancing the European Green Deal (EGD) through digital education [1]. We had contributions from different international institutions and explored the intersection of educational innovation, active learning strategies, digital skills development, and climate citizenship. The sessions addressed how IT tools and interactive platforms can transform learning engagement and critical thinking, and contextualise sustainability in educational settings. A post-workshop survey was an essential tool to obtain feedback from students and teachers on the effectiveness of the discussed content. Participants evaluated whether the workshop enhanced their confidence in using digital IT tools (applications like Genially [2], Wooclap, and Prezi) or inspired new ideas for learning/teaching practices. Questions also assessed perceptions on how digital tools address the pedagogical demands of VUCA (volatile, uncertain, complex, ambiguous) and BANI (brittle, anxious, non-linear, incomprehensible) environments and the role of projects implemented at U.Porto in connecting science, education, and policy [3,4]. The responses demonstrated that this workshop aided digital transformation learning, equipping participants with tools to use in modern academic and societal contexts.

Acknowledgments

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PC 64. Gamification in Digital Education: A Hands-on Student Approach to the European Green Deal

André Torres-Pinto[1,2], Amanda Fujita[1,2], Cláudia G. Silva[1,2], Paqui Blánquez[3], Oksana Mulesa[4], Mihai Dan Caramihai[5], Nicoleta Radu[6,7], Adrián M.T. Silva[1,2]

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Abstract

The "2nd Learning, Teaching and Training" (2-LTT) activity was carried organized at FEUP (2025) in the framework of the Erasmus+ project "*GEEA - Gender, Digitalization, Green: Ensuring a Sustainable Future for all in Europe*". This activity was a significant step in the project through the application of digital education techniques related to the European Green Deal (EGD), which has been developed in the context of the project [1]. In particular, this transnational in-person 2-LTT meeting focused on the practical application and testing of e-learning modules with interactive games that are now in their implementation stage. MSc and PhD students participated in the 2-LTT activity for a hands-on exposure to innovative curriculum content, spanning topics such as climate change, green energy, and circular economy, combined with digital education techniques, like gamification, artificial intelligence-driven assessment, and chatbot-supported learning. The 2-LTT served as a collaborative environment to collect real-time feedback from participants on the usability and relevance of the digital materials that have been developed in the framework of this project. This feedback loop ensures the continuous refinement of the created e-learning platform and supports the co-creation of inclusive digital educational resources. A post-session survey for the participants is under preparation to better understand the strengths and weaknesses of the developed tools for active learning in the context of the topics focused on the project.

Acknowledgments

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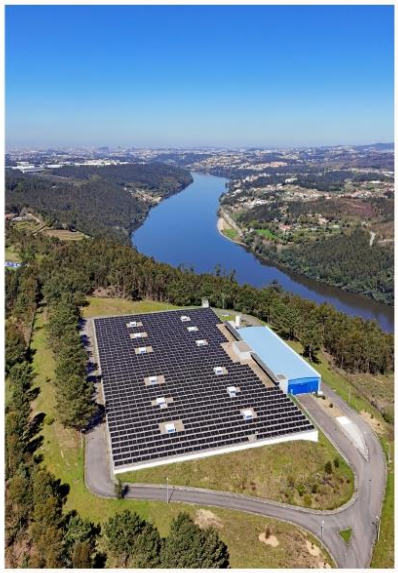


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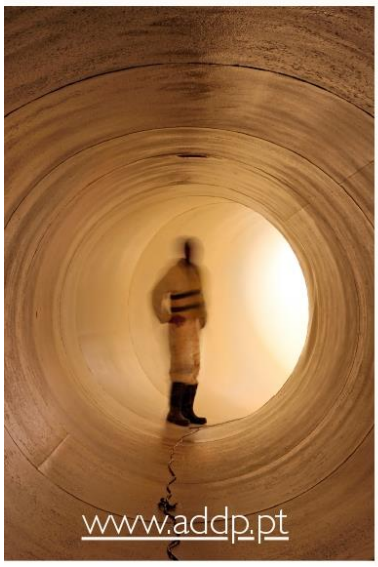
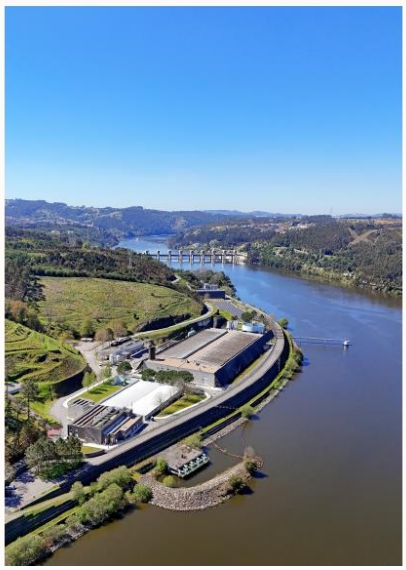
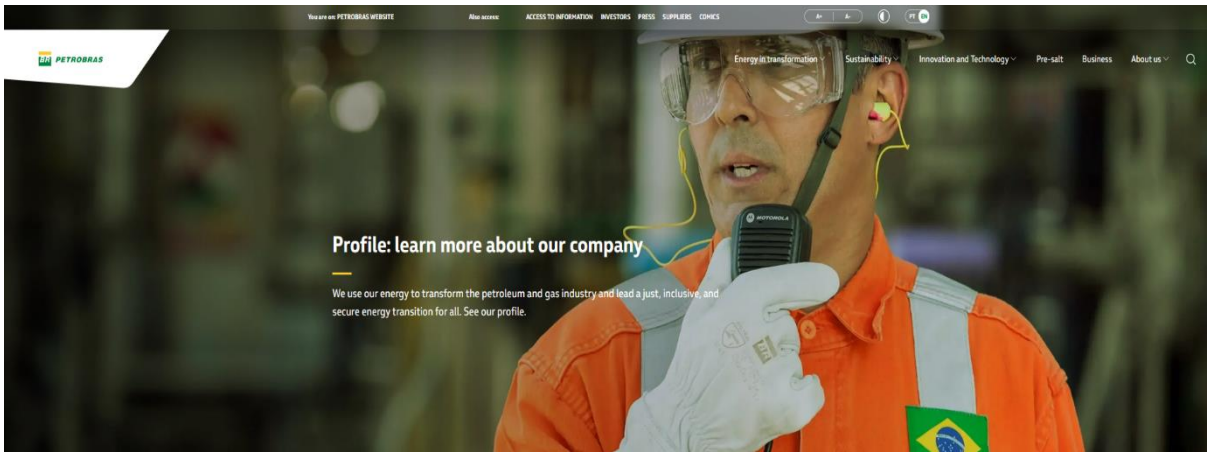
A Portuguese water utility responsible for the bulk water supply system that serves 20 municipalities in the Oporto region, supplying approximately 1.8 million people






PETROBRAS www. petrobras.com.br



Our commitment is the energy that makes us go further

We are a publicly traded corporation operating in an integrated and specialized manner in the oil, natural gas, and energy industry. We have expertise in exploration and production as a result of decades of development in the Brazilian basins, especially in deep and ultra-deep waters. This has made us a world leader in the segment.

Our business goes beyond field reach and oil and gas withdrawal. This entails a long process by which we transport oil and gas to our refineries and natural gas treatment units. Therefore, those units must be equipped and constantly evolving to provide the best products. We have as priority to operate at low costs and with a low carbon footprint, which contributes to our commitment to a sustainable development for a society in transition.

Revenue: US$ 102,4 **billion**

We currently divide our business into three main segments:

Exploration and Production (E&P)

It covers the exploration, development, and production of crude oil, Natural Gas Liquids (“NGL”), and natural gas in Brazil and abroad, with the main purpose of serving the country's refineries. The E&P segment also operates with other companies through partnerships, including interests in other companies in this segment.

Refining, Transport, and Sale (“Refining” or RT&C)

It covers refining, logistics, transportation, sale, and negotiation of crude oil and derivates in Brazil and abroad. It also encompasses ethanol exports, petrochemical operations such as shale extraction and processing, and our interest in petrochemical companies in Brazil.

Gas and Energy (G&E)

It covers the activities of logistics and sale of electric energy and natural gas, as well as the generation of energy through thermoelectric plants. It also includes natural gas processing and fertilizer operations, and our interests in NG transport and distribution companies in Brazil and abroad.

VORTEX-CoLAB is a Collaborative Laboratory that brings academia and industry in perfect sync.

With 40+ brilliant minds from academia and industry, we're your trusted partner. Since 2019, we've been the go-to for technology acceleration across Automotive, Defense, and Space.

Our Mission

Accelerate the launch of cutting-edge cyber-physical systems and cybersecurity solutions.

Our approach is clear and effective

- Tailor-made solutions, from prototyping and consulting to technology training.
- Accelerate time to market, minimizing risks and maximizing rewards.
- Unique solutions that not only solve current problems but anticipate future challenges.
- Flexible licensing and strategic funding options that adapt to your needs.
- Partner with you to create not just products, but industry-shaping innovations.

Our Vision

Create outstanding innovations that propel society forward.

Know More

We collaborate with the best

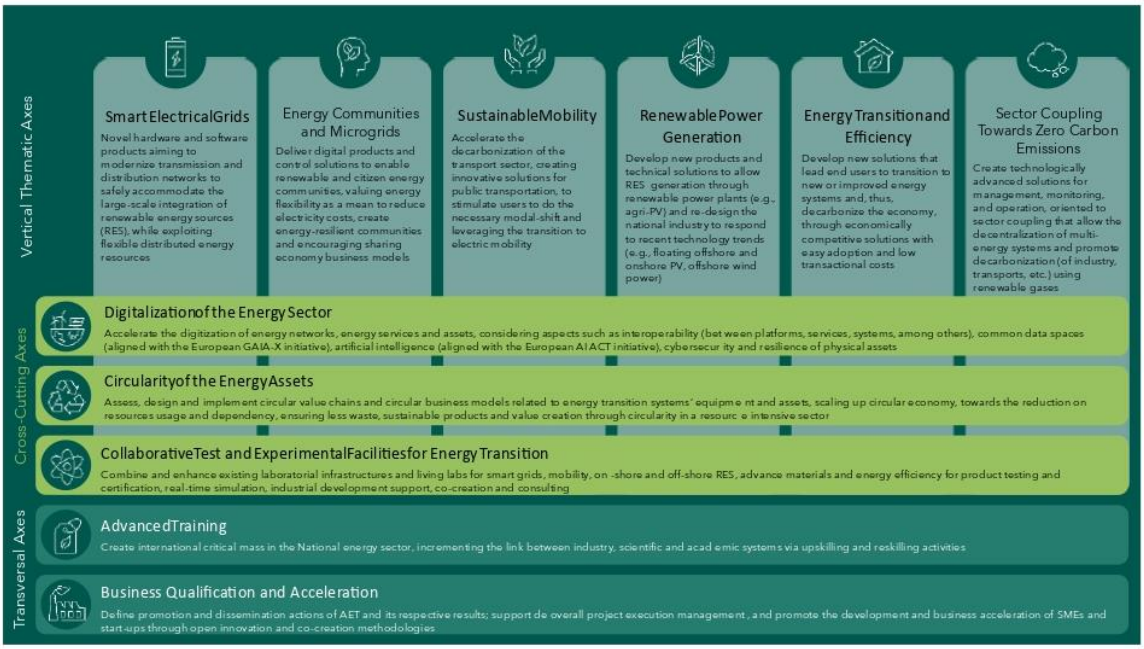
beta-i Capgemini INESCTEC isep Instituto Superior de Engenharia do Porto NOVA UNIVERSIDADE NOVA DE LISBOA

ATE – Alliance for Energy Transition

The Alliance for Energy Transition (ATE) is one of the largest Mobilizing Agendas funded by the Portuguese Recovery and Resilience Program (PRR) and was created to strengthen the competitiveness and resilience of the national energy value-chain, particularly in sight of innovative export-oriented product/service development and consolidation.

This strategic goal is being achieved through a sustained series of strategic objectives, including an increase of goods and services exports, higher investment in R&D and reduction of CO_2 emissions, by allocating a total investment of 274 M€ in added-value activities that are generating around 46 new products and services. This objective is only possible due to the commitment of a total of 58 companies and public entities and 19 Research & Innovation (R&I) centers and universities, indeed crucial to structure an entire ecosystem aiming at energy transition. Furthermore, the ATE promotes the creation of about 700 qualified jobs.

ATE proposes a comprehensive plan for the Portuguese energy transition, based upon the experience and strategic vision of the various players in the energy sector that operate both national and internationally, which results in the creation of a structural ecosystem without precedents for the national energy sector. In this context, 11 thematic axes were defined:



ATE is led by EFACEC ENERGIA, involving organizations with complementary expertise from the research and industrial areas across Portugal. The strong relationship between the scientific and industrial entities in ATE is one of the key distinctive factors of the consortium. National R&I institutes and collaborative laboratories work together with some of the most prominent industrial partners to address market needs. The synergies that are part of ATE enhance the success of all the consortium's initiatives as science is brought together with industry to solve needs and challenges of the energy sector. By covering the whole energy value chain, ATE has a unique positioning in the Portuguese panorama, in a domain that is of utmost relevance as energy impacts the whole economy.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WORLD WATER DAY
2025 Glacier Preservation
We preserve what the future reserves
TOMORROW MATTERS
Bondalti Water transforms seawater and lake water from Antarctica into drinking water to support the Brazilian Research Station.
Learn more at:
BONDALTI.COM

Packaging of the future (Embalagem do Futuro®) **+ecological +digital +inclusive**

https://embalagemdofuturo.pt/en

Project mobilizes a total of 79 entities, committed to transforming the Portuguese industrial fabric of the Packaging Sector. Project Leader: VANGEST - Engenharia Financeira e Gestão, S.A.

An innovative project that aims to produce market packaging solutions on a global scale that are greener, more digital, and more inclusive; envisages the creation of new products, services, and production lines capable of producing sustainable packaging, from raw materials to product design, engineering, molds and tools, processing and manufacturing, information systems, and digital transition, social marketing, collection, and recycling.

Start Date | 01-04-2022; End Date | 30-06-2026; Total funding amount| 104 113 760,36€

Subprojects: The activities and initiatives of the Embalagem do Futuro® project are materializing in 19 new Products, Processes, and Services (PPS) with full integration of the solutions developed and tested.

PPS01 - Food packaging made of recycled polyethylene from fossil and biological origin

PPS02 - Clean Delivery – Lunchboxes of the Future for a Circular economy

PPS03 - REDUCE - REDesigned sUstainable ContainErs and pallets

PPS04 - New glass containers for food and beverage products more sustainable

PPS05 - New Co-Injection process for manufacturing plastic packaging incorporating recycled materials

PPS07 - Biofilm Plant + multi-layer bags with barrier to O2 100% recycled

PPS08 - Recovery of Residues with a High Degree of Purity

PPS09 - Develop new light 100% natural packaging in wood for food sector

PPS10 - New cardboard packages with unique properties for food contact and e-commerce

PPS11 - Intelligent Sustainable Fishery Transport System

PPS12 - Bgreen2Pack -New premium packaging from natural origin with incorporated fragrances

PPS13 - A New Solution for Smart Package Tracking

PPS14 - Traceability farm to fork

PPS15 - New Paradigm of Waste Collection and Citizen Awareness

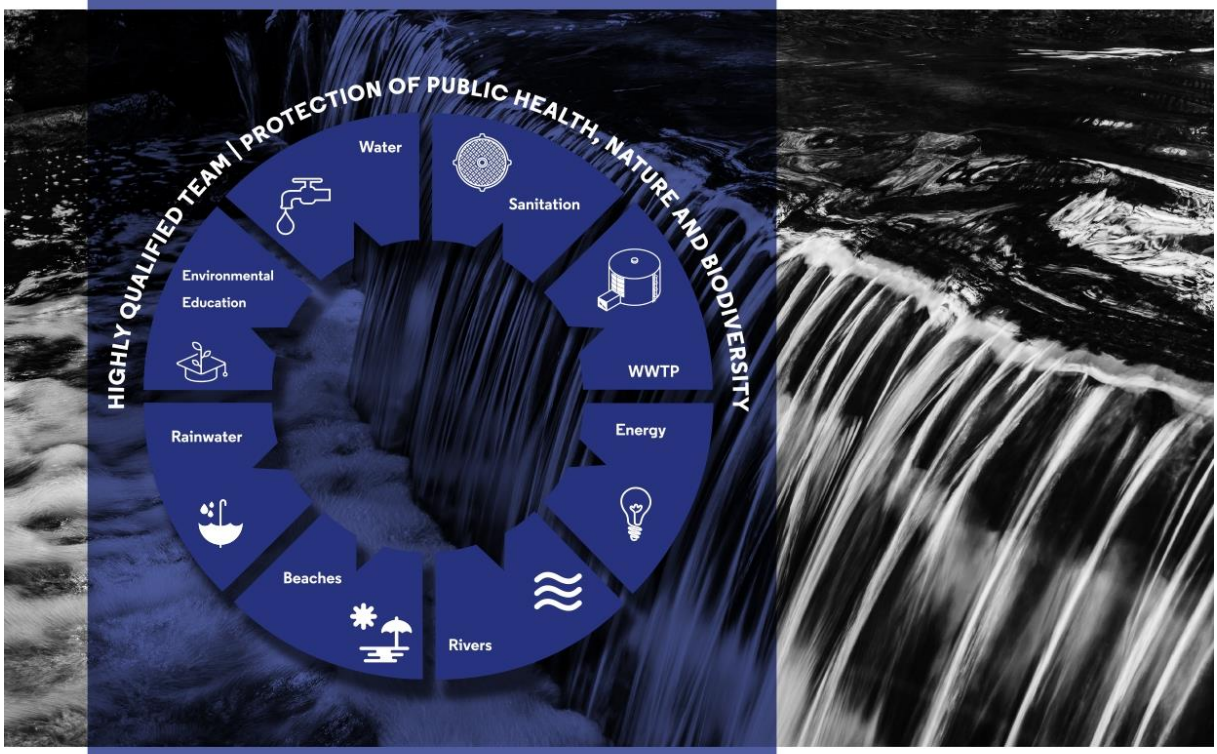
PPS16 - Predictive and Preventive Maintenance Tower

PPS17 - CENTRE FOR LIFE CYCLE ASSESSMENT AND SUSTAINABILITY (CLICAS)

PPS18 - SUSTAINABLE PACKAGING CERTIFICATION

PPS19 - Human Resources Training and Upskilling - Skills for the Future

PPS20 - Project Management, Promotion and Dissemination of the results



WHATWEDO

Integrated and sustainable management of the entire **urban water cycle in the municipality of Porto**

Water distribution

Wastewater drainage and treatment

Rainwater drainage

Management of **urban rivers and streams**

Seafront management

Promotion of **environmental education and sustainability**

Analytical control of **water quality** throughout the urban cycle (**accredited Laboratory**)

Responsible for the **municipal energy management**

+Info: **www.aguasdoporto.pt**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AND SUSTAINABLE FUTURE
THROUGH IMPACTFUL
SCIENCE, TECHNOLOGY
AND INNOVATION.
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About us

KPMG operates in 142 countries and territories and, in FY23, collectively employed over 275,000 people, serving the needs of businesses, governments, public sector agencies, non-profit organizations, and capital markets around the world.

KPMG Portugal has offices in Lisbon, Porto, and Évora with 90 members of the Partnership and over 1700 employees. We provide Audit & Assurance, Tax, and Advisory services, supporting our clients in identifying and managing risks and maximizing opportunities.

Our values form the basis of everything we do. These are:

Integrity Excellence Courage Together For better

Passionately and purposefully, we work side by side with our clients, combining innovative approaches with extensive experience, and we are prepared to deliver truly distinctive results.

Careers at KPMG Portugal

More Information

weimpact

PIONEERING INNOVATION IN LEACHATE TREATMENT FOR A SUSTAINABLE FUTURE

AST Ambiente is internationally recognised for its cutting-edge technological solutions in complex water treatment, with a particular emphasis on **leachate management** — one of the most demanding environmental challenges faced by the waste sector

With over 25 years of applied expertise, AST has developed proprietary systems that combine **reverse osmosis, ultrafiltration, and advanced automation** to treat highly contaminated leachates with precision, efficiency, and cost- effectiveness.

As the **only Portuguese manufacturer** of integrated leachate treatment units using high-performance membrane technologies, AST delivers fully modular and compact solutions deployed across Europe, South America, and Africa. These systems are designed not only to meet the strictest discharge standards but also to promote the **recovery and reuse of water**, contributing directly to the circular economy.

TECHNOLOGICAL EDGE, ENVIRONMENTAL IMPACT

- **Reverse osmosis systems** tailored for landfill leachates and high-load effluents
- **Energy-efficient, low-footprint designs** reducing operational costs and environmental impact
- **Custom-built solutions** for both mobile and stationary installations
- **Reclaimed water** reintegrated into industrial or irrigation systems, reducing pressure on freshwater sources

NEW PROJECTS

Our progress in tackling **micropollutants**, particularly **pharmaceuticals, water reuse strategies, nutrient recovery**, and **PFAS removal**, reflects AST's commitment to anticipating the next generation of environmental challenges. By integrating **advanced treatment technologies** and cutting-edge **membrane systems**, we've developed solutions that go beyond compliance — aiming for true **sustainability**. Our current **R&D projects** focus on **circular approaches** that not only remove emerging contaminants but also recover valuable resources, positioning AST at the forefront of **innovation** in complex **water treatment**.

SUSTAINABILITY IN PRACTICE

AST's technologies have enabled municipalities and private operators to **divert millions of litres of contaminated leachate** from watercourses, significantly reducing **greenhouse gas emissions, groundwater contamination risks,** and **environmental liabilities.**

Whether deployed as standalone systems or integrated into broader treatment frameworks, AST's solutions are a **benchmark in sustainable infrastructure.**

Rua do Bairro, 400, 4485-010 Aveleda, Portugal
+351 220 163 277

OFFICE@AST-AMBIENTE.COM
WWW.AST-AMBIENTE.COM

Nynas premium mineral oil based transformer oils have outstanding dielectric properties, enabling quality transformer design. Our oils superior heat transfer properties provide efficient cooling, and good flow properties make sure that you can start the transformer even in sub-zero climates. Nynas premium transformer oils are extremely stable and resistant to oxidation: there are transformers still in operation today, more than 50, 60 or 70 years after first being filled with Nynas transformer oil.

In 2028 we celebrate our centenary. And while we can look back on an interesting history, we prefer to look forward to a long an innovative future. That's why we no longer restrict ourselves to traditional naphthenic transformer oils, but we also promote the use of biogenic and circular alternatives.

- 100% biogenic insulating fluid - Probably the worlds coolest transformer fluid, NYTRO® BIO 300X,
- Re-refined with unmatched performance - Join the circular economy with NYTRO® RR 900X,

NYNAS

Lutz-Jesco GmbH

About

Lutz-Jesco is a renowned manufacturer of components for monitoring and treating water quality in the drinking water, swimming pool water, municipals and industrial waste water treatment.

Foundation 2003 | **Head office** Wedemark

Product range

Dosing pumps & accessories | Chlorinators up to 200 kg/h | Measuring and control technology | Disinfection systems | Centrifugal pumps | System and process technology | Filter systems

Areas of use

Water treatment | Waste water treatment/ sewage treatment plants | Municipal indoor and outdoor swimming pools | Private swimming pools | Chemical industry | Electroplating and surface treatment | Paint and varnish industry | Ceramics industry | Paper and cellulose industry | Industrial pipeline construction

Chlorinators up to 200 kg/h

Chlorinators
- Chlorinators and vacuum regulators
- Chlorine evaporator
- Flow meter
- Regulation valves
- Changeover switch
- Ejectors / Non-return valves

Room and protective equipment
- Gas warning devices
- Pressure safety shutoff valves
- Crane cross beams / crane scales
- Drum scales / drum supports
- Chlorine scrubber
- Valve closing system

Accessories and more

Measurement and Control Technology

TOPAX® - Single and multi-channel controller

Water sampling stations for
- Drinking & bath water
- Industrial applications

Gas warning devices for
- Chlorine gas / dioxide
- Ozone

Sensors
- Optical measuring cells
- Amperometric measuring cells for disinfection measurement
- Diaphragm-covered measuring cells
- Conductivity measuring cells
- pH/redox single-rod measuring cells
- Temperature / Gas sensors

Software, accessories and more

Disinfection Systems

Chlorine dioxide systems
- EASYZON 5 (diluted solution)
- EASYZON D (diluted solution)
- EASYZON C (concentrated solution)
- EASYZON L/M/H

Sodium hypochlorite systems
- EASYCHLORGEN
- MINICHLORGEN

Calcium hypochlorite systems
- EASYCHLORMIX
- SAFETYCHLORMIX

Flow-trough chlorine electrolysis systems
- TECHNOMAT (private)
- TECHNOSTAR (commercial)

System and Process Technology

Standard systems
- Small dosing stations
- Mobile dosing systems
- Transportable dosing systems
- Polymer preparing and dosing station EASYPURE

Special solutions
- Skid systems
- Container systems

Lutz-Jesco GmbH
Am Bostelberge 19 | DE-30900 Wedemark |
Phone +49 5130 5802-0 | info@lutz-jesco.com |
www.lutz-jesco.com

Now also with an office in Portugal:
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ARSOPI Thermal designs and manufactures plate heat exchangers and thermal systems for diverse industrial applications, delivering efficient, reliable, and customized solutions across Europe and beyond.
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Join us to explore real-world thermal challenges — from fluid dynamics to energy recovery — and the engineering behind efficient, practical solutions. Discover how your technical skills can shape sustainable industry.
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As a GOLD Sponsor we're here to engage with the future of engineering.
Helder Silva
Engineering Manager
"Plate Heat Exchangers: Overview and Applications"

CROMATOGRAPHY - SPECTROMETRY

THERMO UNICAM PORTUGAL is a specialist in Chromatography and Spectrometry, representing cutting-edge technologies from Thermo Scientific.
We present the revolutionary Orbitrap Analyzer®, the most advanced technology for the analysis and identification of environmental contaminants. This system enables precise quantification of both persistent and emerging contaminants with the highest analytical confidence, while also offering a unique qualitative dimension for the detection and investigation of unknown substances.
We are also experts in microwave digestion and synthesis, as well as in mercury analyzers from Milestone, a recognized leader in these technologies.
We understand that working with top-tier scientists requires more than just advanced instruments — it demands deep expertise. That's why we continually invest in technical training, both internally and externally, to ensure high-level support.
Our multidisciplinary technical team is ready to meet all analytical challenges and contribute to the success of your projects.
Contact us:

✉ thermounicam@thermounicam.pt
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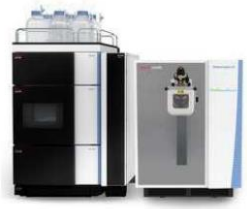

HPLC – HPLC MS – GC – GCMS – ICP – ICPMS – MICRO-FTIR – UV-VIS- IRMS


giatex
Reducing water consumption in the Textile and Clothing Industry through intelligent management
Develop a set of tools that will enable companies to reduce specific water consumption and support decisions on the final destination of water.
Good water management practices
Characterisation of wet processes in textile finishing companies and definition of water rationalisation and recirculation measures
Water management decision-support software
Implementation of monitoring and control systems to obtain data on water quality throughout the process and development of the algorithm for the decision-support software
Range of innovative products and systems for wastewater treatment
Development of effluent treatment technologies (industrial pilots) based on biological processes, electrochemical processes, advanced oxidation processes and membrane systems
Range of eco-functional products and textile structures
Development of more sustainable finishing processes at industrial scale (e.g., processes with reduced water and chemicals, low-temperature processes, eco-dyeing processes, enzymatic processes, etc.)
WWW.GIATEX.PT
PRR
REPÚBLICA PORTUGUESA
Financiado pela União Europeia
NextGenerationEU

cecolab
CIRCULAR ECONOMY

Who We Are

Association CECOLAB – Collaborative Laboratory Towards Circular Economy is the Collaborative Laboratory (CoLAB) for the Circular Economy, headquartered in Oliveira do Hospital in the central interior region of Portugal. With more than 40 highly qualified human resources, through specialized research, we develop sustainable market solutions in a model of CIRCULAR ECONOMY for strategic value chains of the Portuguese economy and with high international impact. We provide innovation management Consulting services high quality advice and transfer knowledge to the MARKET.

In addition, we cordinate the Portuguese Strategic Research Network in Circular Economy (Order No. 4157/2019).

Innovation chains

Florest | Agro-food | Urban Waste | Water | Manufacturing | Construction | Servitization

Mission

(i) Support the transition from a linear economic model to:

-An economy that is responsible towards resources and people;

-An economy that is more efficient in its life cycle.

(ii) Developing and transferring knowledge and technology to the market;

(iii) Creating qualified and scientific employment; and

(iv) Taking the lead, and positioning Portugal in the Circular Economy.

Vision

Development of solutions and knowledge to respond to the market transition to a CIRCULAR ECONOMY centred on national strategic value chains.

Services

Consulting in circular economy;
Circular (re)design;
(Des)classification of waste and by-products;
Circular design group;
Legal studies; and
Training.

Business Centre
Rua Nossa Senhora da Conceição, 2
3405-155 OLIVEIRA DO HOSPITAL

circular@cecolab.pt

+351) 238 011 400

IT'S NOT IMPOSSIBLE

BioShoes4All

Innovation and empowerment of the footwear industry for a sustainable bioeconomy

Promote the transition of the footwear industry to bioeconomy and sustainable circular economy

New **bio and eco materials, components,** and production **processes**.

Functional, durable, circular footwear and leather goods with a lower environmental impact.

Advanced and digital production technologies (automation, robotics).

Solutions for the **valorization of production waste and post-consumer products.**

Reducing the environmental footprint of the sector/products (carbon, water, fossil fuels, chemicals).

Implementation of **industrial pilot production lines,** dissemination of innovations.

Involvement and awareness-raising of consumers for sustainable consumption.

bioshoesforall.pt

Bioeconomia FUNDO AMBIENTAL PRR REPÚBLICA PORTUGUESA Financiado pela União Europeia NextGenerationEU

Bio shoes 4all

BioShoes4All — Partners

Lead Partner **Coordinator**

APICCAPS

ctcp centro tecnológico do calçado de portugal

Footwear, Leather Goods & Retail

AMF · ARCOPEDICO · Belcinto · CARITÉ · KYAIA · LIAGO · RAP

LUIS ONOFRE · RODIRO · SAVANA · SKYPRO · VALUNI · SOMAMC

Leather

A CASTRO & FILHOS · BOAVENTURA · COURO AZUL · Curtumes Ibéria, S.A. · CURTUMES FONTEVELHA

Derma Leather Comércio e Indústria de peles, S.A · Demoscore · DIAS RUIVO · MOSSA · SOFTLEATHER

Chemical products and Bio-resources

AQUITEX · CIPADE · INDUCOL · Indutan · LORCOL · prodyalca · SILOS DE LEIXÕES

Materials and Components

3DCORK · Aloft · atlanta · COBLEX · COMPONIT

DREAMPLAS · ERT · tdepa · LUSOCAL · PROCALÇADO · MONTEIRO RIBAS

Production Technologies and Software

cei · oficinaware · Softideia · TECMACAL · ZIPOR

ENESII

CTIC · citeve · CeNTI · CVR · inegi · INESCTEC

isep Instituto Superior de Engenharia do Porto · ipb Instituto Politécnico de Bragança · IPL · lipor · piep · RAIZ

Universidade Católica Portuguesa Porto · Universidade de Coimbra · Universidade do Minho · U.Porto Faculdade de Ciências · U.Porto FEUP · forestwise

Association / SME

AUSTAR


NADADOR SALVADOR
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CELEBRATING 25 YEARS OF SERVICE TO OUR COMMUNITY, WE RENEW OUR COMMITMENT TO ACCURACY, ENSURING TRUST AND DEFENDING LIFE.
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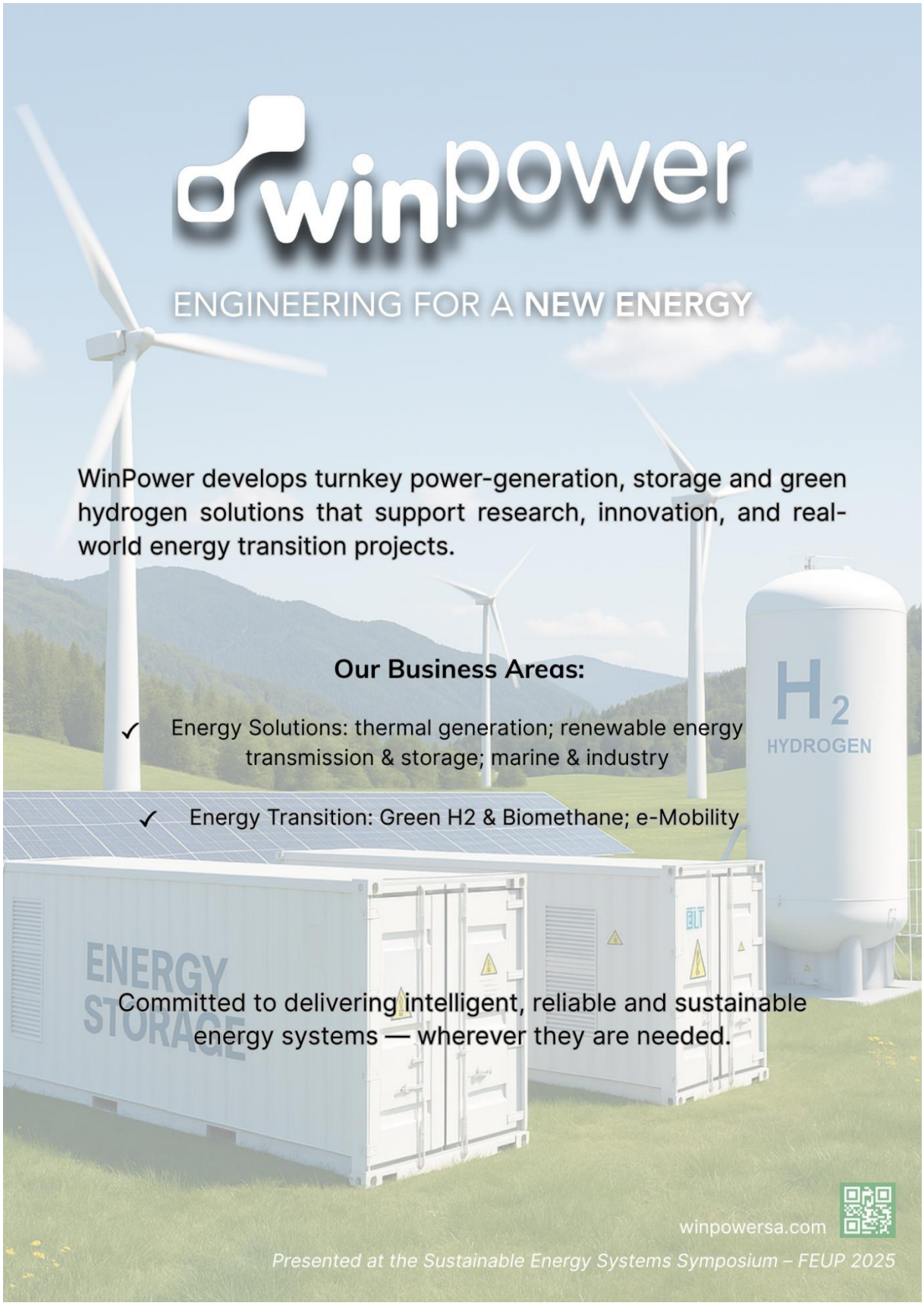
GAIA
TODO UM MUNDO


winpower
ENGINEERING FOR A NEW ENERGY
WinPower develops turnkey power-generation, storage and green hydrogen solutions that support research, innovation, and real-world energy transition projects.
Our Business Areas:
✓ Energy Solutions: thermal generation; renewable energy transmission & storage; marine & industry
✓ Energy Transition: Green H2 & Biomethane; e-Mobility
H2
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ENERGY STORAGE
Committed to delivering intelligent, reliable and sustainable energy systems — wherever they are needed.
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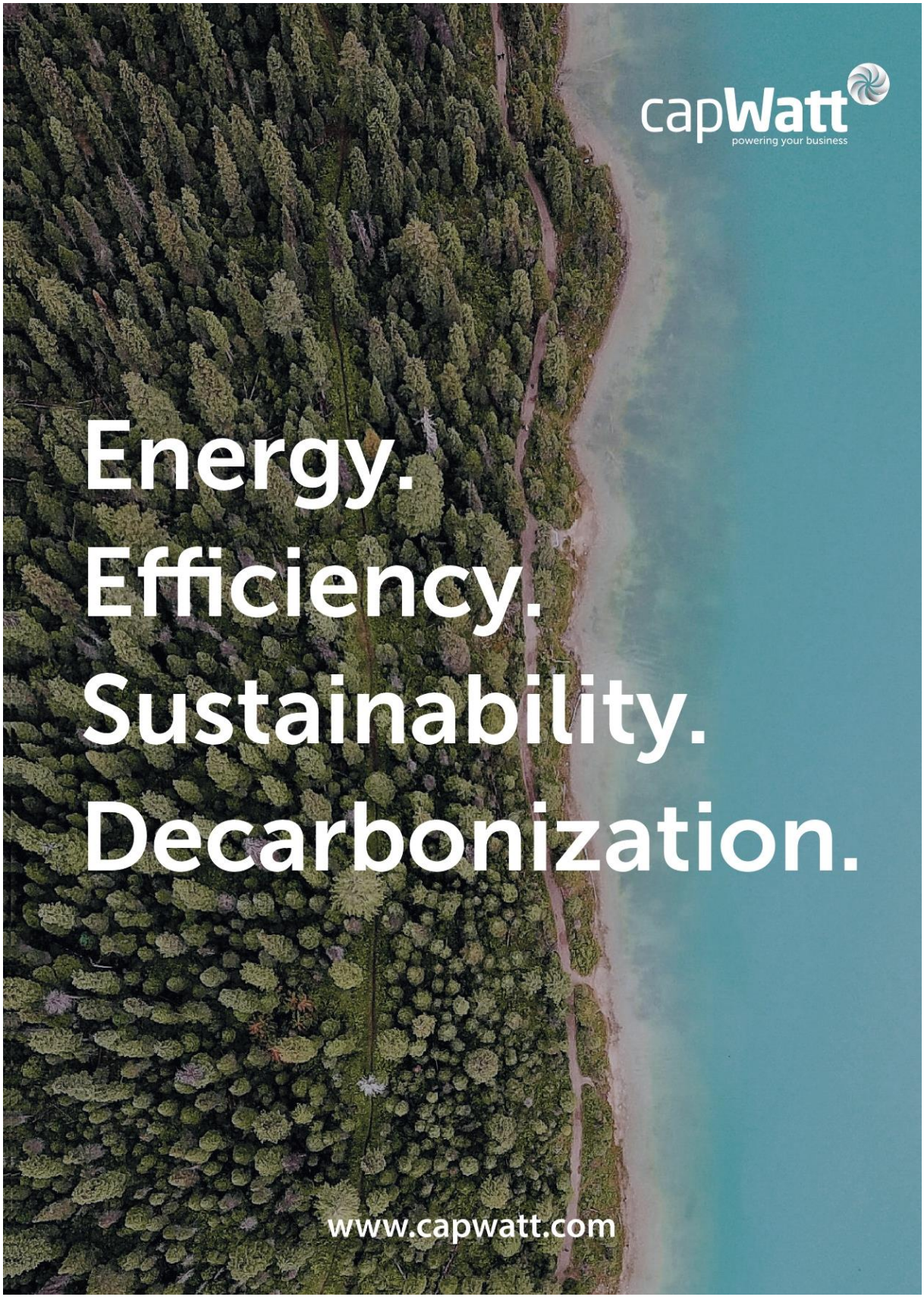
Presented at the Sustainable Energy Systems Symposium – FEUP 2025


BASF
We create chemistry
Sophie and Max create sustainable ways to produce fragrances.
Research Engineers at BASF.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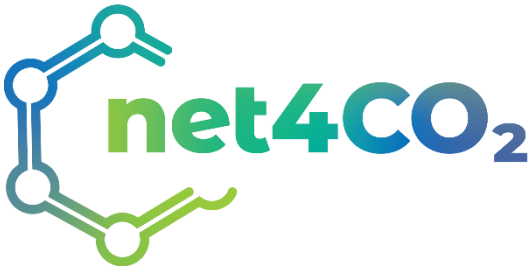

Climate change is one of the most urgent challenges facing humanity, placing significant strain on both society and the environment. In response, **CoLAB Net4CO2 is committed to advancing innovative decarbonization solutions that bridge scientific research with real-world market applications**. The institution focuses on accelerating the development and deployment of competitive, disruptive technologies for CO_2 capture, utilization, and storage, contributing to a more sustainable and resilient future for both society and the planet.

CoLAB Net4CO2's work centers on economically viable decarbonization through cutting-edge technologies. These include capturing and separating CO_2 from industrial combustion gases, converting CO_2 into valuable products such as synthetic fuels, chemicals, and construction materials, and enabling CO_2 transportation and geological storage. By developing integrated solutions across various industrial sectors in Portugal and Europe, CoLAB is positioning itself as a key player in decarbonization efforts. The institution also plays a vital role in shaping regulatory policies that support the adoption of CO2 reduction technologies.

CoLAB is involved in a range of initiatives, including the **engineering and construction of pilot prototypes** for CO_2 capture and valorization, as well as providing **consulting services** to industries seeking to reduce their carbon footprint. Its engagement in national and international R&D projects ensures it remains at the forefront of innovation. CoLAB also organizes and participates in **advanced training programs** to raise awareness and deepen understanding of CO_2 capture, utilization, and storage (CCUS), ensuring the next generation of professionals is equipped to tackle climate change.

The institution is committed to **scientific dissemination**, publishing research, attending national and international conferences, and hosting outreach events to share its findings with the broader scientific community and the public. CoLAB's collaborative approach extends to partnerships with academia, industry, and policymakers, driving innovation and ensuring meaningful impact in decarbonization efforts across Europe and beyond.

CoLAB Net4CO2 is deeply invested in **developing highly skilled professionals** in decarbonization. The center offers numerous opportunities for PhD students, MSc candidates, and early-career researchers to engage in internships, thesis projects, and hands-on research, providing invaluable experience in a dynamic environment. CoLAB also runs internal and external training programs that enhance professional development, further solidifying its leadership in the transition to a low-carbon economy.

For students passionate about addressing climate change, CoLAB Net4CO2 offers an inspiring and impactful environment where they can contribute to meaningful solutions, gain expertise in cutting-edge technologies, and shape the future of sustainable practices and policies.

ARCP CoLAB

REDE DE COMPETÊNCIA EM POLÍMEROS

Research to Innovate Create to Produce

Presentation

ARCP – Associação Rede de Competência em Polímeros (Polymer Competence Network Association) was founded on February 26th, 2007, with the aim of overcoming the challenges of conducting joint research between universities and industry, and of enhancing the use of emerging knowledge. In 2022, it was granted the title of CoLAB – Collaborative Laboratory by the FCT (Portuguese Foundation for Science and Technology).

Combining the expertise of its members, ARCP's activity enables cutting-edge developments not only in the creation and optimisation of new products and processes, but also in more fundamental research.

As such, ARCP positions itself as a shared workspace where members carry out research and development (R&D) projects in a coordinated and interactive way. It stands as a Centre of Excellence in polymer science and technology, with the main goal of promoting innovation and increasing competitiveness.

New Business
Development & Research Center
创新业务发展与研究中心

CTGI New Business Development & Research Centre (CTGI NBDRC)
A Strategic Innovation Hub of China Three Gorges Corporation

Located in **Lisbon, Portugal**, the **CTGI New Business Development & Research Centre** represents China Three Gorges Corporation's (CTG) commitment to driving the global energy transition through cutting-edge R&D, cross-continental collaboration, and sustainable innovation.

Our Mission:

To bridge CTG's know-how with European R&D excellence, enabling innovation that scales, serving real business needs, producing demonstrable outcomes, and generating long-term value.

Our Vision:

To lead CTG's R&D activity across six strategic domains: 1) Business Origination; 2) Technical Operation; 3) Asset Management; 4) Digital Transformation; 5) Technology Research and Validation; 6) Environmental, Social and Governance.

Why CTGI NBDRC?

✓ Co-creation with European entities for projects with real impact within CTG's operation;
✓ CTG's group >120 GW clean energy portfolio (including >2 GW in Spain);
✓ Strategic positioning at the intersection of China, Europe, and South America.

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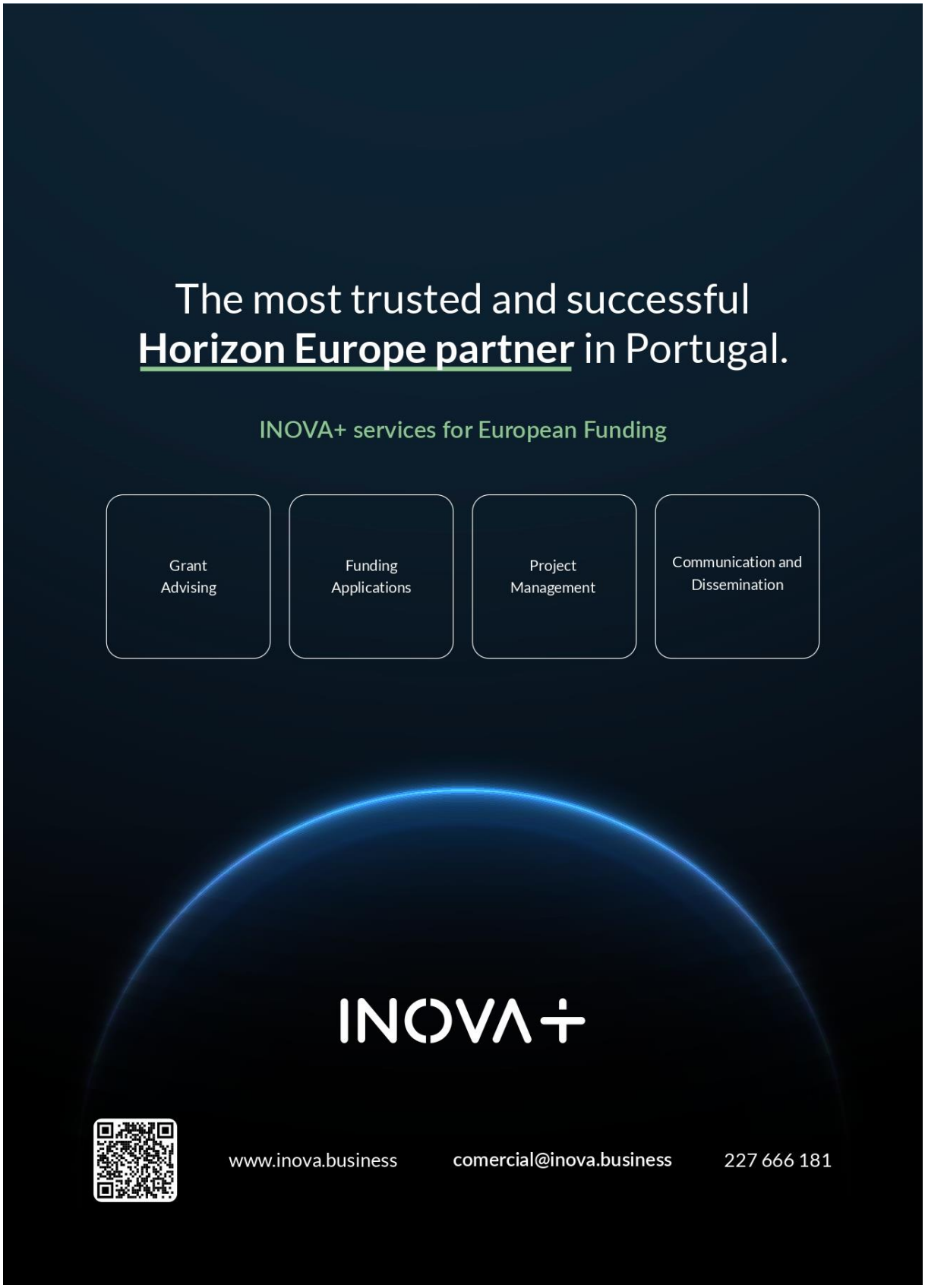
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