1st SENTIATECH CONGRESS

DETECTION, MEASUREMENT AND CONTROL OF EMERGING RISKS

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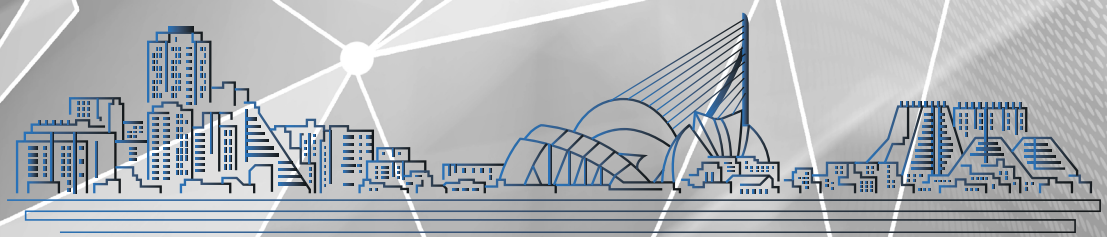
BOOK OF ABSTRACTS

Valencia, Spain 21-22 October 2025



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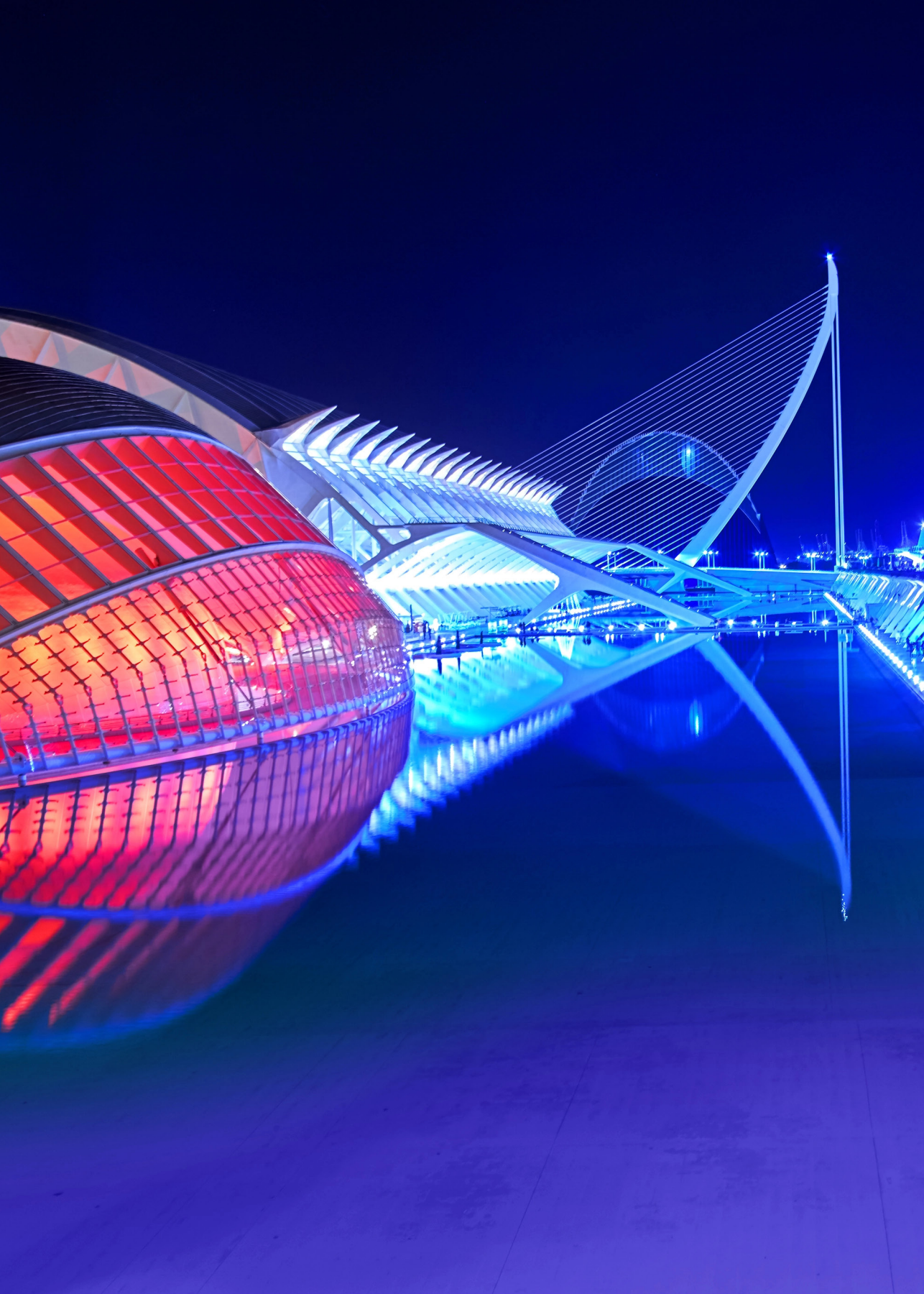

SENTIATECH

SENTIATECH is the **Spanish Technology Platform for Advanced Technologies for Contaminant Detection, Safety Prevention and Environmental Monitoring**. Established in 2023 and promoted by the ITENE Research Centre with the support of the Ministry of Science, Innovation and Universities, this platform is an ecosystem of innovation and cooperation between agents in the Spanish system.

The platform focuses on the development and application of advanced technologies for the early detection, measurement and control of chemicals, pathogens and emerging pollutants that affect human health and the environment. Since its creation, SENTIATECH has attracted more than 60 members and organised more than 20 annual events attended by 1,500 professionals, including renowned researchers, industry professionals and organisations that have established us as a benchmark in the industry.

SENTIATECH's main governing body is its Governing Council, chaired by **Grupo Simetría**. The rest of the Governing Council is made up of **AGQ Labs & Technology, Aqualia, Eurofins, Global Omnium, Kunak Technologies, Labaqua, Laboratorios Tecnológicos de Levante** and **Unimat Prevención**, leading entities committed to promoting innovation in the platform's fields of action.

The Technical Secretariat of the platform is held by the **ITENE Research Centre** through **Carlos Fito**, Safety and Environmental Monitoring Area Manager at ITENE, who acts as Technical Secretariat of SENTIATECH. ITENE brings to the platform moreiatthan 30 years of experience in pollutant detection, safety prevention and environmental monitoring to correctly guide the strategic and research lines of its Working Groups.

Governing Council:

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Francisco José Vea

Chairman of the Governing Council of the SENTIATECH Platform and Director of Innovation and New Technologies at Simetría Grupo

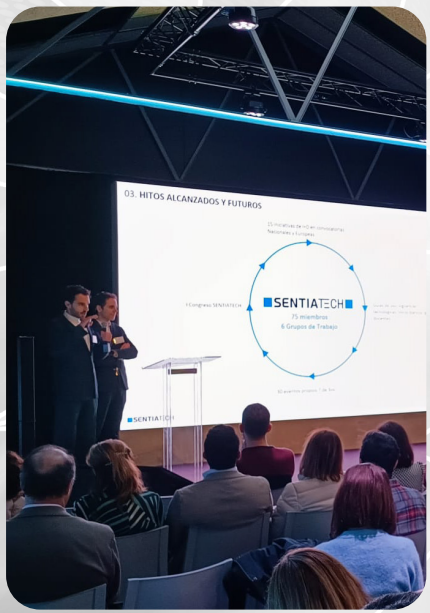
"SENTIATECH is the meeting point for stakeholders interested in process and product safety, human health and the environment. The success of the first edition of this congress confirms that we are on the right track in raising awareness of the need for cooperation and innovation among industry leaders to address emerging risks."

Carlos Fito

Technical Secretariat of the SENTIATECH Platform and Safety and Environmental Monitoring Area Manager at the ITENE Research Centre

"SENTIATECH addresses technologies for detecting and quantifying chemicals, pathogens, and emerging contaminants that have an impact on the environment and human health. These technologies are necessary in everyday life, and international regulators are promoting a shift towards innovation in these fields. The success of the I SENTIATECH Congress is proof of the interest in preventing human and environmental risks."

ABOUT THE CONGRESS



The management of emerging risks has become an essential pillar for ensuring safety in key sectors such as the agri-food industry, the chemical industry, healthcare, the water cycle, occupational risks and environmental health, among others. Our conference aims to promote multidisciplinary collaboration and accelerate the development of innovative solutions to address current and future challenges in this constantly evolving field.

The **I SENTIATECH Congress** has the institutional support of **Valencia City Council** through the collaboration of **Valencia Innovation Capital**.

The congress offers a privileged space for the exchange of ideas, the creation of synergies and the strengthening of the scientific and technological community. Renowned experts in detection technologies, advanced data analysis, nanomaterials and advanced materials manufacturing, food safety and prevention regulations will come together to present the latest advances, discuss and define new application strategies.

+150 ASSISTANTS

+100 SPEAKERS

R&D PROJECTS

EXPO AREAS

NETWORKING

Its **Scientific Committee** is made up of renowned experts in their respective fields of specialisation. Since its creation, SENTIATECH has organised numerous valuable events to promote technological and scientific development in these areas, this being the first conference organised by the platform.

The **programme** includes plenary lectures by leading specialists, market analysis and legislative developments in parallel sessions that will address different perspectives and technological approaches. In addition, there will be a poster exhibition to facilitate dialogue between researchers, as well as meeting spaces with sponsors, who will present their main capabilities and contributions to the industry.

TOPICS

RISK ASSESSMENT, MONITORING AND CONTROL OF EMERGING CONTAMINANTS AND SUBSTANCES OF CONCERN: PFAS, MICRO AND NANOPLASTICS

- Analytical techniques for the determination of PFAS and micro(nano)plastics
- EU policies, regulatory requirements and trends
- Treatment and removal technologies
- New analytical techniques and sensor-based approaches
- Human Health and Environmental Risks Assessment methodologies
- Human exposure to PFAS and micro(nano)plastics
- Other

INNOVATION AND OPPORTUNITIES OF SENSING TECHNOLOGIES IN AGRIFOOD VALUE CHAINS

- Antimicrobial resistance gene detection methods in the agrifood value chains
- New technologies for pathogens detection and food safety analysis in agrifood value chains
- EU policies, regulatory requirements and trends
- New technologies for allergenic substances and harmful chemicals detection and monitoring in agrifood value chains
- Molecular techniques for the detection of food fraud
- Other

INDUSTRIAL CHALLENGES AND SOLUTIONS TO IMPLEMENT THE SAFE & SUSTAINABLE BY DESIGN (SSBD) FRAMEWORK

- Tools and methodological approaches for human and environmental hazard assessment
- Industrial oriented exposure and release assessments models and tools
- Tools and methodological approaches to assist the lifecycle assessment and sustainability
- Policy vision and initiatives to support the SSbD framework implementation at industrial level
- Industrially oriented research projects
- Industrial view and SSbD implementation success stories
- Other

SCIENTIFIC COMMITTEE

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Technical Secretary of SENTIATECH and Manager of Safety and Environmental Monitoring Technologies at ITENE Research Centre

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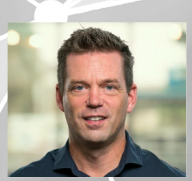
Maidá Domat

PhD Physicist specialised in Material Scienc at the University of Oviedo



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Principal Investigator for Exposure Assessment at TNO

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Head of Nanosafety at the International Ibenan Nanotechnology Laboratory (INL)

Antonio E. Palomares

Vice-Director of the Institute of Chemical Technology (ITQ-CSIC-UPV)

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1st SENTIATECH CONGRESS

DETECTION, MEASUREMENT AND CONTROL OF EMERGING RISKS

With the support of:

Topic 1: Risk assessment, monitoring and control of emerging contaminants and substances of concern: PFAS, micro and nanoplastics

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Monitoring Microplastics in Complex Wastewater

Fernández Benito, Amparo (1)

(1) Captoplastic, S.L.

Type of abstract: Oral

Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Brief description of the submission

Microplastics are an increasing concern in wastewater treatment, yet standardised methodologies for their quantification remain underdeveloped, particularly in complex matrices. This contribution presents a robust and validated analytical method specifically designed for quantifying microplastics at various stages of the wastewater treatment process. The method enables representative sampling, removal of interferences, and gravimetric quantification under real operating conditions. Its design allows for routine monitoring without the need for polymer identification, making it a practical and scalable tool for wastewater treatment plants. The methodology has been tested in different wastewater matrices and demonstrates high recovery and reproducibility. It responds to new regulatory demands, including those outlined in Directive 2024/3019, and is proposed as a candidate for future international standardisation.

Abstract - Contribution details

Microplastics have been recognised as an emerging contaminant in the new EU Urban Wastewater Treatment Directive (2024/3019), highlighting the urgent need for reliable, standardised monitoring methods. Wastewater treatment plants face challenges in quantifying microplastics due to the complexity and variability of matrices at different treatment stages.

This contribution presents a validated analytical method specifically developed for microplastic quantification in wastewater. The method enables representative sampling over time, effective removal of interferences, and gravimetric quantification. Its design facilitates routine use under real operational conditions, delivering robust, reproducible results across different stages.

Tested across various wastewater matrices, the method demonstrates strong recovery, repeatability, and matrix tolerance, making it a reliable and adaptable solution for treatment plants aiming to improve microplastic monitoring, even in the absence of formalised protocols.

The method addresses the technical needs outlined in Directive 2024/3019 and provides a practical tool for assessing microplastic levels in influent, effluent, and intermediate flows. Its simplicity, reproducibility, and versatility position it as a strong candidate for future inclusion in international standardisation frameworks.

Advanced Pyrolysis Techniques

González-Pérez, José A. (1), Correa-López, Gonzalo (1), de la Rosa, José Mª (1), Jiménez-Morillo, Nicasio T. (1)

(1) IRNAS-CSIC

Type of abstract: Oral
Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Keywords: polymers, biopolymers, analytical pyrolysis, environment

Brief description of the submission

Advanced Pyrolysis Techniques for the study of plolymers in complex environmental matrices.

Abstract - Contribution details

Analytical pyrolysis is a technique that thermally decomposes materials (like microplastics) in an inert atmosphere, breaking them into smaller, detectable fragments. These fragments are then analysed (typically by gas chromatography-mass spectrometry, Py-GC/MS) to identify the original polymer composition. This is a fast technique that provides accurate fingerprinting of the analyte, needs minimal sample preparation and is very suitable for the study of polymers (natural and synthesis) in complex matrices (e.g., soil, sediments, biological tissues, …).

In this communication we will provide examples of the application of advanced pyrolysis techniques like conventional and ultra-high resolution analytical pyrolysis (Py-GC/MS and Py-GC-Q-Tof), evolved gas analysis (EGA/MS) and pyrolysis compound specific isotope analysis (Py-CSIA).

SEIRA using resonant antennas for PFAS detection.

Villar Verguizas, Alberto (1), Merino, Santos (1), Alvarez, Roberto (2), Zapata, Mario (2), Aizpurua, Javier (2)

(1) TEKNIKER, (2) Donostia International Physics Center (DIPC)

Type of abstract: Any
Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Keywords: PFAS, SEIRA, Sensing

Brief description of the submission

This work shows the first stage of SEIRA (Surface Enhanced Infrared Absorption Spectroscopy) technique sensorization applied for PFAS detection.

To evaluate the potential of SEIRA, the IR spectra of several PFAS in water media under the influence of gold plasmonic nanostructures was simulated within the framework of density functional theory (DFT), determining the vibrational frequencies and their IR absorption cross sections. The plasmonic frequency of the nanorods can be tuned by choosing the optimal nanoantenna length, obtaining an optimal coupling between antennas resonances and target PFAS frequencies for a particular nanoantenna lengths. Hence, different arrays of gold nanoresonators were manufactured on a single CaF2 substrate.

FTIR measurements of PFAS were acquired using a Varian 620-IR FTIR microscope coupled to a Varian 670-IR spectrometer, equipped with a liquid nitrogen-cooled mercury cadmium telluride detector and referenced to a gold mirror.

Abstract - Contribution details

Infrared spectrscopy (IR) is a powerful tool widely used in research and industry for a label-free identification of molecular species. Nevertheless, an increasing number of applications require ppb sensitivity that cannot be achieved with reasonable uncertainty by conventional IR. Surface-enhanced infrared absorption spectroscopy using resonant metal nanoantennas, or short “resonant SEIRA”, overcomes this limitation. Resonantly excited, such metal nanostructures feature collective oscillations of electrons (plasmons), provide huge electromagnetic fields on the nanometer scale and infrared vibrations of molecules located in these fields are enhanced by orders of magnitude enabling a spectroscopic characterization with unprecedented sensitivity. This work shows the first stage of SEIRA technique sensorization applied for PFAS detection.

To evaluate the potential of SEIRA, the IR spectra of several PFAS in water media under the influence of gold plasmonic nanostructures was simulated within the framework of density functional theory (DFT), determining the vibrational frequencies and their IR absorption cross sections. The plasmonic frequency of the nanorods can be tuned by choosing the optimal nanoantenna length, obtaining an optimal coupling between antennas resonances and target PFAS frequencies for a particular nanoantenna lengths. Hence, different arrays of gold nanoresonators were manufactured on a single CaF2 substrate. The antennas were fabricated by electron beam lithography followed by a lift-off process with evaporated gold and they were encapsulated in a microfluidic chamber.

FTIR measurements of PFAS were acquired using a Varian 620-IR FTIR microscope coupled to a Varian 670-IR spectrometer, equipped with a liquid nitrogen-cooled mercury cadmium telluride detector and referenced to a gold mirror. The measurements were performed at a resolution of 4.0 cm^{-1}, with at least 128 scans averaged per sample. Polarization of the infrared radiation was controlled by employing a rotatable Pike 723-2101 polarizer, which was aligned along the long axis of the gold nanorod.

Control strategies for industrial microplastic spills

Mendoza, Amaia (1), Peña-Rodríguez, Cristina (1), Cabezas, Oihane (2)

(1) "Materials +Technologies" Research Group (GMT), University of the Basque Country (UPV/EHU), (2) Azti-BRTA

Type of abstract: Poster
Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Keywords: microplastic, industry, spills, pellets, control

Brief description of the submission

Microplastics caused by industrial activity are still at an early stage of research and, in general, there is a significant lack of knowledge about the specific industries that contribute to microplastic pollution. However, in some cases it is possible to distinguish the industrial origin of primary microplastics, such as pellets used by the plastic processing industry.

Despite pellets are one of the main types of microplastics found on the marine coastline due to losses in the handling and transport processes, no specific control of microplastics is currently included in the regulations on industrial discharges, since in addition, there are still no standardised procedures for the analytical determination of microplastics in environmental samples.

The aim of this study is therefore to identify the standard parameters included in the current industrial discharge regulations, which could potentially detect a discharge of pellet-type microplastics from the plastics industry.

Abstract - Contribution details

Microplastics caused by industrial activity are still at an early stage of research and, in general, there is a significant lack of knowledge about the specific industries that contribute to microplastic pollution (Wang et al., 2018). In fact, studies on marine plastics and microplastics do not usually report their potential industrial origin (Schwarz et al., 2019), due to the difficulty of distinguishing them. However, in some cases it is possible to distinguish the industrial origin of primary microplastics, such as pellets used by the plastic processing industry.

Pellets are one of the main types of microplastics found on the marine coastline due to losses in the handling and transport processes (Mendoza, 2022; OSPAR Commission, 2017). According to European Commission (2023), between 52,140 and 184,290 tonnes of pellets were lost to the EU environment in 2019. Although the European Commission (2023) has recently published for the first time a proposal for a Regulation to prevent unintentional leakage of pellets, no specific control of microplastics is currently included in the regulations on industrial discharges, since in addition, there are still no standardised procedures for the analytical determination of microplastics in environmental samples.

The aim of this study is therefore to identify the standard parameters included in the current industrial discharge regulations, which could potentially detect a discharge of pellet-type microplastics from the plastics industry, in a hypothetical control of storm water discharges.

In collaboration with URA (Basque Water Agency), the public agency in charge of controlling internal basins of the Basque Country (Spain), the suitability of several parameters usually included in the industrial discharge authorisations for the determination of the organic fraction of solids in an aqueous sample, has been evaluated and verified. Finally, several measures for the control and containment of microplastic discharges from industry are also proposed.

Validation of Microplastic Methods in Water

Egea-Corbacho Lopera, Agata (1), Herrera, Karol Dayana (1), De Juan, Clara (1), Albendín, Gemma (1), Arellano, Juana (1), Coello, Dolores (1), Rodríguez Barroso, Rocío (1)

(1) University of Cadiz

Type of abstract: Oral

Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Keywords: Microplastics; drinking water; Analytical methods; Treatment technologies

Brief description of the submission

The study addresses growing concerns over Microplastics (MPs) contamination in drinking water by validating and applying methods for their identification and quantification in treatment processes. Following EU directives, three different polymer pretreatment techniques and three analytical approaches were assessed to determine MPs detection and quantification efficiency. The research supports regulatory decision-making, helps safeguard public health, and raises awareness about plastic pollution's impact on water resources, emphasizing the importance of sustainable consumption and waste management.

Abstract - Contribution details

Validation of Microplastic Methods in Water

Agata Egea-Corbacho[1], Karol Dayana Herera[1], Clara de Juan[1], Gemma Albendín[2], Juana Mª Arellano[2], Mª Dolores Coello[1], Rocío Rodríguez-Barroso[1]

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Abstract

European Directive 2020/2184 included Microplastics (MPs) on its watch list, and EU Decision 2024/1441 established an official method for their detection in drinking water. Detecting MPs poses a major challenge due to their variability in shape, size, and composition, highlighting the importance of validating analytical methods under specific laboratory conditions, in accordance with the regulation. However, it does not specify which pretreatments or methods must be applied for that purpose. This study evaluated three pretreatment methods for organic matter removal, the first one was a wet peroxide oxidation followed by density separation (NaCl or $ZnCl_2$), and the second one was $ZnCl_2$ separation alone. Two analytical approaches were then compared: one based on visual enumeration under microscopy with Fourier Transform Infrared Spectroscopy (μ-FTIR) verification, and another employing μ-FTIR analysis supported by the SiMPLE software platform. Additionally, it offers relevant tools for the identification and quantification of MPs in water, facilitating a clearer understanding of the technical challenges involved in their analysis.

Funding sources
This work was supported by Spanish Ministry of Science and Innovation, specifically via the project PID2022-141731OB-I00, entitled "Potabilization technologies for the elimination of emerging contaminants in the presence of microplastics in drinking water, testing of toxic effects", funded by MICIU/AEI/10.13039/501100011033 and by ERDF/EU.

Microplastics – Thermoanalysis vs Spectroscopy

Fernández, Patricia (1)

(1) Eurofins Control Ambiental

Type of abstract: Oral
Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Keywords: Microplastics, thermal desorption, quantum cascade laser

Brief description of the submission

The aim of this work is to provide a practical comparison between the main two categories of techniques for microplastics analysis, based on our experience with both the novel Quantum Cascade Laser IR microscopy (LDIR) and with Thermal Desorption coupled with Gas Chromatography – Mass Spectrometry. There are highlighted notable differences in terms of foundation, equipment, operational characteristics, precautions and results, offering complementary information for health and environmental risk assessments that will be studied in this work.

Abstract - Contribution details

The persistence of plastics in the environment triggers a multiple challenge throughout the entire life cycle of plastics, involving many industrial sectors, from manufacturing to mitigation and disposal. In addition, to understand the impact of microplastic pollution, its sources, distribution, and health and environmental implications, it is required to have robust analytical protocols capable of offer reliable data to monitor and assess these substances in the environment.

Microplastics can be identified and quantified using various methodological approaches. Regarding analytical techniques there are two main categories:

1- Vibrational spectroscopy methods (Infrared or Raman optical microspectroscopy) which can identify the type of polymer in individual particles and additionally provide information on particle number, its size and shape. Polymer identification is achieved by comparing the spectral data obtained from particles with reference spectra from known polymeric materials. The minimum particle size detectable for accurate identification varies depending on the specific technique and the performance characteristics of the analytical instrument

2- Thermo-analytical methods (Thermal Desorption or Pyrolysis, coupled to Gas Chromatography-Mass Spectrometry), which can identify the polymers contained in a sample and quantify the total mass of each polymer type. This approach relies on the thermal degradation of polymers, where identification is based on matching the decomposition byproducts with existing libraries of known polymer profiles. Quantification requires individual calibration procedures for each polymer type. However, thermo-analytical methods do not yield information regarding particle count, morphology, or dimensional attributes. These techniques do not limit lower size for particle detection, and their sensitivity is established by the minimal mass required for reliable analysis

PFAS in Air: Regulatory Status+Analytical Advances

Rodríguez, Juanjo (1)

(1) Eurofins Environment

Type of abstract: Oral
Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Keywords: PFAS, air, industrial emissions, regulation, analysis

Brief description of the submission

Per- and polyfluoroalkyl substances (PFAS), often referred to as “forever chemicals,” are raising growing concerns due to their persistence, mobility, and bioaccumulation potential. While most regulatory efforts have so far focused on aqueous environments, increasing attention is now being given to the **atmospheric pathway**, particularly **industrial emissions**, as a significant vector of environmental dispersion.

This presentation offers a dual perspective:

1.- Regulatory aspect
2.- Analytical aspect

Abstract - Contribution details

Per- and polyfluoroalkyl substances (PFAS), often referred to as “forever chemicals,” are raising growing concerns due to their persistence, mobility, and bioaccumulation potential. While most regulatory efforts have so far focused on aqueous environments, increasing attention is now being given to the **atmospheric pathway**, particularly **industrial emissions**, as a significant vector of environmental dispersion.

This presentation offers a dual perspective:

1.- Regulatory aspect – an overview of current French and European policies under development or implementation, with a focus on emerging requirements related to the control of atmospheric PFAS emissions.

2.- Analytical aspect – a feedback on the implementation of **OTM-45** (targeting particulate and gaseous PFAS in ducted emissions) and **OTM-50** (a non-target screening method for volatile and semi-volatile PFAS), recently proposed by the U.S. EPA. These methods are assessed in terms of feasibility, sensitivity, technical limitations, and adaptability to European contexts. Analytical and technical solutions for PFAS detection in other air matrices will also be addressed.

Hyperspectral Imaging of Microplastics in Tap Water

Carvajal, Joan Josep (1), Lozano, Maria (1), Ezenarro, Jokin (2), Pujol, Maria Cinta (1), Ruisanchez, Itziar (1)

(1) Universitat Rovira i Virgili, (2) University of Copenhagen

Type of abstract: Oral
Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics
Keywords: Microplastics Hyperspectral imaging Water

Brief description of the submission

We present a rapid, high-throughput method for detecting microplastics in tap water using near-infrared hyperspectral imaging (NIR-HSI), requiring no sample preparation beyond filtration. The technique enables direct analysis of entire filters, identifying microplastics as small as 600 µm, often invisible to the naked eye, in under 3 minutes with 50×50 µm resolution.

Chemometric models were developed and validated for the 7 priority microplastics among those identified by the EU (2024), achieving over 99% sensitivity and specificity. The method was tested on water filtered through PA and PC membranes (20 µm pore size), with accurate results even in complex matrices.

NIR-HSI offers a promising alternative to conventional IR methods, enabling fast and automated microplastic characterization in drinking water. Ongoing work focuses on optimizing spectral selectivity and model performance for broader application.

Abstract - Contribution details

Microplastic pollution is a growing global concern, and there remains a strong need for faster, less labor-intensive detection methods. This study presents a high-throughput, automated approach based on near-infrared hyperspectral imaging (NIR-HSI) for the identification of microplastics in tap water, requiring no sample preparation beyond filtration.

NIR-HSI enables direct analysis of entire filter surfaces, combining spectral and spatial data for rapid and comprehensive detection. Small, colorless microplastics (<600 µm) that may escape visual inspection or manual collection are reliably detected. Unlike conventional IR spectrometers, our line-scan setup allows simultaneous analysis of multiple particles, scanning a 17 cm^2 area in under 3 minutes at 50 µm resolution.

Chemometric classification models were developed and validated for 7 microplastic polymers among those prioritized by the European Commission (2024): PE, PP, PET, PS, PVC, PA, PU, PMMA, PTFE, and PC. All models achieved >99% sensitivity and specificity at defined statistical thresholds.

The method was tested on water samples filtered using PA and PC membranes (20 µm pore size), demonstrating robust identification even in complex matrices without the need for manual sorting. Automatic detection remained reliable despite potential spectral interferences from filter materials or other constituents.

While the technique shows strong promise as a rapid screening tool for microplastic-type characterization in drinking water, challenges related to spectral selectivity and model robustness must be addressed for broader implementation.

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PFAS Analysis in Wastewater, Sludge & Waste

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Type of abstract: Oral

Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Keywords: PFAS, wastewater, sludge, solid waste

Brief description of the submission

Per- and polyfluoroalkyl substances (PFAS) are persistent and toxic emerging contaminants found in complex matrices like wastewater, sludge, and solid waste. Their low concentrations and strong matrix effects complicate accurate analysis. This study critically reviews current LC-MS/MS-based methods for PFAS extraction, clean-up, and quantification, evaluating their strengths, limitations, and detection limits. It emphasizes the need for standardized protocols and highlights how matrix-specific characteristics must guide methodological adaptation. The goal is to support more reliable monitoring of PFAS in waste-related environments.

Abstract - Contribution details

Per- and polyfluoroalkyl substances (PFAS) are widely distributed emerging contaminants, known for their high persistence, mobility, and potential toxicity. Their occurrence in complex matrices such as wastewater, sewage sludge, and solid waste poses significant analytical challenges, due to their low concentrations and the matrix effects that hinder their detection and quantification.

This work presents a critical review of methodological approaches used for the determination of PFAS in these matrices, with a particular focus on extraction, clean-up, and quantification techniques using liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS). The advantages and limitations of different analytical protocols are discussed, along with achievable detection limits and the need for analytical standardization and harmonization to ensure comparable and reliable results. The specific characteristics of each matrix are also analyzed, highlighting the importance of adapting protocols according to their physicochemical complexity.

This methodological approach aims to contribute to the development of robust and reproducible analytical tools that enable more accurate assessment of PFAS occurrence in environments related to waste treatment and management.

PFAS: From the Regulation to The Analytical Solutions

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Type of abstract: Oral

Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Keywords: PFAS, PPWR, HIGH RESOLUTION CHROMATOGRAPHY, UNTARGET.

Brief description of the submission

PFAS are a family of substances used in many application fields and also in food contact materials. Cookware, paper, plastics are some of the most important materials that often needed the use of PFAS to achieve the intentional features of the items. During the time, the scientific focus has evolved from the toxicological point of view and to the regulatory one. Analytical techniques have clearly become essential to be able to follow legislative changes, leading laboratories to develop methodologies with high added value.

Abstract - Contribution details

Over the past decade European legislation on food contact materials has progressively tightened, particularly with regard to chemical safety and environmental impact. Initial regulations focused on specific materials and substances, but increasing scientific evidence [1] about the persistence and toxicity of compounds like PFAS [2] has driven the EU towards a more comprehensive and precautionary approach. This culminated in the Packaging and Packaging Waste Regulation 2025/40 (PPWR), which not only sets ambitious targets for recyclability and reuse but also imposes stricter controls on the chemical composition of packaging. Therefore, reliable analytical methods are essential to ensure compliance. Advanced instrumental techniques—such as LC-MS/MS and HRMS—are required to detect and quantify trace levels of PFAS and other contaminants in complex packaging matrices.

The PPWR sets three simultaneous limits, two of which are generic without specific molecule lists. Considering the broad number of known PFAS, to cover the requirement it is fundamental to detect the presence of them using untargeted methods by HRMS, together with Top Assay in order to find also the precursors required in the regulation. [3] In this work, case histories demonstrating the reliability of Food Contact Center approach, conceived since 2022, will be presented. Development of instrumental libraries and structuring of a multi-year know-how have been basic to check the compliance.

[1] Phelps DW, et al. “Per- and polyfluoroalkyl substances in food packaging: Migration, toxicity, and management strategies.” Environmental Science & Technology, 2024

[2] Ramírez Carnero, et al. Presence of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) in Food Contact Materials (FCM) and Its Migration to Food. Foods 2021, 10, 1443

[3] Alina Koch, et al. Towards a comprehensive analytical workflow for the chemical characterisation of organofluorine in consumer products and environmental samples, Trends in Analytical Chemistry, Volume 123, 2020, 115423

Microplastic Emissions from a Coastal WWTP

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Type of abstract: Any

Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Keywords: Removal efficiency, contamination, effluent, LDIR

Brief description of the submission

Microplastics (MPs) are persistent pollutants of growing concern, now explicitly addressed in the Urban Wastewater Directive (EU) 2024/3019, which calls for enhanced monitoring and reduction of micropollutants. This study quantifies the load and pathways of MPs in a medium-sized coastal WWTP (~19,000 inhabitants) discharging directly into the productive *Ría de Vigo* (NW Spain). Sampling across four treatment stages (influent, screenings, sludge, effluent) revealed the highest concentrations in sludge (8.1×10^4–9.6×10^6 particles/kg). Effluent, with 45.4–137.2 particles/L, accounts for an estimated 2–6×10^{11} MPs released annually. With removal efficiencies of 88–93%, results highlight the diffuse contribution of medium-scale WWTPs to marine pollution. Findings emphasize the need for systematic monitoring and advanced treatment not only in large plants (≥150,000 p.e.) but also in medium–small facilities in sensitive areas, and for improved sludge treatment regardless of end use.

Abstract - Contribution details

Microplastics (MPs) have emerged as persistent contaminants of global concern, increasingly addressed in European water policy, such as the Marine Strategy Framework Directive (MSFD). The recently adopted Urban Wastewater Directive (EU) 2024/3019 requires more comprehensive monitoring and reduction of micropollutants, including MPs, especially in sensitive areas.

This study examined the presence and fate of MPs in a medium-sized coastal wastewater treatment plant (WWTP) in Moaña, NW Spain (serving ~19,000 inhabitants), which discharges directly into the highly productive and ecologically sensitive *Ría de Vigo*, a key area for shellfish aquaculture and marine biodiversity. Concentrations were quantified at four treatment stages (influent, screenings, sludge, and effluent) in February and April.

New methods were applied to address the analytical challenges inherent to complex wastewater matrices. Suspected plastic particles >500 µm, including fibres, were identified by Nile Red-stained light microscopy, with polymer confirmation by FTIR spectroscopy (ATR mode, PerkinElmer Spectrum Two with UATR Two). Additionally, MPs in the influent, sludge, and effluent were identified and quantified using Laser Direct Infrared (LDIR 8700, Agilent) imaging. The sludge contained the highest concentration (8.1×10^4 to 9.6×10^6 particles/kg), confirming its role as a primary reservoir. Although the effluent showed a lower concentration (45.4–137.2 particles/L), it represented a significant dispersion pathway due to the large discharge volume, with 2 to 6.01×10^{11} MPs estimated to enter the Ría annually.

With removal efficiencies of 88–93%, results highlight the diffuse contribution of medium-scale WWTPs to marine pollution. These findings underscore the necessity of systematic monitoring and advanced treatment not only in large plants (≥150,000 p.e.) but also in medium-scale plants discharging to sensitive areas. Improved sludge treatment is also essential, regardless of end use, to safeguard ecosystems and food safety in line with SDGs 6 and 14.

New Low-Cost Approaches for Microplastic Monitoring

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(1) ITENE

Type of abstract: Oral

Subject area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.1. Analytical techniques for the determination of PFAS and micro(nano)plastics

Keywords: Microplastics; Low-cost sensors; Raman/SERS spectroscopy; Biosensors; Artificial intelligence;

Brief description of the submission

Microplastics (MPs; <5 mm) and nanoplastics (NPs; <1 µm) are widespread pollutants with potential ecological and health impacts. Conventional techniques such as Fourier-transform infrared spectroscopy (FTIR) and pyrolysis gas chromatography–mass spectrometry (pyrolysis-GC/MS) provide reliable polymer identification but are expensive, time-consuming, and limited to specialized laboratories, constraining large-scale monitoring.

Recent developments aim to deliver low-cost, portable, and user-friendly alternatives. Miniaturized Raman and surface-enhanced Raman spectroscopy (SERS) devices allow sensitive on-site detection, while colorimetric and fluorescent biosensors, such as Nile Red staining coupled with smartphone imaging, offer simple visual screening. Microfluidic “lab-on-chip” platforms further integrate pre-concentration and detection in compact formats.

Advances in sample preparation, including digestion protocols and low-cost filtration membranes, combined with machine learning and chemometric algorithms, enhance sensitivity and specificity. Artificial intelligence applied to spectra and images improves polymer classification and particle counting. Collectively, these innovations enable distributed, on-site surveillance to support effective mitigation and policy actions.

Abstract - Contribution details

Microplastics (MPs; plastic particles <5 mm) and nanoplastics (NPs; <1 µm) have become pervasive contaminants in aquatic, terrestrial, and atmospheric environments, raising concern over their ecological and health impacts. Conventional analytical techniques such as Fourier-transform infrared spectroscopy (FTIR) and pyrolysis gas chromatography–mass spectrometry (pyrolysis-GC/MS) remain the gold standard for polymer identification but are limited by high costs, long processing times, and reliance on specialized laboratories. These barriers restrict large-scale monitoring and hinder rapid decision-making in environmental management.

To overcome these challenges, research is increasingly focused on developing low-cost, portable, and user-friendly alternatives. Miniaturized Raman and surface-enhanced Raman spectroscopy (SERS) devices using affordable diode lasers and fiber-optic probes have demonstrated sensitive, on-site detection of MPs. In parallel, colorimetric and fluorescent biosensors, such as Nile Red staining coupled with smartphone imaging, can enable simple visual screening, while microfluidic “lab-on-chip” platforms integrate pre-concentration and detection in compact formats suitable for field deployment.

Equally important are advances in sample preparation workflows. Low-cost filtration membranes, greener digestion protocols, and automated back-flush systems are being optimized to concentrate MPs from complex environmental matrices with minimal reagent consumption. When combined with machine learning and chemometric algorithms, even simplified detection schemes can achieve high sensitivity and specificity, overcoming challenges of fluorescence interference and complex backgrounds.

Artificial intelligence further enhances these approaches. Machine learning applied to Raman and FTIR spectra enables robust polymer classification, while computer vision methods automatically identify and count MPs in microscopy or fluorescence images. Deep learning models integrated into microfluidic devices have already achieved >90% accuracy in

polymer classification. Together, these innovations point toward a new generation of monitoring tools that democratize access to reliable MP data. By lowering financial and technical barriers, low-cost approaches can enable distributed, real-time surveillance and provide the evidence base required to guide effective mitigation and policy actions.

MPs effects on bioconcentration of PFAS in E. eels

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Type of abstract: Oral
Subject area: T1.2. Human Health and Environmental Risks Assessment methodologies
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.2. Human Health and Environmental Risks Assessment methodologies
Keywords: Bioconcentration, depuration, eels' muscle, liver, plasma

Brief description of the submission

In this research, the bioconcentration and depuration kinetics of five PFAS in muscle, liver tissue and plasma of silver European eel were studied through a laboratory approach. Eels were distributed in three groups: control, exposed to PFAS, and exposed to PFAS and microplastics (MPs). The study was carried out for 58 days separated in two stages exposure and depuration. PFDA, PFOS, PFOA showed increasing concentrations in the three tissues (plasma > liver > muscle). During depuration phase, PFAS concentrations were similar or even tended to be higher than at the exposure phase in all tissues. The presence of MPs seemed to affect the bioconcentration and depuration of PFAS in eels' tissues (increased kinetic bioconcentration factor BCFk).

Abstract - Contribution details

In this research, the bioconcentration and depuration kinetics of five PFAS in muscle, liver tissue and plasma of European eel were studied by a laboratory approach. Eels were distributed in three groups: control, exposed to PFASs, and exposed to PFAS and microplastics (MPs). The study was carried out for 58 days in two stages (i) exposure (0–28 days), and (ii) depuration (29–58d). PFAS in eels' muscle and liver samples were extracted by QuEChERS and dSPE whereas plasma by SPE. Extracts were analysed via UHPLC-MS/MS. PFDA, PFOS, PFOA showed increasing concentrations in the three tissues (plasma>liver>muscle). During depuration, PFAS concentrations were similar or even higher than at exposure in all tissues. The presence of MPs seemed to affect the bioconcentration and depuration of PFAS (increased bioconcentration factor). Pollutants as PFAS are believed to be a key issue in understanding the reasons for the eels' stock decrease and therefore, further research about their accumulation, depuration and toxicity on eels is imperative as this may be of great interest for human risk assessment of this widely consumed fish.

Emerging contaminantes and the One Health Framework

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(1) AIMPLAS

Type of abstract: Any

Subject area: T1.2. Human Health and Environmental Risks Assessment methodologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.2. Human Health and Environmental Risks Assessment methodologies

Keywords: One Health - PFAS - microplastics - nanoplastics - advanced analytical techniques - in vitro bioassays - NAMs - sustainable solutions

Brief description of the submission

Emerging contaminants—such as PFAS, microplastics, and nanoplastics—pose serious risks due to their persistence, toxicity, and environmental ubiquity. Addressing these challenges under the One Health framework requires an integrative approach combining advanced analytical techniques, toxicological assessment, and sustainable mitigation strategies.

This work presents a validated workflow that integrates high-resolution analytical methods—such as Py-GC-MS, LC-HRMS, and μ-FTIR microscopy—with in vitro bioassays to detect, quantify, and assess the biological impact of contaminants in environmental matrices like water, soil, and sediments. The toxicological panel includes assays for cell viability, genotoxicity, oxidative stress, endocrine disruption, and in vitro digestion, using organisms representing different trophic levels.

Additionally, sustainable technologies such as bioplastics from renewable resources, microbial biodegradation of pollutants, CO_2 capture, and catalytic systems are explored as potential mitigation tools. This multidisciplinary strategy supports comprehensive risk assessment and contributes to safeguarding human and environmental health.

Abstract - Contribution details

Emerging contaminants—such as per- and polyfluoroalkyl substances (PFAS), microplastics, and nanoplastics—pose a significant threat due to their persistence, potential toxicity, and widespread distribution in the environment. Addressing these challenges within the One Health framework, which underscores the interdependence of human, animal, and environmental health, requires an integrated approach that combines advanced analytical techniques, toxicological assessment, and sustainable mitigation strategiesThis work aims to develop and validate an integrative workflow combining advanced analytical techniques, in vitro toxicological assays, and sustainable mitigation technologies to evaluate the presence, biological impact, and potential solutions for emerging contaminants in complex environmental matrices.

Advances techniques such as pyrolysis gas chromatography–mass spectrometry (Py-GC-MS), liquid chromatography–high-resolution mass spectrometry (LC-HRMS), and microscopy coupled with Fourier-transform infrared spectroscopy (μ-FTIR), enable sensitive detection and quantification of these contaminants in complex matrices such as water, soil, and sediments. Complementarily, in vitro bioassays are crucial for evaluating biological effects. Thus, according to risk assessment, an in vitro bioassays panel must be designed to target toxicological endpoints, including cell viability, genotoxicity, oxidative stress, endocrine disruption, and in vitro digestion along different organisms that represent the trophic chain to assess the impact of contaminants and materials on biological systems.

In response to environmental challenges, recent years have seen the development of sustainable solutions such as bioplastics and biomaterials derived from renewable sources, the use of microorganisms for biodegradation of pollutants (e.g., microplastics, pesticides, halogenated compounds), CO_2 capture technologies, and catalytic systems. This multidisciplinary approach enables the detection, evaluation, and mitigation of emerging contaminants, contributing to the protection of both human health and the environment.

Adverse health impact of micronanoplastics

Hernández, Alba (1), Rubio, Laura (1), García-Rodriguez, Alba (1), Barguilla, Irene (1), Egea, Raquel (1)

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Type of abstract: Oral

Subject area: T1.2. Human Health and Environmental Risks Assessment methodologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.2. Human Health and Environmental Risks Assessment methodologies

Keywords: Micro- and nanoplastics (MNPLs) Chronic exposure Genotoxicity Carcinogenicity New Approach Methodologies (NAMs)

Brief description of the submission

Micro- and nanoplastics (MNPLs) are widespread environmental pollutants that humans are chronically exposed to through inhalation and ingestion. Due to their small size, MNPLs can be absorbed, distributed throughout the body, and accumulate in tissues. Their potential to cause genotoxic and carcinogenic effects is under active investigation. This presentation highlights current findings, especially from the EU PlasticHeal project, and outlines key research priorities and knowledge gaps in MNPLs risk assessment.

Abstract - Contribution details

Micro- and nanoplastics (MNPLs) are emerging pollutants that are now ubiquitous across all environmental compartments. Increasing evidence indicates that humans are chronically exposed to these particles via inhalation and ingestion, and that their small size facilitates absorption, systemic distribution, and bioaccumulation. While the biological effects of MNPLs are currently the subject of intensive research, the long-term consequences of chronic exposure remain largely underexplored. Among the most critical endpoints from a human health risk perspective are genotoxicity and carcinogenicity. This presentation will provide an overview of the current state of knowledge regarding the genotoxic and carcinogenic potential of MNPLs, with particular emphasis on the methodologies developed and the findings obtained within the framework of the EU-funded PlasticHeal project (www.plasticheal.eu/en). Key research priorities and persisting knowledge gaps will also be discussed, with the aim of informing future research and advancing MNPLs risk assessment strategies.

Mapping AMR hotspots in a sewage system

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Type of abstract: Oral

Subject area: T1.2. Human Health and Environmental Risks Assessment methodologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.2. Human Health and Environmental Risks Assessment methodologies

Keywords: antimicrobial resistance, wastewater, metagenomics, WGS

Brief description of the submission

Wastewater contains antibiotic residues, resistance genes (ARGs), and resistant bacteria, which contribute to antimicrobial resistance spread. The GAUSS project conducted an epidemiological study in sewage systems analyzing wastewater from hospitals, urban and industrial zones, and WWTPs. Metagenomic analysis identified 262 ARG variants, with MLSB and beta-lactams being the most prevalent. The hospital sector showed the highest ARG abundance, while industrial zones and treated effluents had the lowest. Wastewater treatment plants reduced ARG levels by 93.3%. Most ARGs were plasmid-borne, facilitating their spread among bacteria. These findings highlighted hospital discharge points as critical hotspots, so LIFE GENESYS align with Directive (EU) 2024/3019 requirements by offering decentralized treatments targeting emerging contaminants at the source. The project developed a cost-effective treatment combining a membrane bioreactor and UV-LED/H_2O_2 oxidation system, along with a digital tool that helps hospitals estimate antibiotic loads and optimize prescriptions to control AMR spread.

Abstract - Contribution details

Wastewater serves as a reservoir for antibiotic residues, antibiotic resistance genes (ARGs), and resistant bacteria (ARBs), contributing to antimicrobial resistance (AMR) spread. To monitor this risk, the GAUSS project conducted an epidemiological study in Sabadell (Barcelona, Spain), analyzing wastewater from seven sites, including hospital effluents, urban and industrial zones, and wastewater treatment plants (WWTPs) [1].

Metagenomics characterized the microbiome and resistome, while multi-drug resistant (MDR) bacteria were selected using chromogenic plates and antibiotic susceptibility tests, enabling genome sequencing of clinically relevant strains.

Metagenomic analysis revealed 262 ARG variants across sites, grouped into 15 resistance categories. The most prevalent were MLSB and beta-lactams, including carbapenems and cephalosporins. Beta-lactam resistance was dominated by blaOXA-464, blaOXA-491, and blaNPS; blaOXA-1 and blaKPC-2 were key for cephalosporin and carbapenem resistance. MLSB resistance featured dominant msr(E) and mph(E) genes, the most abundant in the study.

The hospital sector showed the highest ARG abundance, dominated by beta-lactams, MLSB, and aminoglycosides. WWTP inlets and residential areas had similar profiles, while industrial zones and WWTP effluents showed the lowest levels. WWTP treatment reduced ARG presence by 93.3%. Most abundant ARGs were plasmid-borne, favoring spread across bacterial genera. Statistical analysis confirmed plasmids' role in ARG dissemination, increasing diversity and prevalence in waterborne communities.

These findings helped prioritize high-risk areas, identifying hospital discharges as critical hotspots. Building on this, LIFE GENESYS [2] was launched to meet Directive (EU) 2024/3019 on urban wastewater treatment [3], providing decentralized solutions to remove emerging contaminants at the source.

We aim to implement an innovative, cost-effective treatment to eliminate pharmaceuticals, ARGs, and bacteria from hospital effluents. The GENESYS treatment train includes a membrane bioreactor and UV-LED/H_2O_2 system for efficient, energy-saving oxidation, plus a digital tool helping hospitals estimate antibiotic loads and make informed prescription decisions.

EC in water: application to hospital effluents

Díaz-Esplá, Laura (1), Malvar, Jose Luis (1), Tejada, Segio (1), Gras, Luis (2), Grindlay, Guillermo (2)

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Type of abstract: Oral
Subject area: T1.2. Human Health and Environmental Risks Assessment methodologies
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.2. Human Health and Environmental Risks Assessment methodologies
Keywords: pharmaceutical products, PFAS, hormons, drugs

Brief description of the submission

Emerging contaminants are a source of concern due to their potential effects on human health and the environment. They are common in hospital wastewater, although there is still no clear legislation regulating them. Therefore, strategies for their control and elimination are needed, starting with identifying their sources and applying appropriate technologies. Reliable data on their concentrations in water are key to proposing effective measures.

This study analyzes hospital discharges in the Community of Madrid, focusing on four families of contaminants: hormones, perfluorinated compounds , pharmaceuticals, and drugs of abuse. Advanced analytical techniques such as LC/MS-QQQ and LC/MS-QTOF are used, capable of detecting these compounds at very low levels. The results confirm their presence at all sampled sites, with a particular incidence of pharmaceuticals and drugs. This work lays the groundwork for studying the behavior of these contaminants and assessing the risks associated with their presence in the aquatic environment.

Abstract - Contribution details

Emerging pollutants are substances whose presence in the environment is generating growing concern due to their potential effects on human health and ecosystems. Their appearance in wastewater from healthcare facilities, such as hospitals, is common. However, there is currently no specific, detailed legislation regulating these discharges, despite their potential environmental impact. Given this situation, it is essential not only to begin regulating their presence in water, but also to design effective strategies for their elimination. These strategies must include studies to identify the actual sources of contamination, as well as the application of advanced technologies to control and eliminate these compounds.

A key element in this process is having reliable information on the concentrations of these contaminants. This requires robust and versatile analytical methodologies. In this context, liquid chromatography-coupled mass spectrometry techniques, such as LC/MS-QQQ and LC/MS-QTOF, are essential due to their ability to detect and quantify contaminants at trace levels. Advances in these techniques have allowed for the identification of a greater number of emerging compounds.

This study focuses on the evaluation of discharges from hospitals in the Community of Madrid, analyzing four main groups of contaminants: hormones, perfluorinated compounds , pharmaceuticals, and drugs of abuse. The aforementioned analytical techniques were used. The results obtained to date confirm the presence of these compounds at all sampling points, with the detection of pharmaceuticals and drugs being particularly notable. This study constitutes a crucial starting point for understanding the behavior of these contaminants in the environment, as well as for assessing their potential risk at the concentrations observed in real samples.

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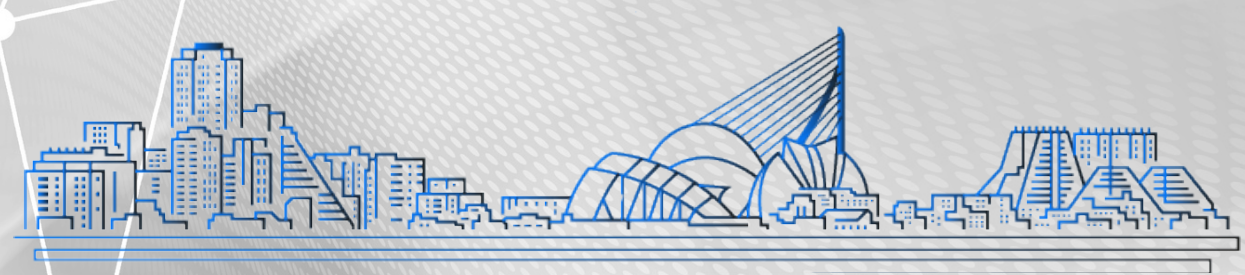

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MACHSENSE project

Abarca, Cristian (1)

(1) SIMETRIA FIDENTIA

Type of abstract: Oral

Subject area: T1.2. Human Health and Environmental Risks Assessment methodologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.2. Human Health and Environmental Risks Assessment methodologies

Brief description of the submission

MACHSENSE makes it possible to correct the deficiencies of current systems by merging two techniques. On the one hand, low -cost sensor technology as a means of estimating emissions from the different sources located in the port area, increasing the spatial resolution of the measurements. On the other hand, Artificial Intelligence and Machine learning techniques make it possible to supplement/complement these measurements with a novel concept, virtual sensorics or soft sensing. In this way, such a system could be used to estimate, given new meteorogical conditions and PM10 particle emission conditions for the same location and time, their possible impacts (inmissions) on other areas.

In summary, the sensors will measure the emissions generated in the port environment and the Artificial Intelligence and/or machine learning technology will estimate the impact on the different surronding areas.

Abstract - Contribution details

Artificial intelligence system for decision making in the control of diffuse particulate matter emissions in port environments

The emission of diffuse particles is a problem associated with most ports where solid bulk is handled, having a significant impact on the health of workers, nearby populations, as well as on the environment and the economy of the port surroundings.

BECSA has been developing and implementing the MACHSENSE project which aims to address this situation through a digital, intuitive, and user-friendly platform that can estimate the impacts of diffuse particles in port environments and predict them 24 hours in advance. This is achieved through two innovative techniques: low-cost sensor technology and Artificial Intelligence, with the aim of improving decision-making and enabling the most appropriate response for each specific situation, leading to a reduction in costs.

The MACHSENSE system operates in several phases. First, a fixed network of sensors is deployed in the port environment to continuously capture particle concentration levels. At the same time, a temporary network of sensors is installed in nearby populated areas to record the environmental impact on the urban surroundings. Based on the collected data (air quality, meteorology and port operations) correlation models are generated using machine learning techniques. These models allow the temporary network to be replaced by a system of virtual sensors, which estimate concentrations in critical areas in real time without the need for additional physical sensors.

The MACHSENSE platform includes two main functionalities. First, a real-time emission estimation system with high resolution. Second, a 24-hour predictive system that allows users to anticipate impact events and plan port operations preventively. Both systems are integrated into a digital interface designed to facilitate quick and effective decision-making, allowing Port Authorities to issue alerts, modify operations or apply corrective measures before impacts occur.

Integrated Methodology for Robust Property Prediction

Zabeo, Alex (1), Carisi, Matteo (1), Rosada, Fabio (1), Pizzol, Lisa (1), Hristozov, Danail (2)

(1) Greendecision, (2) Emerge

Type of abstract: Oral
Subject area: T1.2. Human Health and Environmental Risks Assessment methodologies
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.2. Human Health and Environmental Risks Assessment methodologies
Keywords: Similarity, Grouping, Read Across, MCDA

Brief description of the submission

An innovative methodology for nanomaterial assessment combining similarity analysis, hierarchical grouping, and read-across techniques. Developed for integration into the SunRise e-Infrastructure, it enables reliable property prediction and efficient data exploration to support safe and sustainable nanomaterial development.

Abstract - Contribution details

This presentation outlines a robust methodology for assessing nanomaterials, integrating advanced techniques for similarity analysis, hierarchical grouping, and read-across. Designed to address the complexity of nanomaterial characterization and risk assessment, the approach employs innovative data analysis strategies to support safe and sustainable development.

A novel similarity assessment method is introduced, based on an Asymmetric Sigmoid function. It offers a consistent, dataset-independent way to evaluate resemblance among multi-component nanomaterials (MCNMs), enabling stable groupings even as new materials are added. This method is applicable to MCNMs, mixed materials, and traditional chemicals.

For grouping, the methodology uses hierarchical clustering with an Ordered Weighted Averaging (OWA) similarity matrix. This allows for a nuanced understanding of data relationships, producing more accurate and interpretable groupings.

The read-across component combines Inverse Distance Weighting (IDW), OWA-based similarity, and hierarchical clustering to predict missing properties based on known materials. IDW emphasizes nearby data points, while OWA captures complex molecular similarities, and clustering streamlines group identification.

The approach was applied to a case study on Graphene Oxide within the Potential EU project. Similarity calculations informed grouping, which in turn supported property prediction via read-across. This demonstrated the framework’s effectiveness in generating reliable results with limited data.

All components—similarity assessment, grouping, and read-across—have been implemented in Python and are being integrated into the SunRise e-Infrastructure to enable broader use.

This methodology strengthens data-driven analysis, enhances predictive capabilities, and supports efficient exploration of nanomaterials, contributing to improved safety, sustainability, and regulatory compliance.

Effects of PS nanoplastics on endocrine disruption

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Type of abstract: Any

Subject area: T1.2. Human Health and Environmental Risks Assessment methodologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.2. Human Health and Environmental Risks Assessment methodologies

Keywords: Nanoplastics, endocrine disruptors, alternative methods, health, thyroid

Brief description of the submission

Results are presented from research on the effects of nanoplastics in in vitro and in vivo models (zebrafish), in which a clear endocrine disruption effect is observed, with alterations in both hormonal and genetic profiles and effects on neurodevelopment.

Abstract - Contribution details

The growing global plastic pollution represents an emerging threat to human health. Micro- and nanoplastics (NPs) have been found in food, water, and air. Furthermore, recent evidence of their presence in human tissues highlights the need to assess their potential effects, particularly as endocrine disruptors. This study aimed to elucidate the cellular biokinetics and molecular mechanisms of action of polystyrene NPs as endocrine disruptors in thyroid-derived PCCL3 cells and in the zebrafish embryo (ZFe) model. Their effects on cardiology, morphology, and behaviour were also evaluated. Our results indicate that NPs were rapidly absorbed but only partially eliminated. Cellular localisation was mainly in lysosomes and, to a lesser extent, in the endoplasmic reticulum. Exposure to PSNP rapidly and significantly altered the expression of genes critical for HT metabolism in both thyroid cells and ZFe, with downregulation being the dominant response. In cells, the expression of the HT transporter (MCT8) and iodine transporter (NIS) was also decreased, and NIS function was impaired. In larvae, HT levels decreased and this endocrine disruption caused developmental, cardiac and behavioural abnormalities. Exposure to PSNP caused cellular accumulation and affected HT metabolism at multiple levels, with effects on gene and protein expression, systemic levels and development. Even at low concentrations, this correlated with morphological, cardiac, and behavioural abnormalities in ZF larvae, reinforcing the endocrine-disrupting potential of nanoplastics and highlighting the potential risk to thyroid function and human health.

Microplastics and Risks in Agricultural Soils

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Type of abstract: Poster

Subject area: T1.2. Human Health and Environmental Risks Assessment methodologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.2. Human Health and Environmental Risks Assessment methodologies

Keywords: Circular economy, Soil health, Sewage sludge reuse, Sustainable land management, Plastic toxicity debt

Brief description of the submission

Microplastics have been widely studied in aquatic ecosystems, but agricultural soils are emerging as major and overlooked reservoirs, largely due to the land application of biosolids such as sewage sludge. These inputs often contain high loads of MPs, yet their long-term fate and toxicological effects in soils remain poorly understood. Current toxicity tests are typically short-term and may underestimate subtle, cumulative impacts on soil structure, microbial diversity, nutrient cycling, and plant growth. This mismatch between the persistence of microplastics and conventional testing frameworks poses a serious challenge for risk assessment.

Recent EU policies, including the Sewage Sludge Directive, Landfill of Waste Directive, and the revised Urban Wastewater Directive, stress the need for improved sludge management before agricultural reuse. This study outlines complementary strategies that combine preventive actions with innovative approaches, while advocating for coordinated long-term research and harmonized monitoring to guide future solutions.

Abstract - Contribution details

Microplastics are persistent contaminants of growing concern. While research has focused mainly on aquatic ecosystems, growing evidence shows that terrestrial environments, particularly agricultural soils, are also significant yet overlooked reservoirs. One significant but poorly regulated entry pathway is the land application of biosolids such as sewage sludge, which often contains high concentrations of microplastics and other pollutants. Nevertheless, the long-term fate and toxicological effects of microplastics in soils remain insufficiently understood.

Most toxicity studies rely on short-term assays that may overlook subtle or cumulative impacts on soil structure, microbial communities, nutrient cycling, and plant development. The misalignment between the persistence of microplastics and the design of current testing frameworks hinders accurate risk assessment. Compounding the problem are methodological inconsistencies in detection and the lack of harmonized monitoring protocols for terrestrial systems. Evidence suggests that soil health is more likely compromised through gradual, cumulative changes than through acute effects, while chemical additives and degradation byproducts add additional layers of risk.

EU policies, including the Sewage Sludge Directive (86/278/EEC), the Landfill of Waste Directive 1999/31/EC, and the revised Urban Wastewater Directive (2024/3019), emphasize the need to better regulate sludge use in agriculture and address emerging pollutants such as microplastics. This work presents complementary strategies that combine preventive actions (education, restrictions, separate water systems) with innovative approaches (advanced composting, vermicomposting, physico-chemical treatments) to reduce microplastic loads before land application.

It further advocates for coordinated long-term experiments that capture the persistence and toxicological debt of microplastics, harmonized testing frameworks to improve comparability of results, and the integration of technological innovation into sludge management. By outlining these key points, this study aims to provide a structured perspective to address this emerging risk, safeguard soil ecosystems, and advance the goals of the EU Green Deal and Sustainable Development Goals on soil health and sustainable resource management.

PFAS Risks before and after SOuRCE Solution

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Tipo de comunicación: Poster
Área temática: T1.3. Human exposure to PFAS and micro(nano)plastics
Área temática: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subárea temática: T1.3. Human exposure to PFAS and micro(nano)plastics
Palabras clave: PFAS Groundwater remediation risk assessment

Breve descripción de la propuesta

LIFE SOuRCE is a European project demonstrating sustainable on-site remediation technologies for PFAS-contaminated groundwater. The project evaluates human health and environmental risks before and after intervention at two sites: an industrial/agricultural area in Spain (Human Health Risk Assessment, HHRA) and a Swedish river ecosystem (Environmental Risk Assessment, ERA). In Spain, two exposure scenarios were analysed: industrial workers exposed to PFAS-contaminated water during cleaning (ingestion and dermal contact), and farmers/consumers exposed during crop irrigation and via ingestion of PFAS-contaminated crops (lettuce), respectively. Baseline data showed toxic and carcinogenic risks in all scenarios. After implementing SOuRCE solutions, human health risks were reduced by 74–77%. Relative Potency Factors were effective for initial toxic risk estimation. In Sweden, baseline ERA indicated most PFAS were within safe limits for aquatic life, though PFOS and PFOA posed localized risks. Overall, LIFE SOuRCE solutions significantly reduced PFAS risks to both humans and the environment.

Resumen

LIFE SOuRCE is a European project focusing on the demonstration and evaluation of sustainable on-site remediation technologies for per- and polyfluoroalkyl substances (PFAS)-contaminated groundwater. This study aims to evaluate the human health and environmental risks associated with PFAS in groundwater before and after the implementation of the LIFE SOuRCE solutions. Two sites with different risk profiles are analysed, 1) an industrial and agricultural area in Spain for Human Health Risk Assessment (HHRA) and 2) a Swedish river ecosystem for Environmental Risk Assessment (ERA).

For HHRA, two exposure scenarios were evaluated at the Spanish site. Scenario 1 examines industrial workers exposed to PFAS-contaminated water during cleaning tasks, evaluating ingestion and dermal contact. Scenario 2 considers two potential receptors: (a) farmers using groundwater for crop irrigation and (b) consumers potentially ingesting PFAS through these contaminated crops. Lettuce was selected as the test crop. Exposure pathways considered include ingestion and dermal contact for farmers, and ingestion for consumers (adults and children) through PFAS transferred to crops.

Baseline data, collected before the LIFE SOuRCE solution, found toxic risk for all considered scenarios due to the presence of several PFAS compounds. Carcinogenic risk was also detected in scenarios 1 and 2. LIFE SOuRCE solution implementation showed strong reduction rates in overall human health risk, ranging from 74% to 77% reduction. The use of Relative Potency Factors has proven effective as a first approximation of toxic risk in cases where toxicological parameters have not yet been widely accepted.

For ERA, PFAS risk to the Swedish river ecosystem and fish populations was assessed, establishing a baseline Toxicity Unit (TU) risk prior to the LIFE SOuRCE solution. Results showed most PFAS within acceptable levels (TU ≤ 1); however, PFOS and PFOA concentrations at certain points suggest possible risk to aquatic organisms.

Microplastics in Bivalve Mollusks

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Type of abstract: Poster

Subject area: T1.3. Human exposure to PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.3. Human exposure to PFAS and micro(nano)plastics

Keywords: Microplastics: bivalve molluscs

Brief description of the submission

Microplastics (MPs), plastic particles smaller than 5 mm, are a growing concern in marine ecosystems and food safety. Bivalve mollusks, due to their filter-feeding nature, are particularly susceptible to MP contamination and serve as indicators of environmental pollution. This preliminary study assessed MP presence in bivalves sold in the Valencian Community. A total of 48 samples from seven species were analyzed using KOH digestion and microscopic examination. MPs were found in 33% of the samples, with an average of 4.4 particles per individual. Contaminated species included Donax trunculus, Mytilus galloprovincialis, and others. No significant differences were observed based on production method or origin, possibly due to the limited sample size. While immediate health risks appear low, concerns remain about long-term effects such as antibiotic resistance. The findings highlight the need for continued monitoring, expanded sampling, and standardized methods to better understand consumer exposure and potential health implications.

Abstract - Contribution details

Microplastics (MPs), defined as plastic particles smaller than 5 mm, are an emerging environmental and food safety concern, particularly in marine ecosystems. Bivalve mollusks, due to their filter-feeding behavior, are especially vulnerable to microplastic contamination and serve as effective bioindicators. Human consumption of contaminated bivalves is a key route of exposure to MPs. This preliminary study aimed to assess the presence of microplastics in bivalves sold in the Valencian Community to monitor consumer exposure trends.

A total of 48 samples from seven bivalve species were analyzed, sourced from aquaculture and wild fisheries across nine FAO production zones. Microplastics were extracted using KOH digestion, vacuum filtration, and microscopic analysis. MPs were detected in 33% of the samples, with an average of 4.4 particles per individual and a standard deviation of 11.1, indicating high variability. Contaminated species included Donax trunculus, Mytilus galloprovincialis, Argopecten purpuratus, Meretrix lyrata, and Ruditapes decussatus.

No statistically significant differences were found based on production method or geographic origin, possibly due to the limited sample size. Although the direct toxicological risk from consuming MPs in bivalves appears low, concerns remain regarding long-term effects, such as the promotion of antibiotic resistance. This study highlights the need for continued monitoring, expanded sampling, and standardized methodologies to better understand the implications of microplastic ingestion through seafood. Future research should also explore potential health impacts and environmental factors influencing contamination levels.

HDPE and PET MPs as Vectors of Microbial Pathogens

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Type of abstract: Any

Subject area: T1.3. Human exposure to PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.3. Human exposure to PFAS and micro(nano)plastics

Keywords: microplastics, gastrointestinal, safety, pathogen, barrier

Brief description of the submission

Plastic waste is increasing annually, raising health concerns due to contamination and microplastic (MP) exposure. This study examined the potential toxicity of 5 µm HDPE and 130 µm PET with and without Vibrio parahaemolyticus biofilm on human gastrointestinal cells. Using Caco-2, differentiated Caco-2 (dCaco-2), and triculture models, cells were exposed for 24 hours to 1–100 µg/mL of MPs. Cell viability, inflammation, and barrier integrity were assessed. Microscopy confirmed that V. parahaemolyticus successfully colonized MP surfaces. HDPE+V was significantly cytotoxic to Caco-2 cells, and IL-8 release was elevated in these cells but not in other models. Exposure increased barrier integrity in dCaco-2 and triculture models, suggesting a protective cellular response. Overall, HDPE and PET MPs can carry pathogens like V. parahaemolyticus and pose risks to human gut health. This study was supported by the EU H2020 PlasticsFatE project (Grant No. 965367).

Abstract - Contribution details

Plastic waste is growing each year, intensifying contamination issues that impact the health of humans and other organisms, and raising concerns about potential risks posed by these materials. Microplastics (MPs) can act as vectors for microorganisms like Vibrio parahaemolyticus, a pathogenic species. In this work, we assessed the potential toxicity of 5µm HDPE and 130µm PET MPs with and without V. parahaemolyticus biofilm (HDPE, PET, HDPE+V and PET+V) to the human gastrointestinal tract. Caco2 cells, differentiated Caco2 (dCaco2) cells and dCaco2/HT29MTX/M cells triculture were exposed for 24h to 1-100 µg/mL of these MPs and after that, effects on cell viability, inflammation and barrier permeability and integrity were examined. Scanning Electron Microscopy (SEM) and Confocal Laser Scanning Microscopy analyses were used to characterize the colonization and viability of V. parahaemolyticus on the surface of MPs. Results of SEM analysis showed that after 10 days of incubation, V. parahaemolyticus was able to colonise the surface of MPs, indicating the suitability of these plastics to carry bacteria. In vitro exposures indicated significant cytotoxicity of HDPE+V only for Caco2. A significant induction of IL8 release was observed in Caco2 cells exposed to all samples. Interestingly, this effect was not observed in dCaco2 and triculture models. Barrier integrity of dCaco2 and triculture increased significantly after the exposure of 10 and 100 µg/mL of MPs alone and with biofilm, suggesting a compensatory mechanism of the cells to reduce cellular damage. Overall, results indicated that HDPE and PET MPs may act as carriers for V. parahaemolyticus and induce notable damage in the human gut. This work was supported by the EU H2020 Project "Plastics Fate and Effects in the human body" (PlasticsFatE) under Grant Agreement no. 965367. The authors also thank Frank Milczewski (BAM) for cryo milling.

From Sea to Safe: Cold Microfiltration Power

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Type of abstract: Oral
Subject area: T1.3. Human exposure to PFAS and micro(nano)plastics
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.3. Human exposure to PFAS and micro(nano)plastics
Keywords: Nasal irrigation, microplastics, seawater, microfiltration

Brief description of the submission

The marine environment offers valuable bioactive compounds with medical and biotechnological potential. Marine therapy, inspired by René Quinton's view of the ocean as a life-supporting matrix, utilizes seawater to enhance physical and mental well-being. Nasal irrigation with seawater is a common practice shown to improve respiratory health by clearing allergens, bacteria, and pollutants. However, seawater is increasingly contaminated by microplastics—particles under 5 mm—which raise health concerns, including inflammation, neurotoxicity, and carcinogenicity. Alarmingly, some nasal irrigation products may introduce microplastics themselves. This study validated a double cold microfiltration method to reduce microplastic content in seawater for therapeutic use. Seawater was sourced from phytoplankton-rich high seas with minimal human impact and processed through two filtration stages. Analytical results showed an initial presence of PET, PS, and PVC, which decreased by approximately 90% post-treatment. These results support cold microfiltration as an effective method for producing cleaner seawater, enhancing the safety and viability of marine-based therapies.

Abstract - Contribution details

The marine environment is a unique source of bioactive compounds with promising medical, industrial, and biotechnological applications. As proposed by René Quinton, the ocean—a matrix of life—may significantly promote health and well-being due to its composition of nearly all naturally occurring elements [1-2]. Marine therapy, therefore, uses marine resources to support health. Its benefits are supported by a growing body of evidence demonstrating improvements in health outcomes and quality of life [2–4]. Among others, the use of seawater for nasal irrigation to effectively removes bacteria, allergens, pollutants, and excess mucus from the nasal cavity.

However, like all natural resources, seawater is increasingly exposed to anthropogenic contamination. Microplastics pose particular concern due to their ubiquity and potential toxicity. Recent findings indicate that nasal irrigation products may themselves be sources of microplastics, contributing to oxidative stress, inflammation, neurotoxicity, and even carcinogenic effects after long-term exposure [5].

This study aimed to validate a double cold-microfiltration method to reduce microplastic content in seawater for therapeutic use. Seawater was collected from phytoplankton bloom zones in high seas, selected for their low levels of anthropogenic pollutants. The water underwent a two-step cold microfiltration process to decrease microbial load and eliminate microplastics.

Both raw and filtered seawater were analyzed for multiple parameters, including the presence of key plastic polymers. Initial samples showed relatively high levels of PET, PS, and PVC, which were reduced by approximately 90%, reaching the LOQ. These findings suggest that the double cold-microfiltration method is highly effective in minimizing microplastic contamination in seawater, ensuring safer use and supporting the continued development of marine-based therapeutic applications.

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Microplastics and additives emission in agroecosystem

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Type of abstract: Oral

Subject area: T1.3. Human exposure to PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.3. Human exposure to PFAS and micro(nano)plastics

Keywords: Microplastics, additives, agricultural soils, emissions, release

Brief description of the submission

Contamination of agroecosystems by microplastics (MPs) and plastic additives (PAs) is an increasing environmental concern. This study identifies and quantifies the main sources of MPs and PAs, distinguishing between intentional and unintentional emissions, and analysing the predominant entry pathways to the agroecosystems. The results provide an estimation of the annual amount of MPs and PAs generated and released into agricultural soils from the identified sources at regional, national, and European scale. These results will contribute to establish strategies aimed at mitigating plastic contamination in agricultural soils.

Abstract - Contribution details

In 2023, global plastic production reached approximately 507 million tons (MT) and 37 MT were plastic additives (PAs). When plastics are exposed to environmental factors, they go through degradation and fragmentation into particles <5 mm, known as microplastics (MPs). During this degradation process, PAs are released. In agroecosystems, key sources of these contaminants include: (i) the use of sewage sludge as an organic amendment, (ii) irrigation with treated wastewater, and (iii) the use of plastic materials such as mulching films. Notably, the textile industry contributes to the generation of microfibers, while the agricultural sector emits microparticles, making them the major contributors to the release of MPs and PAs into agroecosystems.

In the textile industry, emissions occur during material production, garment washing, and end-of-life waste management, and indirectly through sewage sludge and treated wastewater. In 2018, Spain was the European country with the highest application rate of sewage sludge (1.1 MT), resulting in the introduction of approximately 4,737.15 tons of MPs. Andalusia, Catalonia, Madrid, and Valencian Community account for 60% of these emissions. The use of treated wastewater in agriculture put around 6.49 tons of MPs in soils annually in Spain, with Murcia, Catalonia, and Valencian Community responsible for 84% of these emissions. Emissions from the use of plastic mulch are primarily due to its low recovery rate (15%). In 2023, global emissions from plastic mulching films were estimated at approximately 0.94 million tons, with 0.15 million tons in Europe. In Spain, emissions are estimated to range between 1,587.96 and 22,055.02 tons of MPs, mainly concentrated in Andalusia, Murcia, Castilla-La Mancha, and Valencian Community, which together account for 87% of total emissions. Approximately 7% of the weight of MPs consists of PAs. The magnitude of these estimates highlights the urgent need to reduce MP and PA pollution in agroecosystems.

Environmental Plastics Affect β-hCG and SDC1

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Type of abstract: Any

Subject area: T1.3. Human exposure to PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.3. Human exposure to PFAS and micro(nano)plastics

Keywords: Microplastics; Placenta; Trophoblast cells; Syncytium formation; β-hCG and Syndecan-1

Brief description of the submission

This study investigates the impact of environmentally relevant microplastics on placental function. Human trophoblast stem cells were differentiated into syncytiotrophoblast-like cells and exposed to polyethylene terephthalate (PET) and polystyrene (PS) particles at three different concentrations for up to six days in vitro. Although no cytotoxic effects were observed, high doses of PET microplastics impaired syncytium formation. Both PET and PS were found to alter the expression of genes that are key to placental endocrine function and cell fusion, such as β-hCG and syndecan-1. This suggests that there are sub-lethal effects that are still biologically significant. These results suggest that microplastics could interfere with placental development and function even without causing cell death, which could have implications for maternal and fetal health. This study highlights the need for further research into the effects of microplastic exposure during pregnancy, including the use of more complex in vitro and in vivo models.

Abstract - Contribution details

Background: Micro- and nanoplastics (MNPs), defined as plastic particles smaller than 5 mm, are pervasive environmental contaminants increasingly detected in human tissues. Their potential effects during pregnancy are of particular concern, as the placenta serves as a critical interface between maternal and fetal environments. This study aimed to evaluate the impact of environmentally relevant MNPs—specifically polyethylene terephthalate (PET) and polystyrene (PS)—on the viability and gene expression of human syncytiotrophoblast-like (SynT) cells in vitro.

Methods: Human trophoblast stem cells were differentiated into SynT cells, which were then exposed to PET and PS microplastic particles at concentrations of 10, 50, and 100 µg/ml for 3 and 6 days. Microplastics were prepared from environmental debris and provided by Prof. Flemming Cassee (RIVM, The Netherlands). Cell viability assays were conducted, and syncytium formation was assessed morphologically. Expression levels of chorionic gonadotropin beta subunit (CGB, encoding β-hCG) and syndecan-1 (SDC1), markers of syncytial function and differentiation, were also evaluated.

Results: Exposure to PET and PS did not significantly reduce cell viability at any concentration or time point. However, PET at 100 µg/ml disrupted syncytium formation, as shown by reduced cell fusion and altered morphology—an effect not observed with PS. Both PET and PS also modulated CGB and SDC1 expression after six days of exposure. Notably, SDC1 was downregulated in PET-treated cells, suggesting impairment of cell fusion and endocrine function.

Conclusion: These findings indicate that environmental microplastics, especially PET, can interfere with the differentiation and function of placental trophoblast cells in the absence of cytotoxicity. Sub-lethal disruptions to syncytium formation and hormone gene expression may have implications for placental development and pregnancy maintenance. Further investigation is needed using more complex in vitro models and in vivo systems to assess potential reproductive risks.

Neurotoxicity of PFAS in SH-SY5Y in vitro models

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Type of abstract: Poster

Subject area: T1.3. Human exposure to PFAS and micro(nano)plastics

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.3. Human exposure to PFAS and micro(nano)plastics

Keywords: PFAS, neurotoxicity, neurodegenerative diseases, SH-SY5Y cell line, in vitro models

Brief description of the submission

This study investigates the neurotoxic potential of PFAS using SH-SY5Y neuronal cells cultured in 2D, 3D, and dynamic 3D (3DDynamic) *in vitro* models. The aim is to determine whether prolonged sublethal exposure induces cytotoxicity and disrupts cellular mechanisms associated with neurodegenerative diseases. The work is carried out within the European DESIDERATA project, which promotes the Safe and Sustainable by Design (SSbD) Framework and supports the development of safer alternatives to harmful substances in industrial applications. By assessing PFAS neurotoxicity across increasing levels of biological complexity, this study contributes to a better understanding of these persistent contaminants and provides a toxicological basis for comparative safety evaluations. The findings will support risk assessment and guide future substitution strategies aligned with environmental and human health protection.

Abstract - Contribution details

Per- and polyfluoroalkyl substances (PFAS) are synthetic compounds widely used in industry due to their chemical resistance, thermal stability, and non-stick properties. However, their environmental persistence and bioaccumulation potential have raised significant concerns about their adverse effects on human health.

PFAS exposure has been linked to alterations in the endocrine, immune, and metabolic systems, as well as to the development of certain types of cancer. Despite this, their neurotoxic effects remain largely underexplored [1]. In this context, our study aims to assess the neurotoxic potential of PFAS using in vitro neuronal models based on the SH-SY5Y cell line, a widely used model for neurotoxicity studies and representative of neurodegenerative diseases.

To this end, exposure experiments are being carried out in 2D, 3D, and 3D dynamic (3DDynamic) culture systems, enabling the evaluation of PFAS effects across different levels of structural and functional complexity. The primary objective is to determine whether prolonged sublethal exposure to PFAS induces cytotoxicity and disrupts key cellular mechanisms associated with neurodegenerative pathologies.

This research is being conducted within the framework of the European DESIDERATA project, which focuses on developing safer alternatives to substances of concern such as surfactants, plasticisers, and flame retardants across diverse sectors of the chemical and materials industries. By characterizing the neurotoxic effects of PFAS, this study provides a toxicological baseline to support the comparative safety assessment of potential substitute substances.

This study enhances understanding of PFAS neurotoxicity and supports risk assessment and safer substitution strategies.

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UFP & MNP mechanisms on fetal health (UPRISE)

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Type of abstract: Poster
Subject area: T1.3. Human exposure to PFAS and micro(nano)plastics
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.3. Human exposure to PFAS and micro(nano)plastics
Keywords: Ultrafine particles; Micro- and nanoplastics; Fetal development; Prenatal exposure; Environmental health;

Brief description of the submission

The UPRISE project explores how exposure to ultrafine particles (UFPs) and micro- and nanoplastics (MNPs) may influence fetal development and contribute to adverse birth outcomes linked to non-communicable diseases later in life. The project integrates environmental exposure modelling, a clinical cohort study involving pregnant volunteers, and in vitro placental models to identify the biological mechanisms connecting pollutant exposure with developmental effects. By combining data-driven analysis with mechanistic research, UPRISE aims to improve understanding of prenatal vulnerability to airborne contaminants and support the design of effective European health and air-quality policies that mitigate early-life risks and reduce the long-term disease burden.

Abstract - Contribution details

The UPRISE project investigates the impact of ultrafine particles (UFPs) and micro- and nanoplastics (MNPs) on fetal health, addressing an emerging environmental and public health concern. Increasing evidence links maternal exposure to airborne pollutants with adverse birth outcomes such as preterm birth, low birth weight, and small-for-gestational-age infants, potentially predisposing to non-communicable diseases later in life.

UPRISE adopts a multidisciplinary approach that integrates environmental exposure modelling, clinical cohort studies, and mechanistic in vitro investigations. Exposure databases and predictive models are being developed to quantify maternal exposure to UFPs and MNPs across diverse European environments. In parallel, biological samples from pregnant volunteers (maternal and cord blood, urine, and placenta) are analysed to determine internal exposure, biological response, and links with fetal growth indicators. Complementary in vitro and ex vivo models of the lung–placenta barrier are employed to study particle uptake, translocation, and molecular toxicity, identifying pathways of oxidative stress, inflammation, and endocrine disruption.

By bridging large-scale exposure data with mechanistic toxicology, UPRISE aims to establish causal links between environmental pollution and developmental health outcomes. The project's results will provide evidence-based recommendations to guide European air-quality and health policies, with the ultimate goal of reducing prenatal exposure risks and protecting early-life health.

Scalable Microplastic Capture in WWTP Processes

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Type of abstract: Oral
Subject area: T1.4. Treatment and removal technologies
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.4. Treatment and removal technologies

Brief description of the submission

Microplastics pose a growing challenge for wastewater treatment plants, particularly due to their persistence in sludge and discharge into the environment. This contribution presents a scalable capture technology designed for integration between pretreatment and primary treatment stages in WWTPs. The system allows for early interception of microplastics, preventing their accumulation in sludge and reducing their concentration in the treated effluent. Its modular design enables adaptation to different plant configurations and flow rates. The technology supports compliance with current and future environmental legislation, including Spain's Royal Decree 1051/2022 on sludge reuse. The system is easy to implement and designed for continuous operation, representing a proactive approach to microplastic reduction at the source.

Abstract - Contribution details

Microplastics are a persistent contaminant in wastewater, accumulating in sludge or being discharged into the environment. Monitoring is now required under the Urban Wastewater Treatment Directive (2024/3019), especially in sludge intended for agricultural reuse, though removal is not yet mandated.

This contribution presents a scalable microplastic capture technology for installation between pretreatment and primary treatment in WWTPs. Early interception reduces microplastics in sludge and effluent. The modular system adapts to various plant sizes and is suitable for municipal and industrial applications. Developed as a zero-waste solution, it features a reusable captor, and captured microplastics can be valorised, contributing to circular economy strategies. It operates continuously with low maintenance and offers a practical, cost-effective approach for improving environmental outcomes and anticipating future regulations.

Capturing microplastics early improves sludge quality and limits emissions into natural water bodies. This proactive strategy supports SDG 6 (Clean Water and Sanitation) by promoting better wastewater management and cleaner effluents.

Although current legislation focuses on quantification, this technology enables WWTPs to move beyond compliance, providing an innovative, field-ready solution for microplastic mitigation and resource recovery. Pilot-scale validation is underway, with full-scale implementation expected in 2025.

A microplastic removal filter based on biomimetics

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Type of abstract: Any
Subject area: T1.4. Treatment and removal technologies
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.4. Treatment and removal technologies
Keywords: biomimetics, water treatment, filter, CFD optimization

Brief description of the submission

Microplastic pollution is a widespread problem affecting atmospheric, terrestrial and aquatic systems. The REMOURE project addresses the issue of microplastics in wastewater systems by defining a new, low-cost, biomimetic filter that optimises the removal of particles efficiency while minimising maintenance and energy costs.

Abstract - Contribution details

Microplastics are plastic particles less than 5 mm in size that are emitted at source or result from the degradation of larger objects. Today, microplastic pollution affects aquatic, terrestrial and atmospheric systems and reflects a global challenge that requires cooperation between governments, industry and citizens to implement effective solutions. Solid-liquid filtration is widely used in both industrial and biological systems, where some aquatic species are studied using very specialized filterfeeding apparatus, and when applied to industrial processes, it can separate microparticles from water while minimizing maintenance costs by reducing the need for backwashing or additional energy consumption. The REMOURE project uses the Mediterranean species Mobula mobular (Bonnaterre, 1788) as a reference to test and optimize low-cost microplastic filters applied to wastewater. The design and optimization of the filter was previously presented in Blanco-Gomez et al. (2025) using a dye injection test on a hydrodynamic test rig for a scaled model to calibrate and validate a CFD model used to optimize the microplastic filter piece. The aim of the present communication is to describe the design of a prototype wastewater treatment plant for the removal of microplastics and the results of its testing with both microplastic-polluted water and real wastewater samples under different filter designs.

Blanco-Gomez et al. (2025), https://doi.org/10.3390/su17010170.

Cost Benefit and Feasibility of PFAS Remediation

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Type of abstract: Oral

Subject area: T1.4. Treatment and removal technologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.4. Treatment and removal technologies

Keywords: PFAS, Cost-Benefit Analysis, Environmental Remediation, Soil and Water Treatment, Surface Active Foam Fractionation Technology, Cold Plasma Technology, Policy recommendations

Brief description of the submission

Per- and polyfluoroalkyl substances (PFAS) pose growing environmental and health risks due to their persistence, toxicity, and widespread occurrence across Europe. This study, developed within the EU-funded SCENARIOS project, evaluates the cost-benefit and feasibility of two innovative PFAS remediation technologies: Surface Active Foam Fractionation (SAFF) for separation and Cold Atmospheric Plasma (CAP) for destruction. By integrating geospatial data, health impact modelling, and cost analysis, the study identifies optimal deployment strategies and quantifies economic and public health benefits. Results show that remediation benefits significantly exceed costs, especially in densely populated or high-exposure areas. The presentation will highlight synergies with existing infrastructure, co-treatment potential at wastewater treatment plants, and a prioritisation framework for selecting future remediation sites. The findings aim to support evidence-based policymaking and promote scalable, effective PFAS mitigation across the EU.

Abstract - Contribution details

Per- and polyfluoroalkyl substances (PFAS) are considered a critical issue at both local and global levels due to their persistent, bio-accumulative, mobile, and toxic nature (Drenning et al., 2023). While awareness of PFAS risks has increased, effective and scalable remediation solutions remain limited, especially in the face of widespread contamination and regulatory fragmentation across Europe (Garg et al., 2021).

The present work evaluates the cost-benefit ratio and environmental feasibility across Europe of two innovative remediation technologies: Surface Active Foam Fractionation (SAFF), for PFAS separation; and Cold Atmospheric Plasma (CAP), for PFAS destruction. The analysis monetises the avoided health risks from reduced PFAS exposure, integrating contamination data, population-level exposure, and health impact coefficients.

Technology deployment costs were calculated based on installation and operational data provided by technology developers. Spatial analysis (QGIS) was used to identify synergies in co-treatment potential at wastewater treatment plants (WWTPs) within 10 km of known PFAS-contaminated sites, using the PFAS Data Hub Dataset (PDHD).

Results show that in all case studies, the benefits of remediation outweigh the costs—particularly in densely populated or high-exposure areas. Drinking water and soil treatment were found to be complementary, and shared infrastructure emerged as a cost-efficient strategy. When extrapolated to the European scale, annual benefits from PFAS remediation are estimated at €21 billion (range: €19–300 billion), surpassing associated costs by at least a factor of two.

A prioritisation framework is proposed to support future site selection based on exposure risk and urgency. These findings underline the potential of SCENARIOS technologies to deliver large-scale health and environmental benefits and to inform evidence-based policy development across the EU.

Acknowledgements: This work was developed within the SCENARIOS project (GA No. 101037509), funded by the European Union’s Horizon 2020 research and innovation programme.

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Drenning, P., Volchko, Y., Ahrens, L., Rosén, L., Söderqvist, T., & Norrman, J. (2023). Comparison of PFAS soil remediation alternatives at a civilian airport using cost-benefit analysis. Science of The Total Environment, 882, 163664. https://doi.org/10.1016/j.scitotenv.2023.163664

Garg, S., Wang, J., Kumar, P., Mishra, V., Arafat, H., Sharma, R. S., & Dumée, L. F. (2021). Remediation of water from per-/poly-fluoroalkyl substances (PFAS) – Challenges and perspectives. Journal of Environmental Chemical Engineering, 9(4), Article 4. https://doi.org/10.1016/j.jece.2021.105784

Degradation of microplastics by electrochemical

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Type of abstract: Poster

Subject area: T1.4. Treatment and removal technologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.4. Treatment and removal technologies

Keywords: Microplastics, Polystyrene, Polyvinyl chloride, Ceramic Anodes, Advanced Oxidation Processes.

Brief description of the submission

This study compares the efficiency of electrochemical and photoelectrochemical oxidation processes for the degradation of polystyrene (PS) and polyvinyl chloride (PVC) microplastics using two types of anode materials: boron-doped diamond (BDD) and an antimony doped tin oxide (Sb-doped SnO2) ceramic anode coated with a photocatalytic layer of cadmium ferrite ($CdFe_2O_4$). The results revealed a significantly higher PS degradation than PVC, particularly under photoelectrochemical conditions. The photoactive ceramic electrode exhibited a performance comparable to BDD at low and intermediate current densities, offering a cost-effective and sustainable alternative. Morphological and structural transformations were monitored by field-emission scanning electron microscopy (FESEM) and Raman spectroscopy, while the mineralization of the polymers into simpler compounds was evaluated by total organic carbon (TOC) analysis.

Abstract - Contribution details

A synthetic suspension of microplastics (100 ppm) with known particle sizes (ranging from 25 to 200 µm) was subjected to electrochemical and photoelectrochemical oxidation treatments to investigate the degradation behavior of two widely used and environmentally prevalent polymers: polystyrene (PS) and polyvinyl chloride (PVC). The study evaluates and compares the performance of a commercial boron-doped diamond (BDD) anode and a novel low-cost ceramic anode based on antimony-doped tin oxide (Sb-doped SnO2) coated with a photoactive $CdFe_2O_4$ layer. Degradation experiments were carried out under dark and visible-light conditions using galvanostatic electrolysis at different current intensities for up to 6 hours. The results revealed that PS exhibited higher degradation rates (>96%) than PVC under all tested conditions, both electrochemically and photoelectrochemically. In the case of PS, the degradation kinetics was fitted using the modified Chamas model with a Monod-type saturation term, where the reaction rate parameter was slightly higher for the BDD electrode; however, comparable values were obtained for the ceramic photoanode under illumination. FESEM and Raman spectroscopy analyses revealed substantial morphological and chemical transformations in both microplastics, including surface fracturing, pore formation, and loss of crystallinity. Nevertheless, PVC showed greater resistance to degradation, likely due to its halogenated backbone, higher thermal stability, and hydrophobicity. Partial oxidation and surface damage of PVC particles were observed, particularly under photoelectrochemical conditions at intermediate and high current intensities. The specific energy consumption (SEC) of the ceramic anode was comparable to that of BDD at moderate current densities, indicating its potential for cost-effective applications. This study underscores the critical influence of polymer structure and electrode material on microplastic degradation performance and supports the use of visible-light-activated ceramic photoanodes as sustainable alternatives to expensive BDD electrodes in wastewater treatment technologies.

BMRex- Membranes to capture and degrade microplastics

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Type of abstract: Poster

Subject area: T1.4. Treatment and removal technologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.4. Treatment and removal technologies

Keywords: Microplastics, analytics, removal,

Brief description of the submission

The BMRex project addresses the rising threat of microplastic (MP) pollution, particularly from wastewater treatment plants, by developing biocatalytic membranes that capture and degrade MPs in water, including urban wastewater. These membranes also feature antifouling properties to prevent biofilm formation and enable real-world use. The system will be tested with actual wastewater samples, supported by a new analytical method for MP quantification. This includes identifying key treatment points for membrane placement and assessing its MP removal efficiency. The methodology uses hydrogen peroxide and enzymes for pre-treatment, followed by filtration and optical microscopy, with computer vision in development to automate particle counting. By 2027, BMRex aims to deliver a validated, low-cost MP detection method and an effective, deployable membrane system. The project is funded by the EU's Horizon Europe programme and UKRI.

Abstract - Contribution details

Microplastic (MP) pollution poses a growing threat to both environmental and human health. One of the main pathways for MPs entering the environment is the discharge from wastewater treatment plants (WWTPs) (Xu et al., 2023; Simon et al., 2018), driven by the widespread use of plastic materials.

The BMRex project proposes an innovative approach to mitigate this issue through the development of biocatalytic membranes designed to capture and degrade MPs from various water streams, including urban wastewater. In addition, the membrane functionality includes antifouling properties to inhibit biofilm formation and allow the real life deployment of the whole system.

The membrane system will be tested using real wastewater samples to assess its operational efficiency. To support this, an analytical methodology for MP quantification is being developed, focusing on: i) identifying key points in the wastewater treatment process suitable for membrane implementation; and ii) evaluating membrane performance in reducing MP levels. Method optimization includes pre-treatment steps to remove organic matter via hydrogen peroxide oxidation and to eliminate cellulose through enzymatic degradation. MPs are then analyzed through sequential filtration for size separation, followed by particle counting using optical microscopy. A complementary computer vision approach is under development to automate and accelerate the counting process.

By project completion in 2027, BMRex will deliver key outcomes including: a validated, low-cost, and robust methodology for MP quantification in complex matrices such as raw wastewater, and a novel, effective membrane solution for MP removal from water systems.

This project has received funding from the European Union´s Horizon Europe EIC Pathfinder Open programme under Gran Agreement N. 101099528 (BMRex). This work is supported by UK Innovation funding agency (UKRI) under Grant Agreement N. 10062709.

EOC-Functionalized Filtering Beds For ARB Removal

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Type of abstract: Poster

Subject area: T1.4. Treatment and removal technologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.4. Treatment and removal technologies

Keywords: antibiotic-resistant bacteria, essential oils, silica microparticles, hospital wastewater

Brief description of the submission

Antimicrobial resistance (AMR) poses a critical threat to global health, with hospital wastewater (HWW) acting as a key reservoir for the dissemination of antibiotic-resistant bacteria (ARB) and resistance genes (ARG). This dissemination is often exacerbated by inadequate wastewater treatment. This study explored the potential of essential oil components (EOCs) with antimicrobial properties as a natural solution. Silica microparticles functionalised with EOCs were tested as a filtration bed for eliminating multi-resistant bacteria (MRB) introduced into sterile HWW. First, ARB were isolated from real HWW and antibiotic susceptibility testing (AST) using β-lactam antibiotics was used to identify MRB strains. Subsequently, the minimum inhibitory (MIC) and bactericidal (MBC) concentrations of several EOCs were determined for clinically relevant isolates. Cinnamaldehyde exhibited the strongest antimicrobial activity, justifying its selection for the silica functionalization step.

Abstract - Contribution details

Antimicrobial resistance (AMR) has been identified as a major threat to global health. It has been established that hospital wastewater (HWW) is a significant reservoir for the dissemination of antibiotic-resistant bacteria (ARB), functioning as both a source and a conduit for their dispersal into the environment. A significant challenge is posed by the rapid dissemination of resistance genes (ARG) between pathogenic and environmental bacteria, a process that is predominantly driven by the inadequate treatment of contaminated wastewater. In response to the pressing need for novel control strategies, essential oil components (EOCs) with intrinsic antimicrobial properties are garnering attention as a promising natural alternative. In this study, silica microparticles functionalized with essential oil components (EOCs) were evaluated as filtration beds for the removal of multi-resistant bacteria (MRB) artificially introduced into sterile HWW. In the preliminary phase, antibiotic-resistant bacteria (ARB) were isolated from real HWW, and antibiotic susceptibility testing (AST) using β-lactam antibiotics was conducted to identify MRB. In the second phase, the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of various EOCs were determined against clinically relevant isolates. Among the compounds tested, cinnamaldehyde demonstrated the highest antimicrobial activity, supporting its use in the functionalization of SiO_2 microparticles. Additionally, two functionalization strategies were evaluated to optimize particle synthesis: one based on the Mannich reaction, and another involving the formation of an imine bond followed by its stabilization by its reduction to amine with borohydride. The filtration of HWW inoculated with MRB through the prepared antimicrobial beds showed high efficacy in reducing these bacterial populations, demonstrating their potential as a strategy for treating such complex effluents.

Acknowledgements: This research was funded by the Conselleria de Innovación, Universidades, Ciencia y Sociedad Digital, Spain, with grant number ciprom2021-053, and the Valencian Agency for Innovation through the project INNEST/2023/40.

Green Extractants for PFAS Removal

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Tipo de comunicación: Oral

Área temática: T1.4. Treatment and removal technologies

Área temática: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subárea temática: T1.4. Treatment and removal technologies

Palabras clave: PFAS remediation; Natural deep eutectic solvents; Computational chemistry; Sustainable extraction; Process optimization

Breve descripción de la propuesta

This research addresses the critical challenge of removing PFAS (forever chemicals) from contaminated water using an innovative green chemistry approach. Natural deep eutectic solvents (NADES) were considered through computational design, combining multiscale simulations with experimental validation to create sustainable extractants from bio-based materials. The integrated methodology screened potential NADES formulations using density functional theory calculations, identifying optimal combinations of natural hydrogen bond donors and acceptors. Laboratory validation confirmed computational predictions, achieving over 99% removal efficiency for key PFAS compounds including PFOA and PFOS. The study demonstrates that computationally-designed NADES offer superior performance compared to conventional solvents while maintaining biodegradability and low environmental impact. Techno-economic analysis reveals promising cost projections for large-scale water treatment applications. This work establishes a robust framework for developing targeted green solvents for emerging contaminant remediation, combining computational chemistry with sustainable engineering principles to address one of today's most pressing environmental challenges.

Resumen

Per- and polyfluoroalkyl substances (PFAS) represent one of the most persistent environmental contaminants, earning the designation "forever chemicals" due to their exceptional stability and bioaccumulation potential. Conventional water treatment technologies demonstrate limited efficacy in PFAS removal, necessitating the development of innovative remediation strategies. This study presents a comprehensive approach combining computational design with experimental validation to develop natural deep eutectic solvents (NADES) as sustainable extractants for PFAS removal from polluted waters.

The research employed molecular multiscale in silico methods to screen potential NADES formulations based on hydrogen bond acceptors and donors derived from natural sources. Key interaction parameters, including binding energies, solubility parameters, and extraction coefficients, were computationally evaluated to identify optimal NADES compositions for target PFAS compounds. The in-silico screening process prioritized combinations that demonstrated strong intermolecular interactions with PFAS molecules while maintaining favorable thermodynamic properties.

Laboratory validation experiments confirmed the computational predictions, with optimized NADES achieving removal efficiencies exceeding 99% for various PFAS compounds, including perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS). Extraction kinetics, selectivity studies, and regeneration cycles were systematically evaluated to assess practical applicability. The NADES demonstrated superior performance compared to conventional solvents while maintaining biodegradability and low toxicity profiles.

Techno-economic analysis revealed favorable cost projections for large-scale implementation, with suitable estimated treatment costs. The integrated approach demonstrates that computationally-designed NADES offer a promising green alternative for PFAS remediation, combining high extraction efficiency with environmental sustainability. This methodology provides a robust framework for developing targeted solvents for emerging contaminant removal applications.

Micro/Nanoplastics Removal by Membrane Bioreactor

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Type of abstract: Oral

Subject area: T1.4. Treatment and removal technologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.4. Treatment and removal technologies

Keywords: Micro and Nanoplastics, membrane bioreactor, membrane fouling, floc characteristics, microbial community.

Brief description of the submission

Membrane Bioreactors have demonstrated high efficiency in removing MPs, achieving rates as high as 99.9%. However, significant gaps persist in understanding the removal dynamics of MNPs mixture and their long term effects on MBR performance under realistic environmental conditions. In this context, this study investigates the removal efficiency and the synergistic impacts of the accumulation of mixed plastics, such as polyethylene and polypropylene microplastics with polystyrene nanoplastics on the floc characteristics, microbial community, and fouling behavior, within a submerged integrated aerated membrane bioreactor system. Preliminary findings revealed that both MBR systems achieved high efficiency in terms of organic matter and MNPs removal. MPs demonstrated a potential scouring effect on the membrane which alleviated fouling rates. Moreover, MP accumulation moderately influenced the microbial structure and diversity, with the microbial community adapting over time under MNP stress. These findings highlight the resilience of MBRs in MNPs removal in real world wastewater treatment scenarios.

Abstract - Contribution details

Membrane Bioreactors (MBRs) have demonstrated high efficiency in removing MPs, achieving rates as high as 99.9%. However, significant gaps persist in understanding the removal dynamics of MNPs and their long-term effects on MBR performance. While studies have examined individual MNPs, the combined impact of mixed plastics, such as polyethylene (PE) and polypropylene (PP) microplastics with polystyrene (PS) nanoplastics, remains largely unexplored. In this context, this study seeks to fill this critical research gap by investigating the removal efficiency and the synergistic impacts of the accumulation of these mixed plastics on the floc characteristics, microbial community, and fouling behavior, within a submerged integrated aerated membrane bioreactor (aMBR) system.

The experiments were conducted in a laboratory scale fully automatic aerobic MBR that contains two independent tanks (30 L and an effective flat sheet membrane area of 0.11 m2). The systems were seeded with aerobic sludge collected from the WWTP located in Guadalajara (Spain) and was daily fed with synthetic wastewater. One reactor was used as a control and the other one exposed to NP-PS (120 nm), MP-PP (120-50 µm) and a recycled MP-PE (500-250 µm). The study spans 120 days.

Preliminary findings revealed that both MBRs achieved high organic removal efficiencies (COD~97%). MPs removal was similarly effective and almost completely removed(<LOD), whereas only traces of NP-PS were detected in the permeate corresponding to a removal efficiency of 99.9%. MP accumulation moderately influenced microbial structure and diversity, with the community adapting over time under MNP stress. However ongoing abundance shift and persistent changes between the late timepoints indicate extended monitoring is required to check stable or new equilibrium. Moreover, MPs demonstrated a potential scouring effect on the membrane. Overall system performance remained stable. These findings highlight the resilience of MBRs in MNPs removal in real world wastewater treatment scenarios.

Advanced Filtration for PFAS and Micropollutants

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Type of abstract: Oral

Subject area: T1.4. Treatment and removal technologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.4. Treatment and removal technologies

Keywords: Superfine Powdered Activated Carbon, Micropollutant, PFAS, Ceramic Membrane Filtration, Pile Cloth Media Filtration

Brief description of the submission

This study investigates the use of superfine adsorbents with a particle diameter of approximately one micrometer for the removal of micropollutants and per- and polyfluoroalkyl substances (PFAS) from water and wastewater using two treatment approaches. The first combines superfine adsorbents with ceramic membrane filtration (CMF) to remove PFAS from groundwater, achieving high adsorption efficiency and significant cost savings compared to granular activated carbon. The second approach uses superfine adsorbents with pile cloth media filtration (PCMF) to treat municipal wastewater, effectively removing over 80% of organic micropollutants, reducing total phosphorus to below 50 µg/L, and eliminating bacteria such as coliforms and E. coli as well as microplastic. In combination with CMF and PCMF, superfine adsorbents offer fast kinetics, low hydraulic retention time, and a compact design with reduced energy and material demands.

Abstract - Contribution details

This study presents two distinct process concepts utilizing sPAC in combination with either ceramic membrane filtration (CMF) with a 0.1 µm pore size or pile cloth media filtration (PCMF) with an OptiFiber Ultrafiber pile cloth media (PCM). The first approach, designed for groundwater contaminated with per- and polyfluoroalkyl substances (PFAS), integrates sPAC with CMF to concentrate and retain PFAS-laden sPAC. Compared to granular activated carbon, this method achieved a 1,000-fold increase in specific adsorption rates and 76 % lower operational costs. The second concept, implemented in a 400-day pilot plant treating municipal wastewater, combined sPAC with PCMF and chemical coagulation using metal salts to ensure sufficient agglomeration and removal of sPAC. The configuration, consisting of an injector (sPAC), static mixer (additive), flocculation reactor (HRT = 0.5 – 5 min), and PCMF, effectively removed organic substances. The studies showed that 150 – 500 mg Fe^{3+}/g sPAC is an optimal range for floc formation and thus efficient removal by PCM. Key findings include a strong correlation between turbidity and residual sPAC concentrations ($R^2 > 0.97$), enabling reliable monitoring of sPAC retention. Optimal sPAC dosing (approximately 9 mg/L) with a hydraulic retention time (HRT) of < 2 – 5 minutes achieved up to 80 % removal of organic micropollutants while maintaining residual sPAC concentrations < 0.2 mg/L in the effluent. Additionally, the process with Ultrafiber PCM enabled simultaneous reduction of total phosphorus to below 50 µg/L and average particulate total phosphorus to approximately below 10 µg/L, as well as elimination of bacteria such as coliforms and E. coli, and removal of microplastics. The study demonstrates that both sPAC-CMF and sPAC-PCMF systems can reduce footprint, energy demand, and costs compared to traditional methods while ensuring high treatment efficiency.

AQUA2VAL: Circular Water Innovation in Valencia

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(1) AINIA, (2) AQLARA

Type of abstract: Oral
Subject area: T1.4. Treatment and removal technologies
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.4. Treatment and removal technologies
Keywords: Wastewater treatment; Water reuse; Circular economy; Emerging contaminants; Sustainable water management

Brief description of the submission

The AQUA2VAL project focuses on developing sustainable and innovative solutions for treating and reusing industrial wastewater. The aim is to foster a circular economy within the water cycle sector of the Valencian Region. The initiative begins with a comprehensive assessment of the needs of key regional industries, identifying technological gaps and water quality challenges. Target pollutants include persistent substances such as PFAS, surfactants and microplastics in textiles and in water and wastewater treatment plants, UV filters and organic dyes in cosmetics, chromium and protein residues in tanneries, and heavy metals and high conductivity in the surface treatment and ceramics industries. The emphasis is on improving effluent quality to facilitate the recovery and safe reuse of water, in line with EU regulatory frameworks. The results of this diagnostic phase will inform the development of advanced treatment technologies that support industrial sustainability, resource efficiency and environmental resilience.

Abstract - Contribution details

AQUA2VAL represents a forward-looking initiative that addresses key environmental and industrial challenges linked to water resource management in the Valencian Region. It aims to provide sustainable, high-impact solutions for the treatment and reuse of industrial wastewater, aligning with the principles of the circular economy and the EU's Green Deal objectives. The project adopts a demand-driven approach, starting with the detailed assessment of technological needs in collaboration with representative industries, including AQLARA, a leading company in water cycle management.

The project is eligible for potential funding under the IVACE + FEDER call, which supports innovation and sustainability across strategic sectors. AQUA2VAL is particularly noteworthy for its integrative and cross-sectoral character: seven technological institutes from the Valencian innovation ecosystem (including AINIA) have voluntarily joined efforts to create a collaborative platform capable of delivering real impact. This unprecedented alignment of expertise reinforces the region's capacity to develop advanced water treatment technologies tailored to specific industrial requirements and effluent compositions.

By targeting pollutants of emerging concern, such as microplastics, PFAs, UV filters, heavy metals, and saline loads, the project seeks to improve effluent quality for safe reuse or even potential conversion into alternative sources of drinking water. The outcomes are expected to contribute significantly to the sustainability, competitiveness, and environmental resilience of regional industries.

AQUA2VAL offers a replicable model for collaborative innovation in the field of water management, driven by technical excellence, strategic cooperation, and a clear environmental mission.

SENTIATECH

PLATAFORMA TECNOLÓGICA ESPAÑOLA DE TECNOLOGÍAS AVANZADAS DE DETECCIÓN DE CONTAMINANTES, PREVENCIÓN DE LA SEGURIDAD Y MONITORIZACIÓN AMBIENTAL

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CEC degradation through photocatalysis in drinking water treatment

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Type of abstract: Oral
Subject area: T1.4. Treatment and removal technologies
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.4. Treatment and removal technologies
Keywords: Photocatalysis, TiO2, Contaminants of Emerging Concern, Drinking Water

Brief description of the submission

This work, part of the NIAGARA project, investigates the degradation of organic pollutants by heterogeneous photocatalysis using an industrial-scale TiO_2 reactor equipped with integrated UV lamps. Phenol, bisphenol A and imazalil were selected as model contaminants, while total, organic and inorganic carbon (TC, TOC, TIC) were monitored to assess mineralization. Kinetic profiles were fitted by weighted non-linear regression, comparing pseudo-first and second-order models; apparent first-order behaviour was found for BPA and imazalil, whereas phenol showed a better second-order fit at high initial concentration.

Concentration decay was monitored by validated HPLC with triplicate sampling (analytical uncertainty ~20–30 %). Kinetic data were fitted by weighted non-linear regression to the pseudo-first-order model, obtaining apparent rate constants and half-lives. Degradation efficiency depended strongly on solution pH, consistent with the influence of pollutant speciation and catalyst surface charge.

Abstract - Contribution details

Within the framework of the NIAGARA project, which addresses the growing pressure on water resources, this study evaluates an alternative to conventional water treatments, which are often insufficient for removing persistent organic pollutants [1, 2]. Heterogeneous photocatalysis with immobilized titanium dioxide (TiO2) is investigated, a technology that avoids the costly separation of the catalyst and facilitates its use in continuous flow systems [3]. The work focuses on the degradation of three model micropollutants of emerging concern: phenol, bisphenol A and imazalil. Samples were taken in triplicate and analysed by validated high-performance liquid chromatography (HPLC) (LOD/LOQ established; analytical uncertainty ~20–30 %).

Concentration–time profiles were analysed using weighted non-linear least squares fitting to the pseudo-first-order kinetic model □=□0∗□−□□. All three pollutants followed apparent first-order degradation with good correlation ($R^2 \approx 0.92$–0.95), yielding rate constants up to k = 1.96 d-1 half-lives from a few hours (BPA) to about one day (IMZ and phenol under the tested conditions).
Degradation efficiency showed a marked dependence on pH, reflecting the interplay between pollutant speciation and the surface charge of the TiO_2 coating.

After several irradiation cycles the immobilized catalyst retained activity and structural integrity, confirming its durability and potential for repeated use.

Although a separate photolysis control could not be performed due to the integrated industrial design, dark adsorption and UV-shielded tests confirmed that pollutant removal is light-driven and attributable to the photocatalytic process.

These findings demonstrate the feasibility of immobilized TiO_2 photocatalysis for the degradation of refractory organics at pilot scale, supporting its development as a robust and sustainable water treatment technology aligned with the objectives of the NIAGARA project.

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NIAGARA

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Effective Photocatalyst to Remove Microplastics

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Type of abstract: Oral

Subject area: T1.4. Treatment and removal technologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.4. Treatment and removal technologies

Keywords: photocatalyst, water remediation, microplastics removal, continuous flow photoreactor

Brief description of the submission

A new heterogeneous photocatalyst based on titanium dioxide (TiO_2)-coated silica sand has been designed for efficient, sustainable and scalable microplastics degradation. The material not only ensures efficient mineralization, but also allows for easy separation and reuse of the photocatalyst, which is conducive to large-scale applications. A continuous flow photoreactor was built for lab testing, consisting of a tubular glass column with the photocatalyst, surrounded by UV-A LEDs, and processing real wastewater containing PET microfibers from polyester garment washing. COD measurements showed minimal adsorption in darkness but a 95% reduction under UV light, indicating effective organic matter mineralization. The photocatalyst shows promise as a scalable, eco-friendly solution for microplastic pollution, aligning with Sustainable Development Goals. It addresses ecological challenges and offers industries practical tools to meet environmental standards, advancing sustainable water treatment technologies.

Abstract - Contribution details

The persistence of Microplastics (MPs), resistance to biodegradation, and traditional disposal methods call for innovative solutions. Photocatalysis has emerged as a promising technology that can be employed for PM removal using light [1]. The present study presents a new heterogeneous photocatalyst based on titanium dioxide (TiO_2)-coated silica sand designed for efficient, sustainable and scalable MP degradation. The material not only ensures efficient mineralization, but also allows for easy separation and reuse of the photocatalyst, which is conducive to large-scale applications. The synthesis involved coating silica sand with TiO_2 and integrating TiO_2-coated SiO_2 microspheres to increase the catalytic surface area [2]. The millimeter-sized sand particles offer key operational advantages, such as preventing overpressure in the photoreactor and reducing clogging, while simplifying the separation process. Batch experiments were performed to optimize the thickness of the TiO_2 coating and obtain maximum efficiency. In addition, a modified rotary evaporator was used to produce larger quantities of the material, ensuring scalability while preserving its photocatalytic performance. A continuous flow photoreactor was built for lab testing, consisting of a tubular glass column with the photocatalyst, surrounded by UV-A LEDs, and processing real wastewater containing PET microfibers from polyester garment washing. COD measurements showed minimal adsorption in darkness but a 95% reduction under UV light, indicating effective organic matter mineralization. The photocatalyst shows promise as a scalable, eco-friendly solution for microplastic pollution, aligning with Sustainable Development Goals. It addresses ecological challenges and offers industries practical tools to meet environmental standards, advancing sustainable water treatment technologies.

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Plasma-Activated Water in Pollutant Degradation

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(1) INESCOP

Type of abstract: Poster

Subject area: T1.4. Treatment and removal technologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.4. Treatment and removal technologies

Keywords: emerging contaminants, oxidation treatment, plasma

Brief description of the submission

Emerging contaminants like PFAS, microplastics, and nanoplastics present a major challenge to traditional water treatment methods due to their persistance and potential health risks. This study explores the use of Plasma Activated Water (PAW) produced by exposing water to non-thermal atmospheric plasma, as a sustainable and chemical-free alternative for pollutant removal. The plasma-water interaction generates reactive oxygen and nitrogen species (RONS), which initiate advanced oxidation processes capable of degrading PFAS and promoting the breakdown or aggregation of micro- and nanoplastics. The effectiveness of PAW was evaluated under various plasma treatmente conditions using advanced chemical and physical analytical techniques. Results demonstrate the ability of PAW to degrade contaminants and transform them into less harmful compounds. This research supports the development of greener water treatment technologies and aligns with EU environmental policies, offering a promising solution for mitigating the environmental and health impacts of emerging pollutants

Abstract - Contribution details

Emerging contaminants such as PFAS, microplastics and nanoplastics pose a critical challenge to conventional water treatment technologies due to their persistence, mobility and potential risks to human health and the environment. This work investigates the application of Plasma Activated Water (PAW), generated through the exposure of water to non-thermal atmospheric plasma, as a sustainable and chemical-free alternative for the degradation and removal of these pollutants.

The interaction of atmospheric plasma with water leads to the formation of a rich mixture of reactive oxygen and nitrogen species (RONS), which drive advanced oxidation processes. These processes are capable of breaking down persistent organic pollutants, including PFAS and promote destabilization, degradation and potential aggregation of micro- and nanoplastics. This study evaluates the performance of PAW under different plasma treatment parameters and its efficiency in treating a selection of model contaminants relevant to current environmental concerns.

Advanced analytical techniques have been used to monitor the degradation pathways and transformation products of the contaminants. The results highlight the potential of PAW as part of innovative water treatment strategies aimed at reducing the environmental and health impacts of emerging pollutants.

This research contributes to the development of greener, more efficient technologies aligned with current EU regulatory trends and environmental policies, providing a promising route for future applications in the field of water treatment and environmental remediation.

Ulva Macroalgae for Remediation and Biomass Recovery

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(1) INESCOP, (2) Mediterranean Algae

Type of abstract: Oral

Subject area: T1.4. Treatment and removal technologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.4. Treatment and removal technologies

Keywords: Algae, ulva, bioremediation, heavy metals recovery, biostimulant

Brief description of the submission

Marine pollution in port areas from heavy metals, nutrients, and CO_2 poses increasing environmental risks. The BIOREMED project addresses this challenge through the controlled cultivation of Ulva spp. as a natural bioremediation tool. Over four months in Alicante Port, Ulva biomass demonstrated effective accumulation of aluminum, chromium, iron, nickel, and zinc, validating its role in mitigating heavy metal contamination. Simultaneously, the stability of proteins and fats in the biomass ensures its quality for valorization. Enzymatic hydrolysis of the algae yielded protein hydrolysates with excellent amino acid profiles suitable for agricultural biostimulants. Importantly, heavy metals remained in the solid residue, safeguarding the extracted products. These findings confirm Ulva spp. as a sustainable and effective solution for environmental remediation while enabling biomass recovery in line with circular bioeconomy strategies.

Abstract - Contribution details

Pollution of marine environments, particularly in port areas, due to excess nutrients, heavy metals, and CO_2 is a growing environmental concern. This type of pollution harms marine biodiversity, contributes to ocean acidification, and promotes eutrophication, leading to serious ecological and economic consequences. In this context, the BIOREMED project, carried out by Mediterranean Algae and INESCOP, offers an innovative solution based on the controlled cultivation of Ulva spp. as a natural bioremediation tool for these environments.

Ulva spp. are green macroalgae well-known for their ability to capture heavy metals and CO_2 through active functional groups in their cell walls (carboxyls, hydroxyls, phosphates). These properties enable the chelation and retention of toxic metals and contribute to CO_2 mitigation, with potential absorption rates of 1–2 kg of CO_2 per kg of dry biomass. However, proving the industrial viability of this approach requires validation under real marine conditions, beyond laboratory environments.

Over four months, controlled Ulva cultures were maintained in Alicante Port, with monthly monitoring of biomass composition and heavy metal accumulation. Results confirmed the algae's progressive uptake of aluminum, chromium, iron, nickel and zinc validating their effectiveness in mitigating heavy metal contamination in port waters. The stability of proteins and fats in the biomass throughout the exposure period supports its valorization potential.

Additionally, enzymatic hydrolysis of the biomass yielded protein hydrolysates with recovery rates of 41–62% and favorable amino acid profiles (arginine, leucine, phenylalanine, lysine, glutamic acid, alanine), reinforcing its suitability for agricultural biostimulant applications. Importantly, heavy metals remained in the solid biomass residue, ensuring the safety of the recovered products.

In conclusion, the BIOREMED project demonstrates the feasibility of Ulva spp. as an integrated solution for environmental remediation and biomass valorization, paving the way for future industrial-scale applications aligned with circular bioeconomy principles.

Tribo-Reactor for fluorine circularity - TriFluorium

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Type of abstract: Oral

Subject area: T1.4. Treatment and removal technologies

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.4. Treatment and removal technologies

Keywords: PFAS, remediation, mechanochemistry, circular economy

Brief description of the submission

Fluoropolymers are essential for applications in semiconductors and green technologies, such as hydrogen production and electric vehicles. However, their disposal is limited and the EU relies on imports for fluorspar, a critical resource with a recycling rate of only 1 % due to a lack of effective recycling technologies. The EU-funded TriFluorium project will demonstrate the tribolysis recycling principle for organofluorides, regardless of their chemical structure or state. The process uses a tribocontact site that can trigger mechanically induced reactions, creating high-energy spots to break down stable organofluorides and activate safe reactants, converting them into stable inorganic products. The project will also develop a dedicated triboreactor for laboratory-scale validation, paving the way for scaling and industrialising tribolysis technology.

Abstract - Contribution details

TriFluorium largely expands current circular economy capabilities for highly stable organofluoride waste (PFAS, including fluoropolymers) and provides safe, sustainable and efficient regeneration of fluorine into safe, stable inorganic fluorides as industrial resource, such as fluorspar. Fluoropolymers are indispensable for many critical (e.g. semiconductors) and green (e.g hydrogen production, fuel cells, EVs) applications and their disposal options are very limited. Needed fluorspar resource is listed as EUs critical raw material and is acquired outside of the EU with recycling rate at 1% due to the lack of proper technologies.

TriFluorium wants to achieve proof of the tribolysis recycling principle for organofluorides (TRL 3) irrespective of particular chemical structure, molecular weight, or liquid/solid form under properly designed controllable tribocontact site, which promotes chemical reactions initiated by mechanical stimuli. Tribolysis shall within one processing step generate local dense-energy spots to initiate decomposition of very stable organofluorides, including the perfluorinated ones, and to activate safe reactants, such as alkaline earth metal (Group II) salts or oxides to efficiently convert organofluorides into safe, stable inorganic products (mineralization).

TriFluorium will also develop a dedicated Tribo-Reactor for laboratory scale validation of tribolysis F-recycling (TRL 4) for process scaling and enhancement of tribolysis technology development towards industrial application. The locally initiated reactions with benign reactants have inherently safe operational and energy-efficiency features. Supporting toxicological and LCA assessments will be carried out to comprehensively evaluate tribolysis recycling process and Tribo-Reactor performance from all relevant perspectives.

The foundation of tribolysis recycling for organofluorides answers urgent technological needs and contributes to current environmental, economic, and social goals.

Eco-materials for the adsorption of water pollutants

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Type of abstract: Poster
Subject area: T1.4. Treatment and removal technologies
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.4. Treatment and removal technologies
Keywords: water treatment; sustainable materials; pharmaceuticals; adsorption

Brief description of the submission

This research provides an overview on the use of low-cost adsorbents for the removal of chemical contaminants from water. The use of seaweed and sawdust for the removal of pharmaceuticals in water are discussed. The results are compared to those of the use of activated carbon as an adsorbent.

Abstract - Contribution details

The release of antibiotics and other pharmaceuticals into aquatic ecosystems from household, industrial and agricultural wastewaters leads to serious environmental issues and adverse effects on human and animal health. There is a lack of effective treatment methods in response to water contamination with drugs; with some conventional techniques such as chlorination even exacerbating the problem.

Misuse of antibiotics and their presence in wastewater has led to the emergence of antibiotic-resistant bacteria. Vancomycin residues in wastewater from hospital use is linked with the appearance of vancomycin-resistant bacteria.

Adsorption processes are widely adopted for the removal of many contaminants from water. Adsorbent materials such as activated carbon have proven to be effective at removing antibiotics from water (Theofanous et al., 2024.). However, production and regeneration costs of some adsorbents, e.g. activated carbon, remain high. Natural materials such as sawdust, wheat straw and seaweed are promising alternative bio-adsorbents. We have previously shown that sawdust is a promising adsorbent for the removal of several antibiotics and pharmaceuticals in water (Abudu et al.. 2025).

This work investigated the use of seaweed as an adsorbent for the removal of the antibiotic vancomycin in water. Operational parameters were investigated such as pH, temperature and adsorbent dosage on the removal efficiency. Adsorbent rates were compared with activated carbon and sawdust.

The outcome of this research will offer a cheaper alternative in the treatment of pharmaceuticals in wastewater prior to their discharge into the environment.

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Antibiotic resistance: The role of WWTPs

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Type of abstract: Oral
Subject area: T1.5. New analytical techniques and sensor-based approaches
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.5. New analytical techniques and sensor-based approaches
Keywords: Antibiotic resistance genes (ARGS), antibiotic resistance bacteria (ARBs), WWTPs, reuse, water quality

Brief description of the submission

The efficiency of bacterial elimination, particularly of genera with potentially pathogenic species, was evaluated using metabarcoding analysis (16SrRNA gene) in the water line of three Mediterranean WWTPs. Two WWTPs include final steps based on MBR ultrafiltration, while the third one presents a classical purification treatment ending with disinfection by chlorination and application of ultraviolet radiation. The removal performances of the 6 months prior to the metabarcoding study of different selected physicochemical variables show that the WWTPs were operating normally. The results showed that in all cases the overall removal (effluent outflow versus WWTP inflow) of bacterial genera with potentially pathogenic species was very high. The MBR systems were particularly efficient compared to the classical treatment systems with final disinfection by chlorination and/or ultraviolet, and the systems completed with MBR treatments were more efficient in the elimination of indicator genera such as Escherichia and Arcobacter, an abundant and problematic genera.

Abstract - Contribution details

The complete regeneration of wastewater, including the removal of chemical contaminants, microbial pathogens, and antibiotic-resistant bacteria, has emerged as one of the major challenges of the 21st century for both human and environmental health. To address this pressing issue and enable the safe reuse of treated water for agricultural irrigation and aquifer recharge, it is essential to determine which currently employed treatments in wastewater treatment plants (WWTPs) are most effective in eliminating antibiotics and antibiotic resistance genes (ARGs).

This is the objective of the RESTWAT project, funded by IVACE+i of the Generalitat Valenciana through the European Union's FEDER Programme, which has applied molecular techniques based on high-throughput sequencing (metabarcoding and metagenomics), along with quantitative PCR (qPCR) methodologies, to evaluate the efficiency of current wastewater treatments in removing antibiotic-resistant pathogens and ARGs.

The studies conducted have enabled the establishment of an effective methodology to assess the efficiency and selectivity of ARG removal, through the evaluation of various WWTPs (WasteWater Treatment Plants) employing different treatment technologies. The results demonstrated the effectiveness of the applied methods—particularly metagenomic and PCR-based approaches—in detecting the impacts of wastewater treatment on the populations of antibiotic-resistant bacteria and their resistance genes.

However, despite these efforts, residual concentrations of ARGs remain in the bacterial populations that survive the disinfection process. Although present in low abundance, these bacteria pose a significant risk, as they remain viable and contain a high proportion of ARGs. Under favourable conditions, they may facilitate the horizontal gene transfer of these resistance traits to other bacteria, perpetuating the spread of resistance.

The removal or significant reduction of such substances and resistant bacteria is essential for improving water circularity, thus enhancing the sustainability of this critical resource for various applications—both for agricultural use and for safe reintroduction into the natural environment.

Size matters: analysis of plastics in the enviroment

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Type of abstract: Oral
Subject area: T1.5. New analytical techniques and sensor-based approaches
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.5. New analytical techniques and sensor-based approaches
Keywords: smallest microplastics, nanoplastics, Raman, NTA, SERS

Brief description of the submission

Plastic can fragment into smaller particles, generating microplastics (MPls) and subsequently nanoplastics (NPls). There is scarce knowledge of the concentration and fate of the MPls smaller than 20 µm and NPls (≤ 1 µm) in the environment. Additionally, their detection and quantification at environmentally relevant concentrations (ng/L - mg/L) remain limited due to the absence of accurate analytical techniques. Herein, we report the advantages and limitations of sample preparation methodology based on cloud-point extraction (CPE), density separation, and microfluidic technology and analysis using a set of complementary techniques, including Raman spectroscopy, Surface-enhanced Raman scattering (SERS), Nanoparticle Tracking Analysis (NTA), and Py-GC-MS, for the analysis of the smallest small microplastics (≤ 10 µm) and NPls in suspended sediments and natural waters.

Abstract - Contribution details

It is estimated that plastic waste in the environment could reach 11 billion tonnes by 2025. Plastic can fragment into smaller particles, generating microplastics (MPls) and subsequently nanoplastics (NPls). The smaller the particle size, the greater the risk they pose to organisms and human health. There is scarce knowledge of the concentration and fate of the MPls ≤20 µm and NPls (≤1 µm) in the environment. Their detection and quantification at environmentally relevant concentrations (ng/L - mg/L) remain limited due to the absence of accurate analytical techniques. The main limitations are the spatial resolution of the available methods and the heterogeneous composition of the matrix, highlighting the need to integrate a pre-treatment step to eliminate other undesirable particulate organic matter and suspended sediments. Herein, we report the advantages and limitations of sample preparation methodology based on cloud-point extraction, density separation, and microfluidic technology and analysis using a set of complementary techniques, including Raman-based techniques, Nanoparticle Tracking Analysis (NTA), and Py-GC-MS, for the study of the smallest small microplastics (≤10 µm) and NPls in suspended sediments and natural waters.

Portable Cytomegalovirus test using nanomaterials

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Type of abstract: Oral

Subject area: T1.5. New analytical techniques and sensor-based approaches

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.5. New analytical techniques and sensor-based approaches

Keywords: Cytomegalovirus, Test strips, Optical detection, Early diagnosis, Molecular gates

Brief description of the submission

In clinical area, it is well-known that an early diagnosis allows more effective treatments, and in grant part of cases, could be the difference of develop a chronic disease or injury. That is the case of Cytomegalovirus (CMV), is an herpesvirus with reduced contagiousness but it causes dangerous infections in newborns and inmunosupressed patiens. Nowadays the methodology employed to detect the CMV is carried out when there are hearing lesions, in this case, when the alterations appear the illness is in advanced stage, where the lesions can not be healed and in some cases, it is too late for saving the patient.

In this work, in order to solve the problems related to the detection, a rapid detection system has been developed employing test strips and silica-based nanomaterials, additionally allowing an economic and portable test that could be used in point-of-care locations.

Abstract - Contribution details

Cytomegalovirus (CMV) is an herpesvirus, it has a reduced contagiousness but it is a serious problem due to the severity of the infection it entails in neonates and immunosuppressed patients, since 4% of infected newborns die and 90% will suffer from neurological lesions such as sensorineural deafness. The CMV is detected by hearing tests and only when this test is carried out with positive results, the PCR (RT-PCR) assay is done, the infected patients who don't manifest hearing alterations are excluded for the PCR assay. Furthermore, this process allows the detection when there are irreversible lesions developed and, despite the RT-PCR is a very specific and sensitive assay, it is expensive and cannot be performed on-site for universal screening, due to the need for specialized workers and materials.

Keeping this problematic in mind, there is a need of a new method that could solve each aspect that has been mentioned in relation to the detection aspect. In this work has been developed a molecular gated material for the detection of CMV. This material is a mesoporous silica nanoparticle (MSN) loaded with a fluorescent dye and capped with an oligonucleotide that recognise specifically a CMV strand of its DNA. The oligonucleotide-gated material is based on the molecular recognition of DNA, in the presence of its complementary strand that is from CMV, the oligonucleotide is displaced from the pores of MSN and the dye is released, allowing a detection by measuring the fluorescence in this specific material. As a final step, it has been implemented in test strips for its use in point-of-care locations, the strips were combined with a “smartphone device” that has been developed for the quantification of dyes through photography, giving as a result a portable, cheap and simple system that could be used for everyone without specific formation.

Virtual sensors for detection of contaminants in WWTP

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Type of abstract: Oral
Subject area: T1.5. New analytical techniques and sensor-based approaches
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.5. New analytical techniques and sensor-based approaches
Keywords: Virtual sensor, machine learning, wastewater, emerging contaminants

Brief description of the submission

Emerging contaminants (ECs) in wastewater, such as pharmaceuticals, personal care products, and microplastics, pose significant environmental and public health risks. Traditional monitoring methods in wastewater treatment plants (WWTPs) often rely on costly and time-consuming laboratory analyses, limiting real-time detection and response. Virtual sensors using indirect measurements offer a promising alternative for the continuous and cost-effective monitoring of ECs. By integrating process parameters (e.g., pH, conductivity, Total Suspended Solids (TTS), COD, BOD5) and machine learning, virtual sensors can estimate contaminant concentrations without direct chemical analysis.

This presentation explores the steps for developing a virtual sensor from data collection and training to validation, implementation, and monitoring. It emphasizes the importance of identifying indirect measurements correlated with emerging contaminants (ECs) while developing a mathematical model.

Abstract - Contribution details

A virtual sensor developed by SAV for the estimation of the concentration of sulfates in the WWTP of Blanca (Murcia) will be presented. This virtual sensor estimates the concentration of sulfates without direct chemical analysis through indirect process measurements such as pH, conductivity, temperature, TTS, COD, BOD5 and Nt. The estimation and monitoring of the sulfates in this WWTP is of importance due that sulfates are responsible for odor by the production of H2S and because this WWTP has an anaerobic biological treatment stage where the sulfates inhibits the production of methane. The predicted values through the developed virtual sensor together with the predicted error in the estimation are compared with the real analyzed values in order to validate the model.

The presentation also shows the development of virtual sensors for the estimation of medications such as antibiotics, anti-inflammatories and antidepressants in wastewater. The influence of the indirect variables for improving the model is analysed with real data. Notably, five of the six pharmaceuticals monitored in the Cieza WWTP —azithromycin, diclofenac, sulfamethoxazole, venlafaxine, and valsartan— are among the substances identified for systematic monitoring and advanced removal under the new Directive (EU) 2024/3019 on urban wastewater treatment. This legislation mandates quaternary treatment in agglomerations exceeding 100,000 population equivalents, highlighting the need for advanced technologies and predictive tools such as virtual sensors.

Modular Digital Twin for Small-Scale WWTPs

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Type of abstract: Any

Subject area: T1.5. New analytical techniques and sensor-based approaches

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.5. New analytical techniques and sensor-based approaches

Keywords: Digital Twin, Hybrid Modelling, Biological Reactor, Functional Mock-up Unit (FMU), Small-Scale Wastewater Treatment Plant (WWTP)

Brief description of the submission

This presentation introduces a modular and scalable digital twin developed for a small rural wastewater treatment plant as part of the Horizon Europe iMERMAID project. The system combines a physics-based Modelica model with machine learning to simulate complex biological processes in the reactor. A middleware in Python handles real-time data acquisition and synchronization, while an interactive 3D Unity interface supports operator training and decision-making. Designed for flexibility and cost-effectiveness, this digital twin helps improve energy efficiency, effluent quality, and operational reliability, offering a replicable solution for advancing digitalization in small-scale water treatment facilities.

Abstract - Contribution details

This work presents the design and preliminary validation of a modular and cost-effective digital twin for the biological reactor of a small-scale rural wastewater treatment plant (WWTP), currently operating in a facility serving approximately 1,000 population equivalents. It addresses the growing need for accessible digitalization in decentralized wastewater systems, especially in under-resourced rural areas where automation is limited.

The proposed digital twin integrates a hybrid modelling approach: combining a physics-based biological reactor model developed in Modelica (exported as an FMU) and a data-driven component using supervised machine learning. This enables simulation of complex biological dynamics like microbial activity and oxygen uptake rates, which are difficult to model mechanistically.

The architecture includes: (1) the hybrid model; (2) a Python-based middleware for real-time data acquisition, preprocessing and synchronization; and (3) an interactive 3D interface in Unity for process visualization, scenario analysis, and operator training. The modular structure ensures flexibility, integration with existing infrastructure, and scalability.

Initial validation with on-site sensor data and simulation scenarios suggests potential energy savings through optimized aeration strategies and signs of improved effluent quality. Real-time monitoring and virtual experimentation allow operators to test control changes in a safe digital environment before physical deployment, minimizing operational risk. The Unity interface improves accessibility by enabling intuitive visualization and safe virtual experimentation, even for non-specialist operators.

This development is part of the Horizon Europe project iMERMAID, which focuses on mitigating agricultural pollution in Mediterranean ecosystems through advanced monitoring and treatment solutions. One of the demonstration sites is located in rural Spain (Aragon region).

The presented work demonstrates the feasibility of hybrid digital twins to enhance operational efficiency, environmental compliance, and sustainability in small WWTPs. It contributes to bridging the digitalization gap between urban and rural water systems through a replicable and intelligent platform for smart control and decision support.

Molecular Gate Biosensor for P. aeruginosa Detection

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Type of abstract: Oral

Subject area: T1.5. New analytical techniques and sensor-based approaches

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.5. New analytical techniques and sensor-based approaches

Keywords: Nanomaterials ● Oligonucleotides ● Molecular gates ● Pseudomonas aeruginosa ● Infection diagnosis

Brief description of the submission

This innovative biosensor is based on nanoporous materials with molecular gates, enables the rapid and highly specific detection of P. aeruginosa in clinical urine samples. The system can provide a diagnosis in under 30 minutes, or in just one minute with test strips, which is significantly faster than conventional methods that typically take three to four days. The mechanism relies on the detection of bacterial DNA through specific oligonucleotides, which trigger the release of a fluorescent signal only in the presence of P. aeruginosa. This ensures high accuracy and clinical applicability. The technology has successfully passed laboratory tests using bacterial genomic DNA and has been validated in urine clinical samples. A sensitivity of 91.67% and specificity of 97.30% was obtained.

Abstract - Contribution details

Approximately 15 million people die from infectious diseases every year, and universal systems for microbial detection face challenges such as long diagnostic times, low specificity and expensive equipment. In this context, the timely detection and surveillance of bacterial pathogens, particularly antibiotic-resistant ones, are critical for effective clinical management and infection control. Smart nanodevice-based biosensors, particularly those with gated porous supports, are attracting attention as they can rapidly detect pathogen DNA. In this study, a biosensor was developed to precisely detect *P. aeruginosa*. This biosensor uses an inorganic porous support with a grafted molecular entity that controls the diffusion of a fluorogenic molecule only in presence of *P. aeruginosa*.

The system exhibits enhanced sensitivity to minimal genomic and bacterial concentrations and is capable of detecting extremely low bacterial concentrations (30 CFU/mL), enabling early identification. Additionally, it demonstrates high selectivity against other prevalent nosocomial microorganisms in intensive care units. Furthermore, it does not require highly specialised personnel or advanced laboratory equipment, making it suitable for use in hospitals with limited resources. Besides, samples do not require processing or pretreatment prior to testing. This nanosensor has been clinically validated in urine patient samples, successfully distinguishing between healthy patients and those infected with the bacterium in approximately 30 minutes.

Finally, the sensor has been implemented in test strips, which improves its portability for on-site analysis of clinical urine samples. In one minute, the biosensor can significantly discriminate between clinical samples from patients. The rapid and accurate detection of *P. aeruginosa* in urinary tract infections, coupled with its ease of use and low cost, makes it ideal for implementation in hospitals and diagnostic laboratories.

Early Detection Methods for Pathogens in Wastewater

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(1) Grupo Simetría

Type of abstract: Oral
Subject area: T1.5. New analytical techniques and sensor-based approaches
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.5. New analytical techniques and sensor-based approaches
Keywords: Pathogens, Sensor, Wastewater

Brief description of the submission

Ensuring the microbiological quality of water is essential for public health, especially as water reuse becomes increasingly important. Traditional methods for detecting key microbial indicators, such as Escherichia coli and Clostridium perfringens, are reliable but often slow and resource-intensive. This submission presents a novel early detection technology developed by CICLAGUA, which uses advanced biosensing techniques to rapidly and sensitively identify these microorganisms in water samples. The system delivers accurate results within hours, significantly reducing response times compared to conventional culture-based methods. This innovation enhances water quality monitoring, enabling timely interventions to prevent contamination and protect public health.

Abstract - Contribution details

The microbiological quality of water is a crucial factor for public health and environmental sustainability, particularly given the increasing global emphasis on water reuse and regeneration. Escherichia coli and Clostridium perfringens are widely recognized as key indicators of bacterial and protozoon contamination respectively, and the effectiveness of wastewater treatment processes. Although traditional culture-based methods for detecting these microorganisms are reliable, they are time-consuming and require specialized laboratory facilities, often causing delays in timely interventions.

To improve water quality monitoring and safeguard public health, the development of innovative early detection technologies is essential. The presence of specific microorganisms is commonly used to assess the microbiological quality of effluents and the success of disinfection. Specifically, E. coli is considered the most appropriate indicator for fecal contamination, while C. perfringens serves as a reliable marker of treatment efficacy.

Addressing these challenges, CICLAGUA has been developing and implementing a novel early detection technology that enables sensitive, rapid, and cost-effective identification of E. coli and C. perfringens in water samples. This system employs advanced biosensing techniques capable of detecting low concentrations of target bacteria within a few hours, significantly reducing analysis time compared to conventional culture methods.

This advancement marks a significant step forward in water quality surveillance, providing a practical tool for early warning and rapid response to microbial contamination, ultimately enhancing water safety and public health protection.

Smart sensing for indoor formaldehyde control

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Type of abstract: Oral

Subject area: T1.5. New analytical techniques and sensor-based approaches

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.5. New analytical techniques and sensor-based approaches

Keywords: Formaldehyde, indoor air quality, continuous monitoring, sensors, exposure assessment

Brief description of the submission

Formaldehyde is a toxic indoor air pollutant released from materials and products used in buildings. Although exposure limits are regulated, conventional measurement methods based on periodic sampling do not detect short-term peaks or emission trends. This presentation introduces a continuous monitoring approach using low-cost electrochemical sensors, recently validated under laboratory conditions. Integrated into smart indoor monitoring systems with on-device processing and cloud analytics, these sensors provide real-time information on indoor air dynamics. The solution is practical, scalable, and suitable for a wide range of environments, offering a more responsive, representative and data-informed way to manage formaldehyde exposure indoors.

Abstract - Contribution details

Formaldehyde is a toxic and volatile indoor air pollutant released from construction materials, furniture, and consumer products. Classified as carcinogenic, neurotoxic, and sensitising, its presence in indoor environments—particularly in offices, schools, hospitals, and homes—poses a significant health concern. Although exposure limits are regulated (e.g. Spanish VLA-ED: 0.37 mg/m³), conventional assessment methods based on periodic sampling, while highly accurate for quantifying average concentrations, are limited in their ability to capture short-term peaks and cannot support continuous trend analysis.

Continuous monitoring using electrochemical sensor technology offers a valuable complement to traditional approaches by enabling real-time detection, temporal trend identification, and early warning of risk episodes. The sensor technology used has been specifically developed to minimise cross-sensitivity to other volatile organic compounds (VOCs), improving specificity and reliability. Recent studies (Pei Z. et al., Sensors, 2023) have validated the performance of low-cost formaldehyde sensors under controlled laboratory conditions.

Building on this foundation, our approach highlights the added value of integrating these sensors into smart indoor monitoring systems. Beyond data collection, the system incorporates on-device processing and cloud-based analysis. This setup allows for autonomous operation, easy deployment in real-world environments and the extraction of meaningful information to generate actionable insights into indoor air dynamics—addressing the limitations of traditional techniques.

Compared to conventional sampling, sensor-based systems offer continuous, high-frequency information that reveal emission patterns, occupant exposure peaks, and ventilation effectiveness in real time. This granularity enables more effective diagnosis of indoor air problems and supports preventive or corrective actions with immediate feedback. Furthermore, the portability, scalability, and cost-efficiency of these sensors make them well-suited for both individual room-level assessments and networked monitoring across entire buildings. This approach represents a significant improvement in the way formaldehyde presence is assessed and managed in everyday indoor environment.

H.pylori in drinking water: EU Project NIAGARA

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Type of abstract: Any
Subject area: T1.5. New analytical techniques and sensor-based approaches
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.5. New analytical techniques and sensor-based approaches
Keywords: Helicobacter pylori, drinking water

Brief description of the submission

Helicobacter pylori, a pathogen infecting over half the global population, poses a growing public health threat through its presence in drinking water. Resistant to conventional disinfection and often found in a viable but non-culturable state, H. pylori can persist in water systems, particularly within free-living amoebae, which protect it from treatment processes. Its detection in drinking water samples in Eastern Spain underscores the urgent need for improved monitoring and removal strategies. The EU-funded NIAGARA project addresses these challenges through a comprehensive technological approach for Drinking Water Treatment Plants (DWTPs), aiming to monitor, eliminate, and manage biological and chemical pollutants. Key innovations include a rapid method to detect viable H. pylori, a nanophotonic biosensor for real-time monitoring, an enzymatic degradation system, UV/TiO_2 photocatalysis for microbial inactivation, and a predictive hydraulic model. NIAGARA's integrated solution will enhance water safety, mitigate health risks, and strengthen Europe's resilience to waterborne pathogens.

Abstract - Contribution details

People affected by drinking water pollution are projected to increase from 1.1 billion in 2000 to 2.5 billion by 2050. Poor ecological status and anthropogenic pollution of water sources promote the proliferation of pathogenic bacteria, while chlorine-based disinfection in Drinking Water Treatment Plants (DWTPs) contributes to emergence of chlorine-resistant strains [1].

One of the most concerning waterborne pathogens is Helicobacter pylori (H. pylori), known for its resistance to conventional disinfection [2]. It was detected in drinking water samples in Eastern Spain (2017) and in DWTP biofilms [3]. Globally, over 4.4 billion people are infected. H. pylori remains viable and infectious in water, posing a major public health risk [4]. Recognized by the WHO as a top-priority antimicrobial-resistant pathogen, water is now acknowledged as a key transmission route [5].

In a previous study, a significant correlation was found between H. pylori in drinking water and clinical infection [6]. However, detection remains challenging due to its frequent viable but non-culturable state [7]. Additionally, free-living amoebae in water systems act as reservoirs and protective hosts for H. pylori, enhancing its survival and disinfection resistance [8]. Their role in internalizing the bacteria increases its transmission potential, reinforcing the need to address amoeba-associated microbial risks [9].

The EU-funded NIAGARA project objective is to develop and validate an integrated solution (TRL5) for DWTPs to monitor, remove, and manage pollutants and associated health risks. Among specific innovations, a robust analytical method for detecting viable H. pylori will be developed. This methodological advancement is critical for overcoming current detection limitations and underpins the validation of NIAGARA's key technological outputs, including the development and validation of a multi-analyte nanophotonic biosensor for real-time monitoring, and of an Immobilized Enzymatic Degradation System. NIAGARA's
multifaceted approach aims to reduce health risks and improve resilience of European drinking water systems against emerging threats.

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CPS: Ceramic Passive Samplers

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Type of abstract: Oral
Subject area: T1.5. New analytical techniques and sensor-based approaches
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.5. New analytical techniques and sensor-based approaches
Keywords: Passive Sampling, Contaminants of Emerging Concern, Monitoring

Brief description of the submission

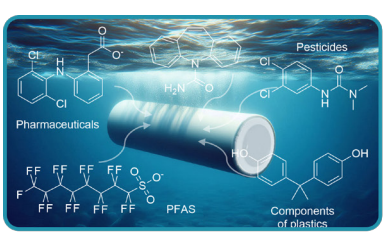
The presence of organic substances in water (pesticides, pharmaceuticals, plasticizers, PFAS, etc.) even at low concentrations represents a risk for the nature and human health. However, the current monitoring of these contaminants is very limited due to high analytical costs. The technology of Ceramic Passive Sampler (CPS) enables continuous monitoring of various types of water (surface water, groundwater, residual water, etc.) for a wide spectrum of organic contaminants while reducing the number of samples required and the costs of sample transport and preparation. Currently at TRL7, the prototype of CPS is being introduced to the market of water quality monitoring across industries, including environmental agencies, water providers, agriculture, and other sectors.

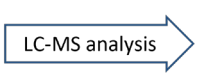
Abstract - Contribution details

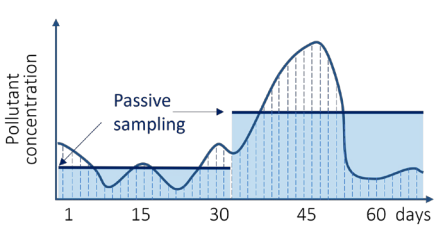
In an era of increasing regulation of organic contaminants in water, often referred to as contaminants of emerging concern, the costs and efficiency of water quality monitoring become increasingly important. Passive sampling offers a scalable and cost-effective alternative to conventional grab sampling for the monitoring of organic pollutants by providing more representative data on contamination while lowering the price of long-term monitoring.

Ceramic Passive Samplers (CPS) are an innovative technology developed at CSIC, based on deliberately designed porous ceramic material that ensures unmatched durability and efficiency of the sampler. CPS devices are porous ceramic cylinders (5 cm × 1 cm) with a sorbent placed inside. The devices are placed into water for a period from several days to one month. The contaminants diffuse through the ceramic membrane and get captured onto the adsorbent. After retrieval, the accumulated pollutants are analyzed using advanced chromatographic and mass spectrometry techniques. The use of pre-calibrated diffusion rates enables quantification of target analytes and accurate determination of time-weighted average concentrations over the deployment period.

This approach enables continuous monitoring of organic contaminants at the cost of a single monthly analysis, avoiding the risk of missing contamination events between samplings. CPS has been developed to the laboratory prototype stage and validated under real-world conditions across a range of water matrices, including drinking water, rivers, groundwater, seawater, and wastewater (TRL 7). Production scale-up and the creation of a spin-off company are currently underway to bring this technology to market and transform water quality assessment and management across environmental and industrial sectors.







WATCH LISTS DERIVED FROM THE WATER EUROPEAN RULES

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Type of abstract: Poster

Subject area: T1.6. EU policies, regulatory requirements and trends

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.6. EU policies, regulatory requirements and trends

Keywords: priority substances, priority hazardous substances, environmental quality standards

Brief description of the submission

The well-known priority and priority hazardous substances (chemical micropollutants) were already restricted in the EU waters under the 2015 Environmental Quality Standards Directive, which established watch lists to assess the potential negative effects of other candidates that were later clearly identified as new priority substances. Five watch lists were published between 2015 and 2025, and 67 compounds were studied and monitored. Of these, a third were antifungals and fungicides, between 15% and 20% were antibiotics and insecticides, and the remainder were sunscreens, herbicides, hormones, pharmaceutical products, antidepressants, synthetic organic compounds, and broad-spectrum pesticides. Each list cancels out the compounds from the previous one, and the latest available list from 2025 includes 29 substances, distributed between 34.5% fungicides, 13.8% sunscreens and antibiotics, and 10.3% insecticides, the remainder being pharmaceuticals, synthetic organic compounds, broad-spectrum pesticides, and antidepressants. Also, it had been published in 2025 a watch list for underground waters, with 22 substances: 50% organic solvents, 25% pharmaceuticals, 20% antibiotics, and 10% PAFs.

Abstract - Contribution details

1.-Introduction to environmental quality standards

Directive (UE) 2008/105 of the European Parliament and of the Council of 2008 established environmental quality standards in the field of water policy, repealing previous Directives. It set quality criteria for priority substances and other chemical micropollutants, as already provided in Article 16 of Directive 2000/60/EC, with the aim of achieving good chemical status of surface waters. All the substances with environmental concern are listed in Annex I, II and III of Directive (EU) 2008/105.

2.-The Watch lists: substances considered in continental waters

The lists of chemical compounds in their current Watch list format, were established in 2013, based on Directive (EU) 2013/39 which stipulates that the EC shall establish a surveillance list of chemical substances for which monitoring data must be collected across the EU to serve as the basis for future prioritization exercises in accordance with Directive (EU) 2000/60, including for the purposes of compiling analytical data and conducting reviews.

Thus, Directive (EU) 2013/39 indicates that the Commission would adopt implementing acts to establish and update the observation list for each subsequent period. This one generates the five Watch lists published by the European Commission to date: Implementing Decision (EU) 2015/495; Implementing Decision (EU) 2018/840; Implementing Decision (EU) 2020/1161; Implementing Decision (EU) 2022/1307; Implementing Decision (EU) 2025/439. All the substances included in Watch lists published from 2015 to 2025 are shown in Table 1, following the order in which they appear in the document available on the website of the Spanish MITERD: color blue indicates year of inclusion of substances in Watch list.

Looking now at the most recent monitoring list, that of 2025, fungicides are again the most prevalent, accounting for 34.5% of the substances listed, followed by sunscreen products and antibiotics, each representing 13.8% of the total. This information is presented graphically in Figure 1.

3.-Watch list for groundwater

With respect to groundwater, the European Commission also published a watch list in February 2025, which is voluntary in nature. This list is shown in Table 2. It includes 22 substances. Most of the chemical substances are organic solvents used for various purposes, both domestic and industrial (11), which have proven to persist in aquatic environments with limited self-purification capacity, such as groundwater, followed by pharmaceutical compounds (9), along with two PFAS (polyfluoroalkane substances) with proven toxicity.

Table 1

Nº CAS	Pollutant	Type of substance
57-63-6	17-α-ethinylestradiol	Hormone
50-28-2	17-β-estradiol	Hormone
5466-77-3	2-ethylhexyl 4-methoxycinnamate	Sunscreen
26787-78-0	Amoxicillin	Antibiotic
81906-01-5	Azithromycin	Antibiotic
131-57-7	Benzophenone-3	Sunscreen
70356-09-1	Butyl methoxydibenzoylmethane	Sunscreen
85721-33-1	Ciprofloxacin	Antibiotic
81103-11-9	Clarithromycin	Antibiotic
18323-44-9	Clindamycin	Antibiotic
23593-75-1	Clotrimazole	Fungicide
15307-86-5	Diclofenac	Non-steroidal anti-inflammatory
114-07-08	Erythromycin	Antibiotic
53-16-7	Estrone	Hormone
86386-73-4	Fluconazole	Fungicide
141-83-3	Guanilurea	Diabetes medication
657-24-9	Metformin	Diabetes medication
22916-47-8	Miconazole	Fungicide
6197-30-4	Octocrylene	Sunscreen
93413-62-8	o-desmethylvenlafaxine	Antidepressant
82419-36-1	Ofloxacin	Antibiotic
723-46-6	Sulfamethoxazole	Antibiotic
738-70-5	Trimethoprim	Antibiotic
54910-89-4	Fluoxetine	Pharmaceutical
79-57-2	Oxytetracycline	Antibiotic
525-66-6	Propranolol	Pharmaceutical
118-60-5	Ethylhexyl salicylate	Sunscreen
60-54-8	Tetracycline	Antibiotic
93413-69-5	Venlafaxine	Antidepressant
793-24-8	N-1,3-dimethylbutyl-N'-phenyl-p-phenylenediamine	Organic compound
2754428-18-5	6PPD quinone	Organic compound
128-37-0	2,6-di-tert-butyl-4-methylphenol	Additive
71751-41-2	Abamectin	Pesticide
135410-20-7	Acetamiprid	Insecticide
65195-55-3	Avermectin B1a	Insecticide
65195-56-4	Avermectin B1b	Insecticide
131860-3-8	Azoxystrobin	Fungicide
116255-48-2	Bromuconazole	Fungicide
38083-17-9	Climbazole	Fungicide
210880-92-5	Clothianidin	Insecticide
120116-88-3	Cyazofamid	Fungicide
119446-68-3	Difenoconazole	Fungicide
83164-33-4	Diflufenican	Herbicide
149961-52-4	Dimoxystrobin	Fungicide
133855-98-8	Epoxiconazole	Fungicide
153233-91-1	Etoxazole	Pesticide
131807-57-3	Famoxadone	Fungicide
120068-37-3	Fipronil	Insecticide
35554-44-0	Imazalil	Fungicide
155827-76-9	Imidacloprid	Insecticide
125225-28-7	Ipconazole	Fungicide
84625-61-6	Itraconazole	Fungicide
65277-42-1	Ketoconazole	Fungicide
1417782-03-6	Mefentrifluconazole	Fungicide
139968-49-3	Metaflumizone	Insecticide
125116-23-6	Metconazole	Fungicide
2032-65-7	Methiocarb	Insecticide
19666-30-9	Oxadiazon	Herbicide
66246-88-6	Penconazole	Fungicide
67747-09-5	Prochloraz	Fungicide
60207-90-1	Propiconazole	Fungicide
107534-96-3	Tebuconazole	Fungicide
112281-77-3	Tetraconazole	Fungicide
111988-49-9	Thiacloprid	Insecticide
153719-23-4	Thiamethoxam	Insecticide
2303-17-5	Triallate	Herbicide
131983-72-7	Triticonazole	Fungicide

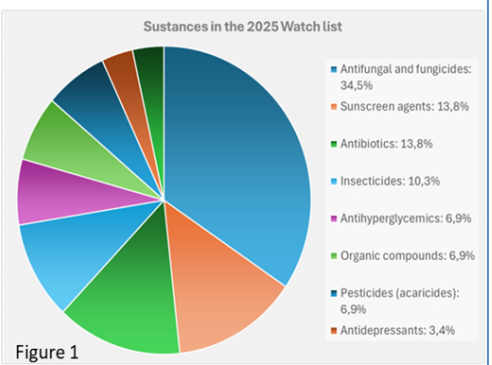

Figure 1

Watch list underground waters	Type of substance	Nº CAS
Amidotrizoic acid	Pharmaceutical product	117-96-4
Clarithromycin	Pharmaceutical product	81103-11-9
Clopidol	Pharmaceutical product	2971-90-6
Crotamiton	Pharmaceutical product	483-63-6
Erythromycin	Pharmaceutical product	114-07-8
Ibuprofen	Pharmaceutical product	15687-27-1
Primidone	Pharmaceutical product	125-33-7
Sotadol	Pharmaceutical product	3930-20-9
Sulfadiazine	Pharmaceutical product	68-35-9
Perfluoro-n-dodecanoic acid	PFAs	307-55-1
Perfluoro-n-undecanoic acid	PFAs	2058-94-8
1,2,3-trichlorobenzene	Solvent	87-61-6
1,4-dioxane	Solvent	123-91-1
Trifluoroacetic acid	Solvent	76-05-1
Chloroethane	Solvent	75-00-3
Chloromethane	Solvent	74-87-3
Diethylene glycol dimethyl ether	Solvent	111-96-6
Diisopropyl ether	Solvent	108-20-3
Nitrile triacetic acid	Solvent	139-13-9
Tert-butanol	Solvent	75-65-0
Tetraglime	Solvent	143-24-8
Tetrahydrofuran	Solvent	109-99-9

Table 2

Conclusions: While the 2015 European Directive on Environmental Quality Standards already addressed toxic substances in water, there it also was established a mechanism called as "watch list" to assess the potential negative effects of other substances that might later be identified as new priority substances. To date, five monitoring lists have been published, covering the period from 2015 to 2025, identifying up to 67 compounds for study and monitoring in EU waters.

Of these, 32.8% were antifungal agents and fungicides, 17.9% were antibiotics, and 14.9% were insecticides, with the remainder comprising sunscreens, herbicides, hormones, general pharmaceuticals, antidepressants, synthetic organic compounds, and broad-spectrum pesticides. Each list supersedes the previous one, and the latest list (2025) includes 29 substances, distributed between fungicides (34.5%), sunscreens and antibiotics (13.8%), insecticides (10.3%), and the remainder comprising pharmaceuticals, synthetic organic compounds, broad-spectrum pesticides, and antidepressants.

Regarding the watch list for groundwater, 22 substances have been considered, of which 50% are organic solvents, 25% are pharmaceuticals, 20% are antibiotics, and 10% are PFAS.

EU Policies on Emerging pollutants in Drinking Water

Du Saillant Du Luc, Elrik (1)

(1) UT SEMIDE

Type of abstract: Oral
Subject area: T1.6. EU policies, regulatory requirements and trends
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.6. EU policies, regulatory requirements and trends
Keywords: European Policy Emerging pollutants Policy recommendations Horizon Europe project

Brief description of the submission

The presence of emerging contaminants—such as pharmaceuticals, endocrine disruptors, and microplastics—in water intended for human consumption represents a significant risk to public health and the environment. The effective management of these risks depends on European Union policy and regulatory framework that is coherent, up-to-date, and capable of responding to scientific advances. This work, framed within the European project NIAGARA (GA 101082015), presents a critical analysis of said regulatory framework.

The main objective is to evaluate the EU's policy-legal framework governing the risk assessment of emerging pollutants in drinking water. Specifically, it seeks to:

- Identify current regulatory requirements and existing legislative gaps for key substances such as Bisphenol A, imazalil, Helicobacter pylori, ibuprofen, paracetamol, and microplastics.
- Analyse regulatory trends and legislative proposals that will shape the future of water policy in the EU.
- Formulate policy recommendations to strengthen the regulatory framework and promote more effective risk management.

Abstract - Contribution details

Methodology:
A systematic analysis of 40 EU regulatory texts was conducted, of which 27 are currently in force and relevant to the study. The methodology focused on key directives as well as cross-cutting regulations. The impact of each regulation on the management of pollutants was assessed, and the results were synthesized to identify patterns and shortcomings.

Results:
The analysis reveals a complex and fragmented regulatory framework. Significant regulatory gaps are identified: there are no EU-level parametric limits in the DWD for pharmaceuticals like ibuprofen and paracetamol, nor for the bacterium Helicobacter pylori. Although Bisphenol A is regulated with a value of 2.5 µg/L, the revision of these parameters follows an ordinary legislative procedure, which can be slow to respond to new scientific evidence. A key trend is the increasing use of "watch lists" to monitor new substances; however, their review frequency and sometimes voluntary nature (as in the Groundwater Directive) limit their effectiveness. Current legislative proposals, such as the revision of the water directives (procedure 2022/0344(COD)), point to a clear trend towards greater stringency, proposing to include BPA and ibuprofen in the list of priority substances and to tighten thresholds for pesticides.

Conclusions:
EU water policy is in a crucial phase of evolution to address emerging risks. The current framework, while robust in some respects, is insufficient to cover the full spectrum of concerning pollutants. It is imperative to act on the identified gaps. The key recommendations focus on coordinating the various legislative instruments to avoid inconsistencies; streamlining the review procedures for substance lists; strengthening and making surveillance mechanisms mandatory; and decisively applying the 'polluter pays' principle to finance monitoring and the implementation of advanced technologies. The adoption of these measures will not only protect public health but also drive innovation and resilience in the European water sector.

EU policy and regulation in drinking water RD3/23

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Type of abstract: Poster

Subject area: T1.6. EU policies, regulatory requirements and trends

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.6. EU policies, regulatory requirements and trends

Keywords: Drinking water Royal Decree 3/2023 EU Directive 2020/2184 PFAS Risk management

Brief description of the submission

The Royal Decree 3/2023, in force since January 2023, updates the Spanish drinking water regulations, adapting them to Directive (EU) 2020/2184. It introduces an approach based on risk assessment and management, expanding microbiological and chemical parameters, and including emerging contaminants such as PFASs and microplastics. It strengthens the obligations of operators, priority buildings and food businesses, and improves transparency to the consumer through the national SINAC system. This regulation is in line with European policies, especially the Water Framework Directive. Thus, Royal Decree 3/2023 not only complies with European regulations, but also promotes innovation and digitalization for sustainable and safe drinking water management.

Abstract - Contribution details

Royal Decree 3/2023, in force since January 2023, updates the Spanish legal framework regarding water for human consumption, transposing Directive (EU) 2020/2184. This new regulation introduces a preventive approach based on risk assessment and management, significantly expanding the microbiological and chemical control parameters. The inclusion of new parameters, such as emerging contaminants (e.g. PFAS, microplastics or disinfection by-products), represents a crucial step forward to achieve a more rigorous control adapted to current and future drinking water risks. It also reinforces the obligations of supply operators, priority buildings and food companies, and increases the transparency of information for consumers through the national SINAC system.

At the European level, these regulations are part of the Water Framework Directive and the European Green Pact, which promote efficiency in the use of water resources, equitable access to drinking water and resilience to climate change. The European Union sets a target of a 10% reduction in water consumption by 2030 and encourages the use of technologies for the detection of persistent pollutants, as well as the modernization of infrastructures.

In this context, Royal Decree 3/2023 not only responds to European regulatory requirements, but also promotes technological innovation and digitalization as pillars for sustainable, safe, and transparent management of water for human consumption.

Microplastics sampling using aquarium pumping systems

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Type of abstract: Oral

Subject area: T1.7. Other

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.7. Other

Keywords: Seawater, microplastics, sampling, aquarium

Brief description of the submission

Through this study, a new method has been developed to facilitate the sampling of microplastics (MPs) in coastal sub-surface waters by utilizing the seawater inlet system of an aquarium facility.

To achieve this, a provisional and manually installed filtration device was designed and placed at the inlet point of the aquarium's seawater pumping system. This system enables the retention of solid particles smaller than 5 mm present in the water, allowing for the subsequent quantification of MPs in the retained material.

This novel MP sampling method is particularly well-suited for monitoring temporal trends in MP concentrations in marine waters, as it provides a fixed sampling point. It offers significant advantages in terms of cost-effectiveness, time efficiency, and spatial accuracy of the sampling location. Moreover, it is transferable to other facilities equipped with fixed seawater inlet systems.

Abstract - Contribution details

Through this work, a new approach was developed to facilitate the sampling of microplastics (MPs) in coastal sub-surface waters, based on the use of the seawater supply system of the Donostia-San Sebastián Aquarium, which draws water from La Concha Bay (located in the Cantabrian Sea, on the northern coast of Spain).

To this end, a provisional and manually installed filtration device was designed and placed at the inlet of the Aquarium's settling tank, without causing any disruption to the normal operation of the facility. The system retains solid particles smaller than 5 mm present in the water, allowing for the subsequent quantification of MPs in the retained material. This sampling strategy was applied during four surveys, in which five replicate samples were collected per survey. Each replicate consisted of filtering 2,000 liters of seawater through a primary 5 mm mesh and a secondary 100 µm mesh.

The newly developed MP sampling method for sub-surface waters, based on the inlet system of an aquarium facility, is particularly well-suited for monitoring temporal trends in MP concentrations in marine environments, as it provides a fixed sampling point. The method offers significant advantages in terms of cost, time efficiency, and spatial accuracy of the sampling location. Moreover, it is transferable to other sites with fixed seawater pumping systems, such as aquaculture facilities or industrial cooling systems, thereby enabling more precise long-term monitoring of MPs. Consequently, this method may serve as a valuable tool for the implementation of the Marine Strategy Framework Directive with regard to coastal MP monitoring.

Overcoming Social Barriers to PFAS Remediation

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Type of abstract: Oral
Subject area: T1.7. Other
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.7. Other
Keywords: PFAS, social acceptance, environmental remediation, stakeholder engagement, communication strategy

Brief description of the submission

Despite increasing awareness of the environmental and health risks posed by PFAS (per- and polyfluoroalkyl substances), public resistance continues to hinder the adoption of remediation technologies. This study explores key barriers to acceptance—such as distrust in institutions, limited understanding of PFAS, and economic concerns—and outlines strategies to overcome them. Drawing on surveys, interviews, and stakeholder workshops in Denmark, Sweden, and Italy, the research reveals a gap between public concern and citizen action. To bridge this divide, the study recommends targeted communication, participatory decision-making, and sustained community involvement. It emphasizes that successful PFAS remediation requires more than technical solutions—it demands social trust and collaboration. By integrating public perspectives into environmental policy and practice, the findings offer a practical roadmap for transforming scepticism into support. This work guides policymakers, industry, and researchers toward more inclusive, effective responses to PFAS contamination, helping pave the way toward a safer, PFAS-free future.

Abstract - Contribution details

Despite growing awareness of the environmental and health risks of per- and polyfluoroalkyl substances (PFAS), social resistance continues to challenge the deployment of remediation technologies. This study identifies the main barriers to public acceptance—including low trust in institutions, limited understanding of PFAS impacts, and economic concerns—and provides a roadmap for transforming public scepticism into informed, proactive engagement. Based on surveys, interviews, and stakeholder workshops conducted across three European demonstration sites (Denmark, Sweden, and Italy), the findings reveal a high level of concern but limited action among citizens. Recommendations stress the importance of tailored communication strategies, co-created decision-making processes, and long-term community involvement to build legitimacy and trust. Effective remediation depends not only on technical innovation, but also on meaningful collaboration with those most affected. By integrating social insights into environmental action, this work highlights how policymakers, industry leaders, and researchers can foster public acceptance, enhance impact, and accelerate the transition to a healthier, PFAS-free future.

Acknowledgement: This work was developed within the SCENARIOS project (GA No. 101037509), funded by the European Union’s Horizon 2020 research and innovation programme.

Metagenomic profile in wastewater of Valencia

Ivorra Ivorra, Carmen (1), Rubio, Pau (2), Moreno, Yolanda (3), Alonso, José Luis (4)

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Type of abstract: Poster

Subject area: T1.7. Other

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.7. Other

Keywords: antibiotic resistance genes (ARG), Antimicrobial Resistance (AMR), wastewater, Shotgun metagenomic, Genomic Surveillance

Brief description of the submission

Antimicrobial resistance is presently one of the leading causes of death worldwide. The surveillance of different environments has become crucial under the One Health approach. Wastewater monitoring is an essential analytical tool for assessing the presence of antibiotic resistant bacteria (ARB) and antibiotic resistance genes (ARG). Wastewater-based surveillance (WBS) is a health tool in development of rapid response and increasing public health.

In this study we have characterised the composition of microbial populations, antibiotic resistance genes and their relative abundance in different socioeconomic areas of the city of Valencia, in winter, spring, summer and autumn. A metagenomic approach has been used to characterise the microbial profile and antibiotic resistance genes. We show detection, abundance, spatio-temporal surveillance profiles of pathogens of interest and demonstrate WBS's utility as an early warning system an for the detection of hot spots in Valencia city.

Abstract - Contribution details

Introduction

Wastewater monitoring is an essential analytical tool for assessing the presence of antibiotic resistant bacteria (ARB) and antibiotic resistance genes (ARG). Wastewater-based surveillance (WBS) is a health tool in development of rapid response and increasing public health.

In this study we have characterised the composition of microbial populations, antibiotic resistance genes and their relative abundance in different socioeconomic areas of the city of Valencia, in winter, spring, summer and autumn.

Methods

Wastewater samples were collected from different sewerage sites (n=12) in Valencia in winter, spring, summer and autumn. DNA samples were subjected to shotgun metagenome sequencing using Illumina Novaseq X. Bioinformatic analyses have been carried out using FASTQC, Megahit/Metaspades, Metaquas, BUSCO and BLAST tools.

Results

This study investigated the presence/abundance of ARGs, and the composition of microbial populations. A total of 60 samples were tested, and, after sequencing metagenomics.

A total of 391 resistance genes were detected, with 288 being antibiotic resistance genes capable of rendering more than thirty classes of antibiotics ineffective. Based on the data obtained, the most represented resistance gene families in the samples correspond to aminoglycosides and beta-lactamases, both of which are of significant clinical relevance due to their widespread use.

Regarding microbial composition, our findings demonstrate that composition of microbial populations and ARG proportion in wastewater were different across different seasons: a greater diversity were detected in summer.

Other remarkable observation was the difference in abundance of some species in the samples from point 6 (close to hospital), with respect to the rest of the samples from the city, among the top 10 most abundant bacteria. This difference was more pronounced in summer.

Conclusions:

Our main findings highlight that seasonal changes influence antibiotic resistance genes and microbial abundance, and further research is needed in future studies.

Plastics in the city

MAILLARD, Emmanuel (1), Edouard, LAVERGNE (1), Anne-Leila, MEISTERTZHEIM (1)

(1) PLASTIC AT SEA

Type of abstract: Poster
Subject area: T1.7. Other
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.7. Other
Keywords: Debris, Mismanagement, Waste, OSPAR, Citizen science

Brief description of the submission

The objective of this poster is to present a pilot project in France for the quantification and characterization of plastic debris along a land-sea continuum in order to support a municipality in the implementation of its policy related to waste. This project allows to transform a simple beach cleaning into a participatory science approach in connection with the inhabitants and local associations, during the waste collection phase according to standardized protocols allowing a comparison of data in time and space. The statistical analysis of collection results then allows the municipality to implement a management and mitigation strategy for the contamination of its environment by waste. The statistical analysis of collection results then allows the municipality to implement a management and mitigation strategy for the contamination of its environment by waste over the years.

Abstract - Contribution details

Plastics are ubiquitous in the environment. All environments are affected, including coastal and river ecosystems, where studies have shown that plastic waste contamination is proportional to the level of urbanization. This study, to our knowledge, is the first in France to investigate the spatial and temporal distribution of litter across the Land-Sea continuum, using debris classifications based on OSPAR and Extended Producer Responsibility. Three samplings, involving the local population and various non-governmental organizations, were conducted in 2022, 2023 and 2024 in the coastal town of Banyuls-sur-Mer, France, located near the Spanish border, with the Baillaury River running through it. The entire town, were sampled. A total of 40,795 debris (2,655 kg) were collected over 73.7 km of streets, riverbanks, port, and beach. Most of the debris collected in the port consisted of tires. The raw amount of waste collected in the town was higher than that observed on the riverbanks or at Central Beach, mainly due to the sampling effort on all streets (65 km), suggesting that the city is the main source of debris pollution. The normalized waste data show an increase of litter concentration along the continuum Land-Sea, with the coastal areas serving as the final repository for mismanaged waste. Plastics represent approximately 64 to 71% of the collected debris (26 to 44 % were cigarette butts and 7 to 12 % were single use food packaging) and exceed the precautionary threshold for ecological and socio-economic nuisances defined for European Union beaches (i.e., 20 debris per 100 m), by the Technical Group on Marine Litter of the Framework Directive “Strategy for the Marine Environment". The data collection and standardization methods used in this study facilitated direct comparison across the continuum land-sea between cities, riverbanks, ports, and beaches, and with other studies, highlighting the value of participatory science in informing decision-making.

BIOINDICATORS OF EMERGING CONTAMINANTS IN WASTEWATER

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Type of abstract: Poster
Subject area: T1.7. Other
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.7. Other
Keywords: Emerging contaminants, pharmaceuticals, phytotoxicity, plant bioindicators, anxiolytics

Brief description of the submission

This study investigates the effects of two emerging pharmaceutical contaminants, Tranxilium (dipotassium clorazepate) and Zolpidem (zolpidem tartrate), on plant development. Lettuce (Lactuca sativa L.) and wheat (Triticum aestivum L.) were used as bioindicators in greenhouse trials, along with phytotoxicity tests on Raphanus sativus. Different concentrations were applied, and parameters such as germination, biomass, and chlorophyll content were measured. Results showed growth stimulation at intermediate doses and phytotoxic effects at higher levels. The findings highlight the potential risks of pharmaceutical contaminants in agroecosystems.

Abstract - Contribution details

Given the increasing concern about the presence of emerging contaminants in wastewater and their persistence in the environment, this study aimed to assess the effects of two anxiolytic pharmaceuticals commonly used in human therapy: Tranxilium (dipotassium clorazepate) and Zolpidem (zolpidem tartrate), on plant development. Lettuce (Lactuca sativa L.) and wheat (Triticum aestivum) were selected as the biotest species. Phytotoxicity assays were also performed on Raphanus sativus. Greenhouse experiments were conducted using different concentrations of both pharmaceuticals, and several physiological and growth parameters were evaluated, including the germination rate, biomass accumulation, SPAD index, and spectrophotometrically measured contents of chlorophyll A, chlorophyll B, and carotenoids.

The results indicated that both pharmaceuticals can affect plant growth, with stimulatory effects at intermediate concentrations and phytotoxic effects at higher levels. These findings highlight the importance of considering the impact of emerging contaminants on agricultural ecosystems and their potential risks to environmental and human health.

FROM DATA TO RECYCLED PLASTIC COMPLIANCE

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Type of abstract: Oral
Subject area: T1.7. Other
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.7. Other
Keywords: AI, Quality control, AI Vision, Decision Making, Recycling Content.

Brief description of the submission

QUANTUM is a digital solution that uses artificial intelligence to evaluate the quality of recycled plastic.. It helps to identify the best batches, track quality and toxicity trends, and provide information on the recommended recycled content for a given application.

By interpreting analytical reports, QUANTUM provides detailed insights into the toxicity of substances in recycled plastics. It also clusters plastics by quality, assesses recycling process variations, and determines material suitability.

The integration of artificial vision aims to reduce the need for analytical testing, streamline workflows, cut costs and promote sustainable production.

Abstract - Contribution details

The plastic industry is under increasing pressure to reduce its environmental footprint. In recent years, significant advancements have been made in lowering emissions and developing recycling technologies to reduce landfill waste and promote circularity.

The Packaging and Packaging Waste Regulation (PPWR) is driving this phased transition, whereby all plastic packaging must contain a minimum amount of recycled material by 2030.

While protocols and solutions are emerging, critical questions remain: *How can we ensure consistent quality? How can we comply effectively with regulations?* These are complex challenges where **data-driven decision-making** becomes essential.

The rise of digital technologies and artificial intelligence (AI) has significantly enhanced our ability to process data and support complex decisions. So, why not apply AI to the plastics industry? In fact, AI has already been successfully implemented for example, to classify plastics of varying quality, contributing to the development of higher-quality material streams.

QUANTUM is a digital solution designed to transform data into actionable decisions, improving the assessment of recycled plastic quality. By comparing materials against predefined benchmarks and quality metrics, it identifies the most suitable batches and end users.

In addition, QUANTUM serves as a powerful database that enables users to:

- **Track** historical data and quality trends.
- Assess the presence and **toxicity of substances** in recycled materials.
- Estimate **recycled content** with greater accuracy.

The tool is **fully customizable** to specific materials, standards, and operational workflows, making it possible to:

- Clusterize recycled plastics by quality.
- Evaluation of recycling processes.
- Determining the suitability of materials for targeted applications.

Our latest development integrates **artificial vision**, using image-based systems to assess material quality. This innovation aims to reduce the need for analytical testing, thereby streamlining key workflows in fast-paced production environments and reducing both lead times and costs.

ARGs detection in sewage via qPCR and Metagenomics

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Type of abstract: Any

Subject area: T1.7. Other

Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics

Subject sub-area: T1.7. Other

Keywords: ARGs; qPCR; Valencia; Public Health

Brief description of the submission

Sewage systems and wastewater treatment plants (WWTPs) are key hotspots for the spread of antimicrobial resistance (AMR). Valencia's extensive sewage network, serving over one million residents, provides conditions that favor antibiotic-resistant bacteria (ARB) and the horizontal transfer of resistance genes (ARGs).

In this study, 48 wastewater samples from 12 locations across the city were analyzed for two clinically relevant ARGs: blaTEM1 and blaOXA-48. Metagenomic sequencing (Illumina NovaSeq X) and quantitative PCR (qPCR, LineGene Mini S) were used to compare relative and absolute abundances. Both genes were consistently detected in 100% of samples, with the highest concentrations near healthcare facilities. blaTEM1 ranged from 10^5–10^6 copies/mL, while blaOXA-48 varied from 10^1–10^5 copies/mL, showing spatial variability linked to local antibiotic use and demographics. The strong agreement between sequencing and qPCR highlights the value of combining both approaches for robust surveillance of ARGs in urban wastewater.

Abstract - Contribution details

Over the last decades, both sewage and wastewater treatment plants (WWTPs) have been considered potential "hotspots" for the dissemination of antimicrobial resistance (AMR) in the environment. The city of Valencia has an extensive and complex sewage network that collects and transports wastewater generated by more than one million residents. The persistent selective pressure from antibiotic residues at sub-inhibitory concentrations, as well as the high density and diversity of microorganisms, sustained by a nutrient-rich environment, create favorable conditions for the proliferation of antibiotic-resistant bacteria (ARB) and the horizontal transfer of antibiotic-resistant genes (ARGs) between different microorganisms. ARB and ARGs present particularly complex challenges for risk assessment and environmental management because they are both highly dynamic and subject to significant knowledge gaps and technical measurement difficulties.

In this study, we investigated the presence and abundance of ARGs in 48 wastewater samples collected from 12 sewer locations across various socioeconomic areas of Valencia. We specifically targeted the clinically relevant blaTEM1 and blaOXA-48 genes. Metagenomic shotgun sequencing was performed using the Illumina NovaSeq X platform, followed by stringent quality control and removal of low-quality reads. The relative abundances of these genes, determined through metagenomic analysis, were then compared with their absolute quantification obtained by quantitative Polymerase Chain Reaction (qPCR) using Bioer Technology's LineGene Mini S system.

Our findings revealed a clear, though non-linear, correlation between the metagenomic read counts and qPCR-measured concentrations of blaTEM1 and blaOXA-48. Notably, both blaTEM-1 and blaOXA-48 were detected in 100% of samples, indicating widespread distribution of these resistance genes in the urban sewer system. The highest detection rates for both genes were observed in samples from areas close to healthcare centers (P6 and P7). Furthermore, qPCR quantification revealed that blaTEM1 concentrations ranged from 105 to 10^6 gene copies per mL, while blaOXA-48 ranged from 101 to 10^5 copies per mL. These findings suggest spatial variability in ARG prevalence potentially linked to local patterns of antibiotic use and demographic factors. The consistency between metagenomic and qPCR data supports the robustness of our dual-method approach to ARG surveillance in complex urban wastewater.

CNTA tools for monitoring emerging food risks

Sánchez-Vicente, Laura (1), Granado, Desiré (1), Pascual Sáez, Sara (1), Cantabrana, Tomás (1), Giménez, Nora (1), Roldán Escuchuri, Jesús (1), Garrido, Cristina (1)

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Type of abstract: Any
Subject area: T1.7. Other
Subject area: T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics
Subject sub-area: T1.7. Other
Keywords: food safety, emerging risk.

Brief description of the submission

Emerging risks in the field of food safety are hazards that arise or intensify due to various potential drivers, such as climate change, new consumer trends, novel foods, trade globalization, demographic changes and technological advances. These risks can affect public health and require constant monitoring and prevention strategies.
To address this challenge, there is an undeniable need to act with a One Health approach, integrating human, animal, and environmental health and promoting initiatives that raise public awareness.
CNTA is developing a continuous surveillance system to identify emerging biological and chemical risks in the food chain, using powerful tools that facilitate the visualization of results. This knowledge enables food companies to make early decisions that will determine the direction of their HACCP systems and control plans, ensuring food safety in an increasingly changing environment.

Abstract - Contribution details

The methodology implemented at CNTA to stay up-to-date on emerging risks includes: (1) selection of sources that provide reliable and/or scientifically based data, (2) monitoring in different geographical areas, (3) data processing using powerful tools that facilitate the visualization of results and consequently facilitate decision-making regarding the controls to be carried out on raw materials, (4) preparation of reports with updated data, highlighting the most relevant data, based on CNTA's experience, technical criteria and know-how.
Monitoring common chemical and biological risks is essential in studying prevalence and detecting increases in exposure. Natural toxins such as mycotoxins and marine biotoxins are clear examples of emerging chemical risks driven by climate change. Tracking alerts and outbreaks of pathogens such as Salmonella and Listeria, as well as the foods involved, is a fundamental source of information.
Among the most current emerging risks, it is necessary to consider and highlight:
- PFAS: characterized by their persistence in the environment, which leads to ongoing proposals to restrict and prohibit their use.
-Microplastics: Information on the toxicity of microplastics is scarce; furthermore, at the analytical level, sampling, sample preparation, and analysis methodologies for microplastics in water and food are not yet harmonized or standardized, making it difficult to compare, and evaluate the results.
In conclusion, proper monitoring and updating of food emerging risks is a necessary starting point for designing industry control plans that guarantee consumer health.

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Topic 2: Innovation and opportunities of sensing technologies in agrifood value chains

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Real-Time Biosensor Monitoring for Water Safety

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Type of abstract: Any
Subject area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Keywords: Water quality, real-time monitoring, pathogen detection, biosensors, biological contaminants

Brief description of the submission

Water biosense is an advanced technology designed for real-time water monitoring and rapid detection of contaminants. Water contamination poses a serious risk due to the transmission of pathogens associated with severe foodborne diseases, highlighting the essential role of quality control methods. However, current laboratory techniques yield delayed results, limiting timely response to contamination events. Therefore, Water biosense offers a breakthrough solution based on antibody-coated nanoparticle **biosensors** for **real-time detection** of *Legionella spp.*, *Escherichia coli*, and *Enterococcus spp*. The technology is being expanded to target other relevant **pathogens** in the agrifood sector, such as *Clostridium perfringens* and *Salmonella enterica*, as well as some **emerging chemical contaminants** (e.g., PFAS, antibiotics, and microplastics). This solution minimizes manual sampling, accelerates detection, and supports regulatory compliance. Moreover, its **integration into treatment processes** enables proactive water management and health risk mitigation. Water biosense represents a sustainable solution with broad applicability to present and future challenges.

Abstract - Contribution details

Drought and **water contamination** pose a global challenge with critical repercussions for society, the economy, and the environment. Insufficient water treatments facilitate the transmission of microorganisms such as *Salmonella enterica*, *Listeria monocytogenes*, and *Clostridium perfringens*, which are associated with **severe foodborne diseases** and pose a serious public health threat. *Legionella pneumophila* contamination in water systems, storage tanks, and cooling towers also requires stringent control. In addition, industrial activities contribute to chemical contamination of water, with potentially harmful health effects including endocrine disruption and cancer. Delayed results from conventional quality control methods increase operational costs and health risks, highlighting the need for **advanced solutions with specific contaminant agent detection, efficient water treatment, and continuous monitoring**.

In this context, Sensactive Technology developed **Water biosense** for real-time water monitoring and rapid detection of contaminants. Through an antibody-coated nanoparticle-based **biosensor system**, it selectively captures and quantifies specific targets automatically and *in situ*, overcoming the limitations of conventional methods. Continuous analysis facilitates the **integration of water treatment processes**, promoting regulatory compliance and food safety. Water biosense minimizes reliance on manual sampling and laboratory analysis, providing results in a few minutes. It has shown stable performance and calibration in laboratory and field tests with **> 99% accuracy**, and high applicability in industrial settings.

Sensactive is advancing the development of biosensors for applications in the food industry, focusing on the detection of relevant pathogens such as *C. perfringens* and *S. enterica*. New developments complement biosensors currently available (*Escherichia coli*, *Enterococcus spp.*, and *Legionella spp.*), which are already deployed as **standard microbiological indicators in water quality**. Moreover, efforts are underway to design optimized devices for chemical contaminants detection, including PFAS, antibiotics, and microplastics. These developments, along with their integration into water treatment processes, position Water biosense as an efficient and sustainable solution to present and future challenges.

GENE-UP® TYPER:fast L.monocytogenes source tracking

Tomas Fornes, David (1)

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Type of abstract: Oral
Subject area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Keywords: Listeria monocytogenes, source tracking, food production, food safety

Brief description of the submission

A well-developed environmental monitoring plan combined with pathogen source tracking is essential for food facilities to avoid finished product contamination and associated costs for stopping production and potential recalls. Rapid and accurate molecular typing methods for source tracking allow reduction of time to results, costs and data analysis complexity compared with high-resolution typing methods.

Abstract - Contribution details

Title
GENE-UP® TYPER for high-resolution, fast and easy Listeria monocytogenes source tracking: food production facility case studies

Authors
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Methods
Listeria monocytogenes (LMO) isolates (n= 616) from nine food facilities (four European countries and food segments) were analyzed with GENE-UP® TYPER, a qPCR-based probabilistic typing technique. From isolated typical colonies, a five-minute mechanical lysis was performed, and the lysate was directly transferred to each well of a GENE-UP® TYPER LMO PCR strip. Results were obtained in less than two hours in total, including the marker absence/presence profiles obtained by qPCR, the analysis by data model driven algorithms and result visualiza□□on and interpretation using the proprietary web application. In parallel, a whole genome sequence analysis was performed on 209 of the isolates using BIONUMERICS®.
Results
The typeability with the GENE-UP® TYPER solution was above 80% for seven facilities analysed. For one facility the results were lower due to the repeated isolation of the same non-typeable strain. For the other facility, the GENE-UP® TYPER address obtained from 13 non-typeable isolates indicated that they belong to at least 6 different strains. The accuracy of GENE-UP® TYPER is on average 98.4% when compared to WGS based clustering at a maximum of 150 intra-cluster core loci differences. GENE-UP® TYPER allowed to reveal potential contamination sources in the facilities and exclude control strain cross-contamination events.

Conclusion
GENE-UP® TYPER provides early visibility on which LMO strains are circulating in a food facility with high-resolution. The fast and easy to perform workflow allows in-house pathogen source tracking and monitoring of the impact of mitigation actions.

Portable Semi-Automated HAB Toxins' Monitoring

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Type of abstract: Oral
Subject area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Keywords: aquaculture; toxic harmful algal blooms; nanomaterials; microfluidics; online monitoring

Brief description of the submission

In this study, we report the development of a one-of-a-kind portable and semi-automated monitoring system for harmful algal bloom (HAB) toxins in seawater. This device will be able to operate with minimum human intervention and will provide an estimation of the HABs toxins concentration in seawater. This system aims to facilitate early warning of HABs, helping to prevent seafood contamination beyond acceptable limits for human consumption and providing a tool to ensure food safety, economic growth, and sustainability of the aquaculture sector.

Abstract - Contribution details

Seafood aquaculture is heavily impacted by toxic harmful algal blooms (HABs) yearly. Significant efforts have been made to develop early warning systems for HABs, enabling the prediction of seafood contamination and facilitating early intervention. Still, none have been proven reliable and/or efficient enough for implementation. In this work, we describe the development of a portable and semi-automated system for detecting HABs toxins in seawater, allowing tracking of the appearance and progression of the toxic HAB before the concentration in the seafood reaches regulatory level thresholds.

We designed and optimised a modular portable system for real-time in situ implementation of HABs toxins monitoring. This system requires minimum operator intervention: sample collection (5 L), microalgae pre-concentration by filtering (0.2 µm) and recovery from the filter and resuspension of microalgae in 5-10 mL buffer. Then, the sample is placed in the device, and the rest of the analysis is automated; the sample is pumped through a microfluidic chip designed to accumulate and disrupt the cells. The chip features a serpentine channel and a chamber with pillars to confine glass microbeads. Under portable bath sonication, cells are exposed to mechanical stress, causing cell walls and membranes to break and release cellular content, including intracellular toxins. The resulting sample is then filtered to remove the debris and incubated with specifically tailored composites based on covalent organic frameworks and gold nanostars (COF/GNS) for surface-enhanced Raman scattering spectroscopy (SERS) detection. The composites are accumulated in a microfluidic cartridge, and the read-out is performed using a portable Raman system with a 785 nm laser line. Finally, an automated measurement and analysis are performed using ML/AI algorithms to estimate the toxin concentration in the sample. Our results indicate that the system can detect pM concentration of biotoxins in the microalgae extract from the seawater sample.

LAMP EC-Sensor for L. monocytogenes detection in food

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Subject area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Keywords: LAMP, electrochemistry, biosensor, extraction-free, point-of-care

Brief description of the submission

This work presents a low-cost sensor for the detection of Listeria monocytogenes (LMO) in food samples. The developed sensor combines an extraction-free LAMP with electrochemical detection inside a microfluidic chamber with integrated sensing electrodes. For the validation of the sensor, 9 different food samples were tested following extraction-free method. For this purpose, 25 g of food samples were spiked with 1 CFU of LMO. Following 24h of enrichment at 37ºC, the samples were directly amplified by LAMP and the detection was performed within the sensor. The e-sensor was able to detect as little as 1 CFU/25g of LMO in all tested food samples. The real-time detection of the LAMP reaction using the developed e-sensor will allow the monitorization of the amplification in a point-of-care device. This real-time detection is being optimized to improve the potential of the sensor.

Abstract - Contribution details

Loop mediated isothermal amplification (LAMP) technique is an alternative to the PCR molecular detection method that allows the DNA amplification at a single temperature.

This work presents a low-cost sensor for the detection of Listeria monocytogenes (LMO) in food samples. LMO detection is crucial in the control of food quality and safety throughout the food chain. Proper detection can prevent cross-contamination leading to production losses and food alerts with their associated costs. The developed sensor combines an extraction-free LAMP with electrochemical detection inside a microfluidic chamber with integrated sensing electrodes. The sensor requires simple and portable equipment, perfectly suited for on-site analysis.

The developed amplification was totally specific for the detection of all LMO serotypes and without cross-reactivity with other typical foodborne microorganisms. Moreover, the limit of detection of the LAMP was 312 fg of DNA. The detection is achieved by adding the redox-active Methylene-Blue molecule to the LAMP reaction and analyzing its electroactive activity by cyclic voltammetry.

For the validation of the sensor, 9 different food samples were tested following extraction-free method. For this purpose, 25 g of food samples were spiked with 1 CFU of LMO. Following 24h of enrichment at 37ºC, the samples were directly amplified by LAMP and the detection was performed within the sensor. The results obtained show a significative difference between the current intensity detected in positive and negative samples independently of the food assayed. The e-sensor was able to detect as little as 1 CFU/25g of LMO in all tested food samples [1].

The real-time detection of the LAMP reaction using the developed e-sensor will allow the monitorization of the amplification in a point-of-care device. This real-time detection is being optimized to improve the potential of the sensor.

[1] A. Rivas-Macho et al. Food Control 163, 110546 (2024).

Amoebae as CRB vectors in Hospital WW

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Subject sub-area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Keywords: Free-living amoebae, antibiotic resistance, antibiotic resistant bacteria, pathogens.

Brief description of the submission

This study investigated the role of free-living amoebae (FLA) as reservoirs for carbapenem-resistant bacteria (CRB) in hospital wastewater (HWW). Sixteen HWW samples from two hospitals were analyzed to detect different FLA and recover internal and viable CRB. Following selective treatments and culturing, FLA were successfully isolated from all samples, with qPCR confirming the presence of target FLA. Several viable CRB, including multidrug-resistant *Pseudomonas* spp. and Enterobacterales, were identified using MALDI-TOF MS. These bacteria exhibited resistance to multiple antibiotics, including cefotaxime, ceftazidime, meropenem, and imipenem. Findings highlight that FLA in HWW not only shields CRB from harsh environments but may also facilitate the spread of resistance in the environment, becoming a notable risk for environmental and public health.

Abstract - Contribution details

Background. Carbapenems are increasingly compromised by carbapenem-resistant bacteria (CRB), which exhibit limited therapeutic options and high case-fatality rates. Hospital wastewater (HWW) is a recognised hotspot for the emergence and dissemination of CRB and antibiotics.. Free-living amoebae (FLA) such as *Acanthamoeba* spp., *Vermamoeba* spp. and *Naegleria* spp. can host bacteria, shielding them from adverse conditions and potentially fostering the evolution and spread of antimicrobial-resistance traits.

Objectives. This study aimed to:
(i) quantify the presence of *Acanthamoeba* spp., *Vermamoeba vermiformis* and *Naegleria* spp. in HWW;
(i) isolate and identify FLA from HWW;
(iii) recover and identify viable carbapenem-resistant endosymbiotic bacteria from within these FLA;
(iv) determine antibiotic-susceptibility profiles of the isolates ;
(v) compare FLA distribution, associated bacterial diversity and resistance patterns between two hospitals.

Methods. Sixteen wastewater samples (8 per hospital) were collected. One portion of the samples was plated on non-nutritive agar to obtain FLA cultures. These were treated with hypochlorite to kill the bacteria outside FLA. Then an aliquot was stained with propidium monoazide (PMA) to exclude extracellular DNA and dead bacteria, and another aliquot was plated on SuperCarba medium for selective isolation of CRB from FLA. CRB colonies were identified by MALDI-TOF MS, and antibiotic susceptibility was assessed.

Results. All samples yielded FLA cultures. qPCR confirmed the presence of the three target types of FLA in some of the HWW samples. Several CRB potential pathogenic genera, including *Pseudomonas* spp., and Enterobacterales, were isolated from FLA isolates. Antibiotic testing revealed multidrug-resistant profiles, with resistance to several types of antibiotics such as cefotaxime and ceftazidime.

Conclusions. HWW harbours FLA that serve as reservoirs for CRB. These bacteria may use FLA populations as protective hosts, allowing them to survive and spread throughout the environment.

This research was funded by CIPROM2021-053 and INNEST/2023/40.

Molecular detection of pathogenic protozoa in food

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Type of abstract: Poster
Subject area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Keywords: Protozoa Cryptosporidium Giardia qPCR immunofluorescence microscopy

Brief description of the submission

Water for human consumption, essential in the agri-food chain, is recognized as a food and its microbiological quality is key to food safety. Within the framework of Royal Decree 3/2023, surveillance of pathogenic protozoa such as *Cryptosporidium* and *Giardia*, whose presence can go undetected by traditional methods, is reinforced. This work applies advanced techniques such as qPCR and targeted sequencing of the 18S rRNA gene to detect these pathogens in drinking water. These tools allow early detection of possible contamination caused by extreme weather events, such as DANAs, which increase turbidity and microbial load in surface water. The incorporation of these technologies contributes to guarantee the safety of water in food use, aligning with the requirements of RD 3/2023 and reinforcing the warning systems in the agri-food value chains.

Abstract - Contribution details

Water for human consumption, considered an essential foodstuff by European and Spanish legislation, is key to the safety of agri-food chains. Royal Decree 3/2023, which transposes Directive (EU) 2020/2184, includes the surveillance of resistant protozoa such as *Cryptosporidium* and *Giardia*, given their ability to overcome conventional treatments. This research was carried out in a DWTP in Valencia, applying a multi-technique approach combining immunofluorescence microscopy (IMS-IFA), specific qPCR and targeted sequencing of the 18S rRNA gene, achieving accurate detection of viable protozoa even after UV and chlorine treatments.

The results demonstrate the need to complement regulatory methods with molecular techniques in order to obtain more robust and earlier information. In addition, the use of these methodologies as early warning systems is encouraging against extreme meteorological phenomena such as DANAs which can compromise the quality of catchment water. These tools make it possible to anticipate microbiological risks, protect water as a strategic resource in the food industry and respond proactively to the requirements of the new regulatory framework.

The adoption of these advanced technologies improves surveillance capabilities, contributes to reducing public health risks and ensures a safe water supply in contexts where climate change intensifies high contaminant load events. The work reinforces the role of technological innovation in water microbiological risk management within agri-food systems.

Legionella: advanced molecular detection in water

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Type of abstract: Any
Subject area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Keywords: Legionella spp. RD 3/2023 RT-qPCR Drinking water Molecular detection

Brief description of the submission

The incorporation of *Legionella* spp. as a new parameter in the Royal Decree 3/2023 represents a key advance in the protection of water for human consumption, especially in its use in the food industry. This measure, aligned with Directive (EU) 2020/2184, reflects a preventive strategy based on microbiological risks. In this work, molecular techniques were implemented, such as RT-qPCR which targets the 16S rRNA gene, and it is able to detect viable *Legionella pneumophila* in drinking water treatment plants (DWTP). Unlike traditional culture based-techniques, these methods offer high sensitivity and rapidity, essential for early response to contamination. Tests performed on real and simulated matrices confirm their efficacy, positioning these tools as key surveillance systems. The application of these technologies significantly improves water safety in agro-industrial processes, reinforcing food quality systems and anticipating the regulatory requirements established by the new regulatory framework.

Abstract - Contribution details

The update of the Spanish legal framework through Royal Decree 3/2023, which transposes Directive (EU) 2020/2184, introduces the obligation to control the presence of *Legionella* spp. in water for human consumption. This change is especially relevant for agri-food environments, where water is not only considered as a food, but also an essential component in transformation, cleaning, and cooling processes. The presence of *Legionella* spp. represents an emerging health risk that requires more advanced detection technologies than traditional methods.

This study presents the application of molecular techniques based on RT-qPCR targeting the 16S rRNA gene, designed to identify and quantify viable *Legionella pneumophila* cells. Compared to classical culture methods - slow, less sensitive, and not very representative of the viable-unculturable state (VBNC) -, molecular biology allows obtaining rapid and specific results under complex environmental conditions.

The tests performed in a DWTP with real and simulated matrices demonstrate the high sensitivity and specificity of the method, allowing the implementation of early preventive actions. These tools not only improve water sanitary surveillance, but also strengthen food quality and safety protocols, contributing to reduce risks.

The integration of these technologies responds to the principles of RD 3/2023: anticipation, traceability, and consumer protection. In addition, it positions the agri-food industries in line with European trends in sustainability, digitalization, and public health, consolidating the role of safe water as a central axis of modern food safety.

Photonic Sensing Systems: PHOTONGATE Project

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Subject area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Keywords: photonics; molecular gates; localized surface plasmonic resonance (LSPR); porous silica; biosensing; microfluidics; respiratory viruses; chemical contaminants

Brief description of the submission

The PHOTONGATE project, funded by the EU Commission, is developing a novel adaptable sensing solution capable of detecting multiple analytes (e.g., chemicals, metals, bacteria) in a single test with high sensitivity and selectivity. It integrates two core technologies: biochemical molecular gates for specificity and enhanced sensitivity through porous substrates, and photonic localized surface plasmonic resonance (LSPR) structures for light-based transduction. These micron-scale technologies enable compact sensor integration (within mm^2 areas) and are intended for applications in health diagnostics and food safety. The system will feature a modular design with a microfluidic cartridge housing the sensor and a fully EU-made platform for fluid handling, optical interrogation, and signal processing, eliminating the need for optical fibers and costly optical components.

Abstract - Contribution details

In our everyday environment, we are exposed to a wide range of health threats, including pathogens and hazardous chemicals, which can compromise both human health and food safety. Rapid and accurate detection of these threats is essential to prevent their spread and impact. Current diagnostic methods like PCR, although considered the gold standard, face significant limitations such as high cost, time consumption, and restricted multiplexing capabilities. These challenges are equally present in the food industry, where multiple testing methods are often needed to detect various contaminants, making the process labor-intensive and time-consuming. There is a growing demand for simple, cost-effective, and sensitive solutions capable of detecting multiple analytes in a single test.

Biosensors have emerged as promising alternatives due to their speed, specificity, and adaptability. Among the different types, optical biosensors, particularly those using surface plasmon resonance (SPR) and localized surface plasmon resonance (LSPR), stand out for their sensitivity and compatibility with micro/nanofabrication techniques. However, traditional SPR-based systems often require complex and expensive optical setups and are limited in their ability to detect large biomolecules or perform multi-analyte detection. LSPR, in contrast, offers significant advantages by simplifying instrumentation and enabling detection of smaller targets with high sensitivity.

In parallel, biochemical recognition elements like gated materials are gaining attention. These materials use molecular gates on porous supports to trap and release reporter molecules in response to specific analytes, offering a smart and adaptable detection mechanism.

The PHOTONGATE project combines these two cutting-edge technologies—LSPR structures for optical transduction and molecular gates for analyte-specific recognition—to create a highly adaptable, sensitive, and multiplexed sensing platform. Designed for use in health diagnostics and food safety, the PHOTONGATE system aims to be user-friendly, modular, and cost-effective, significantly improving upon the capabilities of current detection methods.

16S-Based Microbial Risk Prediction in Meat Industry

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Type of abstract: Oral
Subject area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Keywords: 16S analysis, food safety, predictive modeling, microbial risk, hygiene

Brief description of the submission

This project is funded through the PERTE (Strategic Project for Economic Recovery and Transformation) initiative in the agri-food sector, within the framework of the ALIMTECH call, which aims to promote technological innovation throughout the food industry. Christeyns participates in this consortium in collaboration with Leitat Technological Center, contributing its expertise to the research, development, and implementation of cross-cutting solutions. The project's objective is to strengthen traceability, improve food safety and quality, and promote greater sustainability and resource efficiency throughout the agri-food chain.

Abstract - Contribution details

Microbiological risk management throughout the meat production chain is crucial to ensuring food safety. This study involves developing a predictive microbiological risk model in the meat industry. For this purpose, samples were systematically collected at multiple critical points in the production process—from the live animal, the slaughterhouse, and the cutting rooms to the final product—at different stages of production. 16S rRNA metagenomic analysis was used to characterize the bacterial communities and their relative abundance at each stage.

The results allowed for the identification of microbial hotspots where pathogenic, spoilage, or biofilm-forming microorganisms accumulate during production. Using all the data obtained, a predictive microbiological risk model was developed that can predict the probability of detecting a specific microorganism at a given point after a defined number of hours of production. This knowledge supports a preventive hygiene approach, allowing for early optimization of cleaning and disinfection protocols, focusing on the most critical areas before contamination becomes a concern.

Therefore, the microbiological risk predictive model offers a powerful enhancement to Hazard Analysis and Critical Control Point (HACCP) systems, enabling the optimization of cleaning and disinfection strategies tailored to microbial risks, helping to ensure the food safety of meat products.

Innovative Biosensor Technology for Water Safety

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Subject area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.2. New technologies for pathogens detection and food safety analysis in agrifood value chains
Keywords: Water quality, real-time monitoring, pathogen detection, biosensors, biological contaminants

Brief description of the submission

Water biosense is an advanced technology designed for real-time water monitoring and rapid detection of contaminants. Water contamination poses a serious risk due to the transmission of pathogens associated with severe foodborne diseases, highlighting the essential role of quality control methods. However, current laboratory techniques yield delayed results, limiting timely response to contamination events. Therefore, Water biosense offers a breakthrough solution based on antibody-coated nanoparticle biosensors for real-time detection of Legionella spp., Escherichia coli, and Enterococcus spp. The technology is being expanded to target other relevant pathogens in the agrifood sector, such as Clostridium perfringens and Salmonella enterica, as well as some emerging chemical contaminants (e.g., PFAS, antibiotics, and microplastics). This solution minimizes manual sampling, accelerates detection, and supports regulatory compliance. Moreover, its integration into treatment processes enables proactive water management and health risk mitigation. Water biosense represents a sustainable solution with broad applicability to present and future challenges.

Abstract - Contribution details

Drought and water contamination pose a global challenge with critical repercussions for society, the economy, and the environment. Insufficient water treatments facilitate the transmission of microorganisms such as Salmonella enterica, Listeria monocytogenes, and Clostridium perfringens, which are associated with severe foodborne diseases and pose a serious public health threat. Legionella pneumophila contamination in water systems, storage tanks, and cooling towers also requires stringent control. In addition, industrial activities contribute to chemical contamination of water, with potentially harmful health effects including endocrine disruption and cancer. Delayed results from conventional quality control methods increase operational costs and health risks, highlighting the need for advanced solutions with specific contaminant agent detection, efficient water treatment, and continuous monitoring.

In this context, Sensactive Technology developed Water biosense for real-time water monitoring and rapid detection of contaminants. Through an antibody-coated nanoparticle-based biosensor system, it selectively captures and quantifies specific targets automatically and in situ, overcoming the limitations of conventional methods. Continuous analysis facilitates the integration of water treatment processes, promoting regulatory compliance and food safety. Water biosense minimizes reliance on manual sampling and laboratory analysis, providing results in a few minutes. It has shown stable performance and calibration in laboratory and field tests with > 99% accuracy, and high applicability in industrial settings.

Sensactive is advancing the development of biosensors for applications in the food industry, focusing on the detection of relevant pathogens such as C. perfringens and S. enterica. New developments complement biosensors currently available (Escherichia coli, Enterococcus spp., and Legionella spp.), which are already deployed as standard microbiological indicators in water quality. Moreover, efforts are underway to design optimized devices for chemical contaminants detection, including PFAS, antibiotics, and microplastics. These developments, along with their integration into water treatment processes, position Water biosense as an efficient and sustainable solution to present and future challenges.

IMMUNOSENSING OF BIOTOXINS. THE CASE OF PATULIN

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Type of abstract: Oral

Subject area: T2.3. New technologies for allergenic substances and harmful chemicals detection and monitoring in agrifood value chains

Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains

Subject sub-area: T2.3. New technologies for allergenic substances and harmful chemicals detection and monitoring in agrifood value chains

Keywords: Biotoxins; Monoclonal antibodies; Immunoassay; ELISA; LFIA

Brief description of the submission

Biotoxins are the group of chemical contaminants potentially present in the food chain for which immunoanalytical techniques enjoy a higher degree of implementation in analytical laboratories – supported and recommended, in some cases, by regulatory authorities. Our research group focuses on developing novel immunochemical methods for monitoring toxic chemicals in food and environmental samples. We produce our own high-affinity monoclonal antibodies and highly effective hapten conjugates, which we implement into various analytical platforms, including ELISA, affinity columns, lateral flow immunochromatography, and biosensors. Nowadays, our collection of immunoreagents comprises over 500 antibodies with diverse specificities, targeting toxic compounds such as cyanotoxins and mycotoxins. Notably, our laboratory pioneered the development of the first – and currently only – bioconjugates and monoclonal antibodies for the sensitive immunochemical detection of anatoxin-a and patulin (Quiñones-Reyes et al., 2019; DOI: 10.1002/anie.201904002 and Duncan et al., 2024; DOI: 10.1021/acs.analchem.4c01631) through innovative technologies that have since been patented and licensed.

Abstract - Contribution details

Biotoxins are the group of chemical contaminants potentially present in the food chain for which immunoanalytical techniques enjoy a higher degree of implementation in analytical laboratories – supported and recommended, in some cases, by regulatory authorities. Our research group focuses on developing novel immunochemical methods for monitoring toxic chemicals in food and environmental samples. These studies are inspired by three main reasons: (i) the lack of suitable immunoreagents for some toxins; (ii) the search for novel, more appropriate chemical approaches to prepare haptens; and (iii) the demand for cost-effective, rapid analytical methods. Nowadays, our collection of immunoreagents comprises over 500 antibodies with diverse specificities – targeting toxic compounds such as cyanotoxins and mycotoxins – and it is likely one of the largest international repositories of monoclonal antibodies for toxic chemical contaminants. Additionally, various analytical platforms, including ELISA, affinity columns, lateral flow immunochromatography, and biosensors, are assessed for user-friendly and on-site monitoring of biotoxins.

Notably, our laboratory pioneered the development of the first – and currently only – bioconjugates and monoclonal antibodies for the sensitive immunochemical detection of anatoxin-a and patulin (Quiñones-Reyes et al., 2019; DOI: 10.1002/anie.201904002 and Duncan et al., 2024; DOI: 10.1021/acs.analchem.4c01631) through innovative technologies that have since been patented and licensed. As a case of study, a direct competitive ELISA and a lateral flow immunoassay have been developed for the rapid analysis of patulin. These immunoassays were validated by analysing certified contaminated materials. The optimized ELISA was able to accurately and precisely quantify patulin in apple juice at 5 ng/mL, thus encompassing the most demanding European maximum permitted level for infant food products. On the other hand, the developed immunostrips were able to classify in 10 minutes at room temperature the reference samples as complying or not complying with European legislation.

Multiplexed immunochemical assays for contaminants

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Subject area: T2.3. New technologies for allergenic substances and harmful chemicals detection and monitoring in agrifood value chains

Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains

Subject sub-area: T2.3. New technologies for allergenic substances and harmful chemicals detection and monitoring in agrifood value chains

Keywords: biosensor, antibodies, pesticides, antibiotics, immunoassay multiplexed

Brief description of the submission

Immunochemical techniques are based on the use of antibodies as a biorecognition element for the sensitive and specific recognition of the targeted pollutant. These kinds of techniques can be use as alternative or complementary tools in analytical chemistry, to lighten the great amount of analysis that have to carry out with less cost. Moreover, allow configurations for on-site monitoring not requiring highly qualified personnel and high-cost equipment.

In this communication we will present the work performed to develop distinct multiplexed immunochemical analytical platforms will be presented. Thus, ELISA, fluorescent microarray, optical and electrochemical biosensors have been developed to simultaneously detect the presence of pesticides, antibiotics, hormones, persistent organic pollutants or marine toxins in food matrices as well aquaculture samples. The detectabilities obtained in all the platforms developed reached low detection limits (in the ppb range) measured directly in the matrix of interest and fulfilling the legal requirements.

Abstract - Contribution details

The development of novel methodologies for environmental monitoring sea water contaminants has gained prominence for quality assurance in aquaculture and protect marine biodiversity. The aquaculture industry represents nowadays the 20% of the total fish production with an expected increasing of this percentage in the following years. To ensure food safety and quality it is essential to guarantee environmental health. In this way, the Marine Strategy Framework Directive (MSFD) and the Water Framework Directive (WFD) support the development of new technologies for monitoring pollution and management of good practices in environmental vigilance and food safety. In this communication we will present the work performed to develop distinct multiplexed immunochemical analytical platforms will be presented. The detectabilities obtained in all the platforms developed reached low detection limits (in the ppb range) measured directly in sea water.

Misuse of antibiotics in food producing animals enhances the possibility to develop antibiotic resistance and can also lead to the appearance of these compounds in derivated products.New strategies to overcome this issue are required. In this context, the FoodSmartPhone project will provide analytical tools to ensure the food quality concerning pesticides, vetenary products or allergens, from farm to fork. One of the strategies are fluoresncent microarrays which emerge as potential screening tools to determine the presence of multiple analytes at the same time. In this study, we present a multiplexed analytical platform based on hapten-oligonucleotide arrays to detect three families of antibiotics. The use of hapten-oligonucleotide conjugates allows the directed immobilization (DDI) of the signal for each antibiotic family by immobilizing the complementary oligo-probes over the surface of glass slide. Using this system a group of penicillins, sulfonamides and tylosins can be quantified on buffer and milk samples. The format of the assay will be the basis for the implementation of a Smartphone readout system.

Food fraud detection using next generation sequencing

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Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.4. Molecular techniques for the detection of food fraud
Keywords: Metabarcoding Sequencing Meat Fish PCR

Brief description of the submission

Correct labelling of processed foods under EU Regulation 1169/2011 requires proper consumer information. Traditional species detection methods have limitations identifying non-routinely analyzed species and scaling for many samples. DNA metabarcoding offers significant progress, providing detailed species lists and detecting species lacking PCR methods. Molecular identification by metabarcoding was applied to detect all species in meat, fish, spices, cereals, seeds and vegetal oil samples. A database was built with marker gene sequences (rbcL, matK, trnL, and ITS2) from global databases (NCBI, BOLD). Samples from local supermarkets plus prepared foods like mixed hamburgers, surimi, tortellinis, spices and oil were analyzed. Metabarcoding reliably characterizes complex mixtures, detecting as little as 1% DNA with 100% accuracy, and even less confirmed by qPCR. Unlike PCR, massive sequencing uses universal primers to detect rare species. Relative abundance quantification may vary by tissue, so qPCR validates results.

Abstract - Contribution details

Food fraud is a significant threat to the agri-food industry and to consumer safety, according to a 2022 report by the European Commission. These activities cause substantial economic losses for legitimate producers and pose health risks, particularly for individuals with food allergies or intolerances.

To address this issue, it is essential to develop robust analytical techniques capable of accurately identifying the ingredients present in food products. With this aim, the projects FOODFRAUD and GREENTRACE project were launched—an R&D initiative focused on the development of new methodologies for authenticating complex food mixtures and detecting adulterants in processed food. The projects are funded by the Valencian Institute for Business Competitiveness (IVACE) and co-financed by the European Union through FEDER funds.

One of the main technical challenges tackled is the extraction of high-quality DNA, due to the highly degraded nature of the DNA and its extremely low concentration. A combined approach, integrating both manual and automated steps, proved to be the most effective, enabling DNA recovery from matrices such as olive oil at a quality sufficient for downstream qPCR and NGS analysis.

NGS has played a central role in the project as a tool for molecular species identification. A multilocus barcoding strategy has been developed, specifically designed to detect DNA in complex mixtures. Primers were designed for highly conserved, well established and discriminatory genetic regions: rbcL, matK, trnL, and ITS2.

In parallel, species-specific qPCR protocols are being developed. qPCR serves as a valuable complement to NGS by providing precise quantification—essential for detecting substitution or dilution-based fraud. To date, species-specific primers have been successfully designed and optimized, and detection limits have been established.

The implementation of these technologies is expected to enhance transparency across the food supply chain, improve consumer protection, and strengthen the fight against food fraud using state-of-the-art tools.

Identifying cinnamon by terpene synthase sequence

Fialova, Lenka (1), Trödlerova, Martina

(1) Faculty of Chemistry, Brno University of Technology

Type of abstract: Poster
Subject area: T2.4. Molecular techniques for the detection of food fraud
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.4. Molecular techniques for the detection of food fraud
Keywords: qPCR-HRM, cinnamon, terpene synthase, food adulteration

Brief description of the submission

A poster presentation showing the results of a qPCR-HRM-based approach targerting the active site of *Cinnamomum* terpene synthase, which was applied on DNA from individual *Cinnamomum* species and on DNA isolated from their mixtures.

Abstract - Contribution details

Out of several species of cinnamon (Cinnamomum) used as spices, Cinnamomum verum is the most expensive. Its substitution for, or adulteration with other Cinnamomum species, which are cheaper, but also richer in coumarin (a hepatotoxic substance), is therefore a concern. One possible way to detect cinnamon adulteration is by PCR-based methods. In this work we present a real-time PCR-HRM based approach with newly designed primers targeting the active site of cinnamon terpene synthase, coupled with data analysis by hierarchical clustering. We were able to differentiate between several Cinnamomum species, as well as between several of their model mixtures. We concluded, that while several aspects of this approach still need optimization, the method has potential to be used for the detection of cinnamon adulteration.

Identifying cinnamon by terpene synthase sequence.

Fialova, Lenka (1)

(1) Faculty of Chemistry, Brno University of Technology

Type of abstract: Oral
Subject area: T2.4. Molecular techniques for the detection of food fraud
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.4. Molecular techniques for the detection of food fraud
Keywords: qPCR-HRM, cinnamon, terpene synthase, food adulteration

Brief description of the submission

results of a qPCR-HRM-based approach targerting the active site of Cinnamomum terpene synthase, which was applied on DNA from individual Cinnamomum species and on DNA isolated from their mixtures.

Abstract - Contribution details

Out of several species of cinnamon (Cinnamomum) used as spices, Cinnamomum verum is the most expensive. Its substitution for, or adulteration with other Cinnamomum species, which are cheaper, but also richer in coumarin (a hepatotoxic substance), is therefore a concern. One possible way to detect cinnamon adulteration is by PCR-based methods. In this work we present a real-time PCR-HRM based approach with newly designed primers targeting the active site of cinnamon terpene synthase, coupled with data analysis by hierarchical clustering. We were able to differentiate between several Cinnamomum species, as well as between several of their model mixtures. We concluded, that while several aspects of this approach still need optimization, the method has potential to be used for the detection of cinnamon adulteration.

IoT node for monitoring NH3 levels in livestock farms

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Type of abstract: Oral
Subject area: T2.5. EU policies, regulatory requirements and trends
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.5. EU policies, regulatory requirements and trends
Keywords: Gas sensors, Ammonia Sensing, EU directive, Livestock, Climate change mitigation

Brief description of the submission

The goal of NANOCHRONIA is to create a gas sensing system that improves the safety of producing, transporting, storing and using clean gases in industrial settings. NANOCHRONIA is developing small gas sensors made of metal oxide semiconductor (MOS) or functionalized graphene (f-G), which are highly specialized to measure gases such as hydrogen, ammonia, hydrogen sulfide, and methane. These sensors are significantly superior to current sensors due to their selectivity to the specific gas, small size, and low power consumption.

Abstract - Contribution details

Conducting continuous ammonia level measurements in the facilities where pigs are being fattened is of high interest, as the exposure to high ammonia levels is harmful, thus affecting the development of pigs. Having reliable information on ammonia levels would enable, on the one hand to correctly measure ammonia emissions and, on the other hand, to take action when needed (e.g., actuating on ventilation), which would result in an energy-efficient use of the heating, ventilation and air conditioning (HVAC) systems. The currently available technological solutions for measuring ammonia are not well suited to the harsh conditions (high humidity, dust, splashes) found in livestock fattening facilities. Here we will present and discuss our technological approach for measuring ammonia. Our solution comprises low-power, low operating temperature chemoresistive sensors that are highly sensitive and selective coupled to proprietary close-loop control electronic driving and readout for achieving fast and stable responses. Finally, our solution includes wireless communications and AI algorithms, enabling the deployment of IoT, unattended ammonia sensing networks throughout the facilities. The results of two pilots conducted for six months under real conditions in an experimental pig fattening farm will be thoroughly reviewed and discussed at the conference.

Acknowledgements: We are thankful to the Director and the staff of the Centre d'Estudis Porcins (CEP) for allowing us to conduct two pilot exercises in their facilities. This work has been funded in part by R2B 2021, Universitat Rovira i Virgili, 2021 INNOVADORS 00036, ACC1Ó, and project 56 30142 2021 2A from DARP-Generalitat Catatalunya, and Start Up Capital.

HClO for microbiological control in process water

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Type of abstract: Poster
Subject area: T2.6. Other
Subject area: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subject sub-area: T2.6. Other
Keywords: Electrochlorination Hypochlorous acid Biofilm Disinfectants Bacterial control

Brief description of the submission

Microorganisms in water systems can form resilient biofilms on pipe walls. To mitigate this, chlorine-based disinfectants like sodium hypochlorite (NaClO) and hypochlorous acid (HClO) are employed. Electrochlorination offers an on-site method for generating disinfectants from brine and electricity, providing a safer alternative to chlorine gas. This project, conducted within Valencia's secondary water distribution network, compared the efficacy of membrane electrochlorination-generated HClO against the routinely used NaClO. The study analyzed physicochemical and microbiological parameters, including ATP for microbial activity, and conducted metagenomic analysis of water and biofilm samples to assess bacterial composition. Results indicated that both disinfectants affected bacterial communities differently, with biofilm composition exhibiting similarities to the circulating water. Notably, HClO demonstrated superior efficacy in reducing biofilm populations compared to NaClO. These findings suggest HClO's potential as a disinfectant for industrial process water. This research was part of the AvantREG project (INNEST/2022/253).

Abstract - Contribution details

The microorganisms present in any aqueous matrix can adhere to the pipe walls and grow in an uncontrolled manner, protected within a biofilm that is difficult to eliminate. Thus, different chlorine-based disinfectants are used to control microorganisms such as sodium hypochlorite (NaClO), hypochlorous acid (HClO), etc. Among the alternatives, electrochlorination is defined as a process of in situ generation of the disinfectant, based on its precursors: salt (brine) and electricity. The solution generated, due to its low concentration, makes its handling much safer and reducing the risks incurred using chlorine gas. The city of Valencia has a secondary water distribution network that captures groundwater and then disinfects it with NaClO. The aim of this project was to compare the use of HClO obtained with a membrane electrochlorination technology against the commonly used disinfectant, NaClO, on the microbiological population in suspension and biofilms present in the low-pressure distribution network. During the study with NaClO and HClO, physicochemical and microbiological parameters were analysed, as well as ATP to determine microbiological activity. In addition, water and biofilm samples were taken for metagenomic analysis to evaluate the bacterial composition during the implementation of the disinfectants. It was observed that the treatment with the both chlorine species used affected the bacterial community differently. In addition, it was inferred that the bacterial composition present in the biofilms showed some similarity with the water that was circulating through the network at the time. Indeed, HClO was observed as a major abrasive agent of the biofilms, being able to reduce the populations to a greater extent than using NaClO. These results in the low-pressure water distribution network demonstrate that HClO could be a disinfectant agent transferable to industries that need to disinfect their process water. This work was enclosed in the AvantREG project (INNEST/2022/253).

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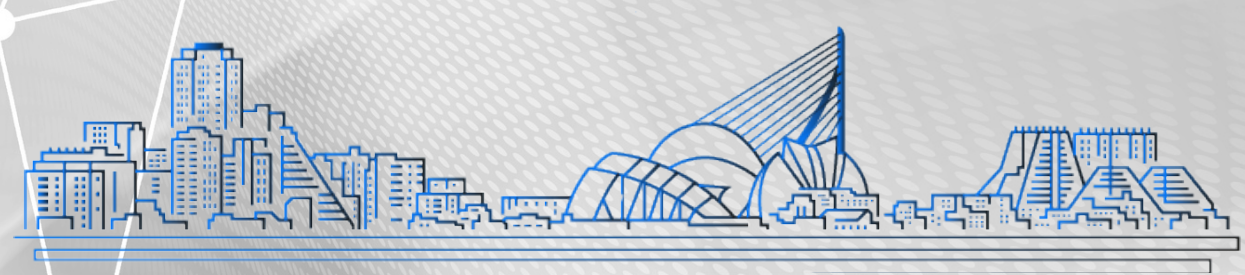

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Carbon based Electrochemical Platforms for Sensing

de Oliveira Paulo Roberto (1), Sans Victor (1)

(1) INAM-UJI

Tipo de comunicación: Oral
Área temática: T2.6. Other
Área temática: T2. Innovation and opportunities of sensing technologies in agrifood value chains
Subárea temática: T2.6. Other
Palabras clave: Carbon composite material; 2D and 3D electrodes; sustainable sensing

The development of carbon-based sensors combines low cost, chemical robustness, and excellent electrical properties, making them ideal for creating sustainable, high-performance platforms for real-world detection of pathogens and contaminants. In this work, it will be introducing three carbon-based electrode strategies (macro, 2D, and 3D electrodes), as sustainable sensing platforms for detection of contaminants and pathogens. First, a commercial glassy carbon (macro) electrode is modified with carbon black and bee propolis, enabling in situ formation of metal complexes which support simultaneous determination of total sugars and hydroxymethylfurfural (HMF) in honey samples. The use of propolis as a binder, a renewable and natural material, contributes to green chemistry by minimizing synthetic modifier usage. In a second moment, 2D paper-based electrode using conductive carbon ink is demonstrated for ciprofloxacin detection. This design emphasizes disposability, minimal waste, economic fabrication and scalability. The ink-based approach offers a more environmentally friendly alternative to traditional SPE systems. Finally, 3D conductive carbon filament electrodes, manufactured by additive manufacturing technique, are employed in two example applications. First, detection of bisphenol A is achieved by exploiting the three-dimensional architecture to improve analyte transport and sensor interface. Then, a biosensor for dengue virus detection is implemented by embedding biorecognition elements onto 3D carbon electrode surface.

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Topic 3: Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework

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Integrating data-mining and QSAR tools in SSbD

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Type of abstract: Poster
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: QSAR models, risk assessment, advanced materials, SSbD, life cycle

Brief description of the submission

The growing demand for advanced materials introduces challenges regarding safety and sustainability throughout life cycle. To address these issues, the Safe and Sustainable by Design (SSbD) approach promotes early-stage innovation integrating safety and environment considerations. In this context, the SUBBIMATT (Grant Agreement No. 101129911), funded under the European Union Horizon Programme, and DeCoRiS (INNTA2/2024/2), funded under IVACE+I “Incorporació” programme, projects focused on developing a workflow to facilitate comprehensive risk assessment in alignment with the SSbD framework. This workflow enables the extraction of experimental data and prediction of missing parameters using QSAR models. These in silico methods allow for efficient hazard evaluation while reducing the use of animal testing. Additionally, the system ensures alignment with regulatory frameworks such as REACH and CLP, facilitating the development of innovative materials that meet both safety and legislative requirements.

Abstract - Contribution details

The increasing demand for materials exhibiting advanced and smart properties has become critically important for the economic, environmental, and social development of contemporary societies. Nevertheless, this expanded application introduces significant challenges concerning safety and sustainability throughout the entire product life cycle. To effectively address these challenges, implementing strategies such as the Safe and Sustainable by Design (SSbD) is crucial, as it guarantees product safety and environmental sustainability from the earliest stages of development.

Within this framework, the SUBBIMATT (Grant Agreement No. 101129911), funded under the European Union Horizon Programme, and DeCoRiS (INNTA2/2024/2), funded under IVACE+I “Incorporació” programme, projects assume a pivotal role in driving innovative solutions. Both projects focus on developing a workflow engineered to facilitate comprehensive risk assessment in alignment with the SSbD framework. This strategy aims to systematically minimise risks associated with materials throughout their life cycle.

The proposed workflow enables the systematic extraction of experimental data and the efficient prediction of missing parameters using Quantitative Structure-Activity Relationship (QSAR) models. These in silico methodologies establish quantitative correlations between chemical structure and biological activity or toxicological endpoints, thereby significantly reducing the need for animal testing and facilitating the risk assessment process. Consequently, this approach supports a more rapid, precise, and SSbD-compliant hazard evaluation.

Furthermore, this system integrates regulatory frameworks, specifically the Classification, Labelling and Packaging (CLP) and Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulations, supporting alignment with legislative requirements for novel materials.

SUNRISE approach to establish methods for EHS impact

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Type of abstract: Any
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: Environment, health, safety, approach, assessment

Brief description of the submission

The SUNRISE project aims to develop an Integrated Impact Assessment Framework (IIAF) based on lifecycle thinking to support Safe and Sustainable by Design (SSbD) decision-making for advanced materials (AdMa). The IIAF consists of three tiers, with tailored methodologies and tools to assess health, environmental, social, and economic impacts, targeting various users across the innovation process. For Environmental, Health, and Safety (EHS) assessments, SUNRISE emphasizes hazard and exposure analysis. Key building blocks—tools, models, databases, and New Approach Methods (NAMs) like in vitro, in chemico, and in silico techniques—are evaluated for their relevance to the SSbD framework and different IIAF tiers. These elements address materials' identity, environmental behavior, and biological effects. A major focus is adapting or developing NAMs for AdMa hazard assessment, aligned with the 3Rs principles. The project aims to establish Integrated Approaches to Testing and Assessment (IATA), enabling robust, non-animal data generation for next-generation risk assessment (NGRA).

Abstract - Contribution details

The SUNRISE project seeks to create a comprehensive Integrated Impact Assessment Framework (IIAF) based on lifecycle thinking. This framework is designed to support Safe and Sustainable by Design (SSbD) decision-making throughout the supply chains of advanced materials (AdMa) and their products. The IIAF is structured in three tiers, each featuring a distinct integrated methodology (supported by a toolbox) to assess health, environmental, social, and economic impacts. These methodologies target different user groups at various stages of the innovation process, requiring varying levels of data and expertise. For Environmental, Health, and Safety (EHS) considerations, SUNRISE focuses on methodologies related to hazard and exposure. In this context, we present the SUNRISE approach for establishing a methodological foundation to assess EHS impacts within the three tiers of the IIAF. We have identified several key EHS-related building blocks, including tools, models, databases, and methodologies—such as New Approach Methods (NAMs) like in vitro, in chemico, and in silico methods. These have been evaluated for their relevance across the different tiers and aligned with the Steps 1, 2, and 3 of the EC-JRC SSbD framework. These building blocks will measure indicators related to 'what they are' (intrinsic physicochemical identity), 'where they go' (lifecycle release, environmental fate, biodistribution, and transformation by-products exposure), and 'what they do' (human health and environmental effects). Additionally, there is a need to adapt existing NAMs for assessing AdMa hazards or develop new ones, in line with the 3Rs principles, for regulatory purposes. This goal is a central focus of SUNRISE and will culminate in the development and application of Integrated Approaches to Testing and Assessment (IATA) based on NAMs. These approaches will support the generation of robust non-animal data, contributing to next-generation risk assessments (NGRA).

Sensor Network for PM Monitoring under TI Events

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Type of abstract: Any
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: Aerosols, PM2.5, PM10, IoT, Thermal Inversion

Brief description of the submission

The increasing presence of airborne particulate matter (PM2.5 and PM10) poses significant health and environmental risks, especially under thermal inversion conditions that trap pollutants near the ground. This work presents the design and deployment of a low-cost sensor network using LoRa (Long Range) technology for real-time air quality monitoring. The system measures PM2.5 and PM10 concentrations, temperature, humidity, and pressure, enabling detection and analysis of thermal inversion episodes. Sensors are calibrated and deployed across different altitudes using the “valley-mountain” method, allowing for vertical profiling of pollution during stratification events. Data are transmitted via LoRaWAN and visualized through a cloud-based platform for real-time and historical analysis. This approach demonstrates the feasibility of scalable, energy-efficient sensor networks to support early warning systems and inform environmental health strategies, particularly in regions with complex topography and recurring air pollution episodes.

Abstract - Contribution details

Air pollution caused by fine and coarse particulate matter (PM2.5 and PM10) has become a major public health and environmental concern, worsening respiratory and cardiovascular risks [1]. Thermal inversion events can significantly increase the risk of air pollution by trapping fine particulate matter close to the ground, particularly in urban areas with complex topography, such as valleys or mountain basins [2,3].

To address this, we developed and validated a wireless environmental monitoring system based on low-cost sensors and LoRa (Long Range) communication technology. The system integrates SDS011 laser scattering sensors for PM2.5 and PM10 detection [4], as well as BME280 modules for measuring ambient temperature, humidity, and barometric pressure, essential parameters for detecting thermal inversions and their correlation with particle accumulation.

The sensor nodes were deployed across altitudinal gradients following the "valley-mountain" method, allowing the capture of vertical pollution profiles during inversion episodes. The system uses LoRaWAN for energy-efficient data transmission over long distances, enabling operation in remote areas without relying on cellular infrastructure. Data streams are collected, processed, and visualized for both real-time and historical trend analysis.

A calibration process was conducted to ensure measurement consistency between sensor units. Additionally, the power system was optimized using solar panels, ensuring autonomous operation. The results confirm that this architecture provides reliable and scalable monitoring for early warning of critical pollution events and supports strategic air quality management efforts, democratizing environmental sensing technologies and complementing regulatory networks by offering spatial and temporal data resolution at finer scales [5].

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Plastic additives in Microplastics

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Type of abstract: Oral
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: Plastic additives, Py-GC-MS, LC-QTOF, GC-MS, prioritization

Brief description of the submission

The presence and environmental release of plastic additives (PAs) from microplastics (MPs) remain poorly understood. This, combined with the vast number of chemical compounds classified as PAs, underscores the need for robust methodologies to study exposure to these contaminants and to assess the associated risks to environmental and human health. This study presents a methodology based on an interdisciplinary approach that integrates the experience in experimental design and the knowledge on analytical chemistry to address this challenge. The approach involves the application of various analytical techniques, controlled additive release experiments, and the harmonization of results using databases and literature sources to identify the most relevant PAs for safeguarding environmental and human health.

Abstract - Contribution details

Plastic waste has increased exponentially, accompanied by a parallel rise in microplastics (MPs) generation. Plastics are typically formulated with additives that are not chemically bound to the polymer matrix, so they can leach out. MPs, due to their high specific surface area, are more exposed to environmental factors such as solar radiation, oxygen, and temperature that speed up the release of plastic additives (PAs). The limited information available on the specific additives present in many plastic products hinders accurate estimations of their release. This challenge is further compounded by the existence of approximately 10,000 chemical compounds classified as PAs. Therefore, prioritizing these substances is a key issue. This study proposes a methodology with an interdisciplinary approach to identify and prioritize PAs associated with MPs that are most likely to be released into the environment and potentially more harmful for human and environmental health.

To this end, an integrated approach combining controlled additive release experiments and specialized analytical techniques has been implemented. Pyrolysis coupled to gas chromatography mass spectrometry (Py-GC-MS) enable the detection of a wide range of PAs present in MPs particles and the application of complementary methodologies based on liquid and gas chromatography coupled to mass spectrometry (LC-HRMS and GC-MS) is very useful to monitor the release of PAs. The information achieved from the combination of these techniques is essential for expanding the scope of detection and improving analytical accuracy.

On the other hand, harmonizing the experimental results with existing databases and literature sources allows for the incorporation of additional prioritization criteria, including regulatory status, production volume, and estimated risk derived from QSAR models. This integrated strategy supports a more targeted quantification of the release of high-priority PAs from MPs in the environment, protecting human and environmental health.

Safety Evaluation for TiO2 Nanomaterials

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Tipo de comunicación: Oral
Área temática: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Área temática: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subárea temática: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Palabras clave: TiO2 nanoparticles; Surface functionalization; Nanosafety assessment; In-silico modeling; In-vitro toxicology

Breve descripción de la propuesta

This study presents an innovative integrated approach to assess the safety and sustainability of organically-functionalized TiO2 nanoparticles through combined computational and experimental methodologies. As part of the SUNRISE project framework, a multi-scale assessment strategy bridges molecular-level interactions with biological responses. The methodology integrates multiscale simulations and AI-based modeling to predict nanoparticle-biological system interactions. In-silico studies evaluated surface functionalization effects on cellular uptake, membrane interactions, and potential toxicity pathways. Computational predictions were validated through systematic in-vitro assays using relevant cell lines. Results demonstrate that organic functionalization significantly modulates TiO2 nanoparticle biocompatibility. The computational models predicted experimental toxicity trends, establishing reliable structure-activity relationships for rational nanomaterial design. This integrated framework enables predictive safety assessment early in the design phase, supporting the development of safer-by-design nanomaterials. The approach contributes to sustainable nanotechnology development by reducing animal testing requirements and accelerating the identification of environmentally benign nanoparticle formulations.

Resumen

The rapid expansion of nanotechnology applications necessitates comprehensive safety assessment frameworks to ensure sustainable development of nanomaterials. This study, conducted within the SUNRISE project, presents an integrated computational-experimental methodology for evaluating the safety and sustainability of organically-functionalized TiO2 nanoparticles, addressing critical knowledge gaps in nanosafety assessment.

The in silico multi-scale approach combines quantum mechanical calculations, molecular dynamics simulations, and quantitative structure-activity relationship modeling to predict nanoparticle-biological interactions at the molecular level. Density functional theory calculations characterized surface functionalization effects on electronic properties and reactivity patterns. Molecular dynamics simulations investigated nanoparticle interactions with cellular membranes, protein corona formation, and cellular uptake mechanisms. QSAR models were developed to establish predictive relationships between surface chemistry modifications and biological responses. In-silico studies evaluated different organic functionalization strategies to TiO2 surfaces. Computational results revealed that functionalization significantly modulates surface reactivity, hydrophobicity, and binding affinity to biological macromolecules. The integrated framework successfully established structure-activity relationships enabling rational design of safer nanomaterials. This predictive approach reduces reliance on extensive animal testing while accelerating the identification of sustainable nanoparticle formulations. The methodology provides a robust foundation for implementing safe-by-design principles in nanomaterial development, contributing to the SUNRISE project's objectives of promoting responsible nanotechnology innovation.

PREVENTION OF MICRO- AND NANO- PLASTICS IN RIVERS

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Type of abstract: Oral
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: Emergent pollutants, Microplastics (MPs), ecotoxicity, (bio)degradability, SSbD framework

Brief description of the submission

Prevention of micro- and nano- plastics in European rivers through the development of safer and biodegradable plastics by design (Project - UPSTREAM)

This study discusses global concerns over pollution caused by litter, plastics, and microplastics (MPs), prompting the search for sustainable solutions to reduce plastic waste. One of the UPSTREAM project's main objectives is to develop biodegradable and bio-based materials as alternatives to conventional plastics, having the packaging industry as one of the cases of study. Within this study, strategies are being devised to monitor the behaviour of new bio-based materials, as recommended in Step 3 of the SSbD Framework, which involves examining material release during product usage and assessing the transformation of polymers and their (bio)degradability in freshwater. This collaborative effort brings together industrial and academic partners compromised in the design of new biobased and biodegradable plastics preventing plastic pollution.

Abstract - Contribution details

In recent years, serious pollution issues coming from litter, plastics, and microplastics (MPs) formation have been a global concern [1]. Therefore, several alternatives and more sustainable solutions have been proposed to reduce plastic contamination. To prevent the creation of MPs, biobased and biodegradable materials can be produced as promising alternatives to petroleum-based plastics. The UPSTREAM project brings together industrial and academic partners compromised in the design of new biobased and biodegradable plastics to be used in the packaging industry. To investigate the potential release of materials from the final product as part of the Step 3 of the Safe & Sustainable by Design (SSbD) Framework, transformation mechanisms of the materials during the use stage of the final product were assessed. In this context, strategies to characterize the transformation of the polymers were developed, including monitoring of (bio)degradability capacity under laboratory (microcosm) and real environmental-based scenarios (mesocosm) as well as through the characterization of the newly developed biobased materials along accelerated weathering processes. In detail, biodegradability screening assays, following the standard protocol ISO 14851, of the different bio-based polymeric compounds in freshwater were performed. Biodegradability results, together with the material's performance results, permits to select the best material formulation composition. A PVA-PHBV blend has been found to be readily biodegradable in freshwater. However, as this material is intended to produce cutlery products at a large scale, further improvements on the PVA grade and the PHBV content are being carried out to improve material processability and performance. To simulate the end-of-life of the product, (bio)degradability tests of the final PVA-PHVB blend will be performed also using actual river sediment.

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A novel High throughput bio-membrane sensor

Rashid, Ashi (1), Andrew Nelson, Laurence (2), Kapur, Nik (1)
(1) University of Leeds, (2) School of Chemistry, University of Leeds

Type of abstract: Oral
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: novel coatings, plastics, bio-membrane sensor, membrane disruption.

Brief description of the submission

Monitoring emerging contaminants (ECs) e.g. pharmaceuticals, pesticides, microplastics and PFAS is a rapidly growing concern for environmental health and safety due to their persistence, bioaccumulation, and potential adverse effects on human health and the environment. Reducing the release of emerging contaminants from materials at source is crucial. One way is to minimize their human exposure by finding a better substitute through a toxicity assessment and an understanding of their mechanism of action. This contributes not only towards evaluation of their potential long term health hazards but also allows us to tune the material formulation with a less hazardous alternative, based on structure activity (SARs) data, following the SSbD framework. This research work involve use of a biomembrane based sensing platform for the assessment of membrane disruption caused by these materials.

Abstract - Contribution details

This presentation highlights the use of an electrochemical biomembrane sensor coupled with the innovative mini release accelerator (MRA) for membrane disruption of release products from plastic and PFAS coatings following the safe and sustainable by design (SSbD) approach. Tbe MRA has been used for the release studies of thermosetting epoxy plastic coatings under conditions simulating natural environmental ageing varying the temperature, pH and exposure time. Leachates from these plastic coatings and other coating materials are subjected to biomembrane screening to investigate the biomembrane disruption properties of these material leachates The biomembrane sensor utilizes a layer of dioleoyl phosphatidylcholine (DOPC) on a fabricated Hg-on-Pt chip electrode to generate characteristic rapid cyclic voltammograms (RCV). These RCVs contain current peaks due to underlying phase transitions in response to applied electric field. Changes in the RCV scan and associated capacitance peaks such as peak suppression in the presence of (bio)membrane active substances are related to membrane disruption detailing the nature and extent of the interactions. Extraction of membrane affinity parameters from the data enables the estimation of SARs of materials with the sensing layer. The data is continually used to access and improve the resilience and stability of the coatings reducing the release of damaging compounds from the coatings. This unique advanced material screening technology, and the results from screening of plastic and other coatings and their analysis will be presented at this conference.

This work is funded by the UKRI Horizon Europe Guarantee Fund: Grant Number 10056199.

QSAR for Evaluating NMs Coatings (Eco)toxicity

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Type of abstract: Any
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: Nanomaterials (NMs), QSAR, (Eco)toxicity, Endothelial cells

Brief description of the submission

Nanomaterials (NMs) possess unique properties that significantly enhance their industrial and technological applications but complicate evaluating their potential toxicological risks to human health and the environment. The CheMatSustain and MoToMaMi projects are dedicated to creating innovative methodologies to assess the safety and sustainability of chemicals and materials, particularly at the nanoscale. Given that NM coatings or ligands—organic molecules attached to nanoparticles—can influence their toxicity, the projects have developed Quantitative Structure-Activity Relationship (QSAR) models to predict toxicity based on molecular structure. These QSAR models utilize data from human endothelial cells and non-conventional organisms, such as algae and invertebrates, to assess human and ecological risks effectively, demonstrating strong predictive performance despite some data limitations.

Abstract - Contribution details

Nanomaterials (NMs) exhibit unique properties that have significantly enhanced their application in various industrial and technological sectors. However, these same characteristics that facilitate their application also make the assessment of their potential toxicological effects on human health and ecosystems difficult. In this context, the CheMatSustain project (Grant Agreement No 101137990), funded under the European Union Horizon Programme, and MoToMaMi (INNTA3/2024/2), funded under IVACE+I “Innodocto” programme, aims to develop innovative methods for assessing the safety and sustainability of chemicals and materials, particularly at the nanoscale level. NMs could exhibit complex compositions that comprise several layers, including the core, the shell, impurities or dopants, and ligands or coatings. These ligands or coatings are organic molecules attached to the external surface of the particle, contributing to its stability and functionalisation. Nevertheless, they can also influence the toxicity of NMs. Thus, to evaluate the potential hazard of NMs, Chematsustain's and MoToMaMi's initial step focuses on assessing the toxicity of these organic compounds. To achieve this, we have developed various Quantitative Structure-Activity Relationship (QSAR) models, which help predict toxicity by analysing the molecular structure of these compounds. Specifically, we have developed QSAR models using data from endothelial cells, as they are highly sensitive to stress and often come into contact with NMs, to evaluate the effects of organic compounds on human health. Concurrently, we have developed QSAR models using data from non-conventional organisms, including various algal species and invertebrate animals, to assess their environmental toxicity. Although there were some limitations in the available data, the developed models demonstrated good performance and will enable the prediction of potential risks from chemical substances.

Human-Relevant Toxicity: PCTS within IATA Framework

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(1) Sciensano

Type of abstract: Oral
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: NAMs, Risk Assessment, 3D models, longitudinal culture, precision cut tissue slices

Brief description of the submission

International organizations such as the OECD, ECHA, EFSA are increasingly supporting NAMs. Among these, precision-cut tissue slices (PCTS) stand out for preserving the complex architecture and cellular diversity of human organs. When applied within an Integrated Approach to Testing and Assessment framework, PCTS data can be combined with *in vitro* assays, computational models, and exposure data to offer a more comprehensive and predictive view of human toxicological responses.

We focused on precision-cut liver slices, confirming their metabolic activity in 4-day cultures and their use in studying lipid peroxidation following exposure to ZEN. In parallel, lung slices were cultured for 14 days, and patient-derived intestinal and ovarian cancer slices showed therapeutic responses consistent with clinical data.

By integrating multiple lines of evidence—including PCTS, computational models, and existing data—we aim to improve the scientific rigor, human relevance, and regulatory value of toxicity testing, ultimately strengthening human health risk assessment.

Abstract - Contribution details

International organizations such as the OECD, ECHA, and EFSA and others are increasingly supporting a paradigm shift in toxicology—moving away from traditional animal testing toward mechanistic, human-relevant approaches. Central to this shift is the growing support for New Approach Methodologies (NAMs) and Integrated Approaches to Testing and Assessment (IATA), which aim to improve the reliability, relevance, and ethical standards of toxicity testing for human health protection.

Ex vivo models such as precision-cut tissue slices (PCTS) are gaining attention for their ability to preserve the complex architecture and cellular diversity of human organs. When applied within an IATA framework, data from PCTS can be integrated with *in vitro* assays, computational models, and exposure data to provide a more comprehensive and predictive view of toxicological responses in humans.

Our research focuses on advancing the risk assessment of chemicals, mycotoxins, and micro/nanoplastics using Precision-Cut Liver Slices (PCLiS) as a 3D human-relevant tissue platform. PCLiS were cultured for four days, during which their metabolic competence was demonstrated by comparing viability after exposure to irinotecan and its active metabolite SN-38, confirming their ability to metabolize drugs ex vivo. For toxicological evaluation, slices were exposed to zearalenone, and lipid peroxidation was assessed measuring the oxidized-to-non-oxidized BODIPY ratio in enzymatically dissociated cells.

In parallel, human lung slices were longitudinally cultured for 14 days, retaining tissue integrity. Furthermore, patient-derived intestinal and ovarian cancer PCTSs evaluated for their response to various drug formulations showed very close correlation with the clinical data demonstrating PCTS as a predictive tool.

By combining multiple lines of evidence—including PCTS, computational models, and existing toxicological data—we aim to improve the scientific rigor, human relevance, and regulatory applicability of toxicity testing. Ultimately, our goal is to strengthen existing risk assessment platforms, contributing to more robust and human-centered decision-making in public health.

Monitoring microbiological risks in drinking water

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(1) bsns

Type of abstract: Oral
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: Viruses, Antibiotic Resistance Bacteria, Antibiotic Resistance Genes, Drinking water

Brief description of the submission

Although DWTPs are effective in reducing microbial contaminants, the persistence of viruses and ARGs remains a concern due to potential risks to public and environmental health. An initial metagenomic assessment was conducted on 44 influent and effluent samples from two DWTPs in Spain. This was followed by a comprehensive study analysing 192 samples, including influent, effluent, supply water, and biosolids, from six DWTPs. Viruses were concentrated by ultrafiltration and polyethylene glycol precipitation, and detection of enteric viruses, viral indicators and ARGs was performed using (RT-)qPCR. Bacteriophages, Escherichia coli, and ESBL-E. coli were determined by culture methods. NorovirusGI was the most frequently detected enteric virus in water samples, while astrovirus predominated in biosolids. ARG screening revealed high prevalence of tetA, catI, and sul1. Only few effluent samples tested positive for viruses or ARGs. Further research on drinking water production is necessary to ensure more efficient treatment processes and water quality.

Abstract - Contribution details

Although drinking water treatment plants (DWTPs) reduce microbial contaminants, the persistence of enteric viruses and antibiotic resistance genes (ARGs) remains a concern due to potential public and environmental health risks. This study investigated the occurrence of these hazards in different samples from DWTPs using metagenomic and targeted molecular approaches. A preliminary analysis of 44 influent and effluent samples from two Spanish DWTPs was conducted by untargeted metagenomics. This was followed by a three-year longitudinal study that analysed 192 samples from 6 DWTPs, including influent (n=72), effluent (n=72), supply water (n=24), and biosolids (n=24). 10 L water samples were concentrated using Dead-End Hollow Fiber Ultrafiltration (DEUF) combined with polyethylene glycol (PEG) precipitation. Enteric viruses including human norovirus GI and GII, rotavirus, hepatitis E and A viruses, and human astrovirus, as well as viral faecal indicators (Pepper mild mottle virus (PMMoV) and crAssphage), and ARGs (blaCTX-M, tetA, catI, qnrB and sul1) were detected by (RT-)qPCR. Additionally, concentrations of bacteriophages, Escherichia coli, and Extended-spectrum beta-lactamase (ESBL)-E. coli were determined by culture methods. Results showed that only 4 effluent samples tested positive for rotavirus by RT-qPCR. Most metagenomic data aligned with bacteriophages, although reads from hepatitis E virus, human adenovirus, and human gammaherpesvirus were also identified. In the extended study, human norovirus GI was the most prevalent enteric virus in influent, effluent, and supply samples, while human astrovirus was most frequently detected in biosolids. Viable bacteriophages, E. coli and ESBL-E. coli were detected in 43%, 38% and 9% of influent samples, respectively, with no ESBL-E. coli found in other matrices. ARGs tetA, catI, and sul1 were frequently detected by qPCR While most effluent and supply samples tested negative, the intermittent presence of viruses and ARGs highlights the need for further research to enhance treatment processes and minimize associated risks.

Active Nanomaterials: A Regulatory Approach

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Type of abstract: Any
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: Regulatory Evaluation, Antimicrobial, Antiviral, Nanocoatings, Risk Assessment

Brief description of the submission

To tackle regulatory challenges of active nanomaterials (ANMs) under the Biocidal Product Regulation (BPR), we've elaborated an approach. First, define the active substance as the core nanoparticle responsible for antimicrobial effects to streamline data requirements. Second, use existing non-nano exposure scenario documents (ESDs) temporarily while conducting specific studies on surface treatments' impact on toxicity and efficacy. Third, engage proactively with national Competent Authorities to clarify dossier expectations and risk assessment approaches, given the lack of harmonized standards. This strategy balances regulatory compliance with innovation, supporting companies to introduce advanced nanomaterial-based biocidal products into the EU market despite current gaps in guidance.

Abstract - Contribution details

The Biocidal Product Regulation (BPR, Regulation EU 528/2012) establishes a harmonized EU framework to ensure the safe and effective use of biocidal products. Within the SUSAAN project, innovative active nanomaterials (ANMs) have been developed for application on high-traffic public surfaces. These include bio-based hybrid systems, nanocapsules, active extracts, and inorganic nanocomposites. While promising in terms of antimicrobial efficacy, their novelty presents significant regulatory challenges.

A primary issue lies in the fact that such advanced technologies are not fully addressed by current regulatory provisions. Although the BPR includes definitions and some guidance on nanomaterials, it lacks clarity on essential aspects, such as whether functionalizations—e.g. surface treatments—are considered part of the active substance. This uncertainty complicates both data generation and the identification of the "true" active substance.

Another critical challenge is the risk assessment of nanomaterials. While the regulation requires nano-specific risk assessments, it offers limited guidance on how these should be conducted and lacks exposure scenario documents (ESDs) tailored to nanoscale substances. Additionally, only a few OECD test methods are validated for nanomaterials, further increasing uncertainty for applicants.

In the SUSAAN project, the current regulatory strategy is to identify the core particle as the active substance, as it drives the antimicrobial effect. Available properties and parameters of the active nano-substances have been used as inputs for non-nano ESDs, which act as a temporary basis for exposure assessment, while further studies investigate the impact of surface coatings ("shells") on efficacy, (eco)toxicity, and release characteristics. The lack of harmonized guidance requires applicants to engage directly with national Competent Authorities.

Overall, the absence of specific regulatory frameworks for biocidal ANMs hinders innovation. Bridging these gaps is essential to support the safe introduction of advanced nanomaterials in the EU market.

Understanding Packaging Scorecard

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(1) Food Packaging Forum

Type of abstract: Oral
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: Sustainability, Food contact, Chemicals of concern, circularity, migration

Brief description of the submission

- How do we define truly sustainable food packaging? Toxics can contaminate our food, bodies, and environments, resulting in liability for companies. Addressing packaging waste and the emissions associated with packaged foods are only two-thirds of the sustainability equation. The third piece of the puzzle is ensuring that all materials and chemicals used to produce that packaging are toxic-free. This is especially important in the food sector, where research shows toxic chemicals in packaging are entering our food.
- Potential chemical hazards associated with new alternative food packaging. New sets of rules and requirements from regulations are going to induce a shift away from conventional packaging materials (conventional plastics). We need to anticipate the chemical safety challenges with new alternative food packaging.
- How to assess the impacts of food packaging and foodware? The UP Scorecard helps holistically assess food service procurement options following a data and science-based approach within a single framework.

Abstract - Contribution details

Foodware and food packaging fulfill important functions throughout the life cycle of many foods, but identifying the most fully sustainable packaging options is complex for procurement professionals. Currently, what stakeholders assess and how they assess it is not always consistent or comprehensive. Different sustainability criteria are being applied across assessments and often with an overly narrow focus on single-impact areas, such as CO2 emissions, thereby distorting actual impact assessments. To enable a more holistic assessment and procurement of truly sustainable foodware and packaging products, decision-makers sourcing for the food service sector need science-based guidance and tools. To support this, we have developed the Understanding Packaging (UP) Scorecard as a free, open access, comprehensive, and LCA-based tool to help decision-makers compare commonly used foodware and food packaging across six impact areas: climate change, water use, plastic pollution, sustainable sourcing, recoverability, and chemicals of concern. Developed through an unprecedented collaboration of leading food service companies, NGOs, academics and technical experts, the UP Scorecard provides an easy-to-use, authoritative resource with a fully transparent methodology to help businesses make more holistic procurement decisions. We present the tool, share recent updates including a new list of chemicals of concern, and highlight some case studies of its use in procurement and beyond.

Regulatory readiness of in silico NAMs

Puzyn, Tomasz

Type of abstract: Oral
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: NAMs, in silico, regulatory readiness

Brief description of the submission

The talk aims to map the existing state-of-the-art and provoke discussion on the readiness of the available and recently developed computational tools to be used in the regulatory context for the chemicals and materials risk assessment worldwide.

Abstract - Contribution details

New Approach Methods (NAMs) have been recently considered by regulatory agencies worldwide to replace unnecessary animal testing in the process of chemicals and materials risk assessment. Efficient testing strategies should include using computational (in silico) models whenever possible to reduce the time and cost of the experimental work. The group of in silico NAMs covers various types of models, including physics-based models (e.g., molecular docking, Density Functional Theory calculations) and data-driven models employing Machine Learning techniques (e.g., Quantitative Structure-Activity Relationships).

Many various in silico NAMs have already been proposed. However, while the focus of the scientific community is rather on profoundly exploring phenomena, which certainly takes time, regulators urgently need to have tools that are practical in use and regulatory-relevant. For which groups of chemicals/materials and endpoints do we already have such in silico tools? In addition, both groups (scientists and regulators) declare high concern about quality, but the term ‘quality’ may be understood differently. In the context of in silico NAMs, one can ask about defining ‘minimum quality criteria’ to evaluate the applicability of the computational tools and models in the regulatory context. Although the OECD QSAR Assessment Framework, published last year, has been developed specifically for QSAR, can it be extended to other types of data-driven models employing machine learning? Is there anything to be added, considering the specificity of (nano)materials? How about the quality criteria of physics-based methods? Finally, how can we use generative Artificial Intelligence to accelerate the development and use of in silico NAMs for regulatory purposes (e.g., automated data extraction validation of the models according to the regulatory criteria)?

The talk aims to map state-of-the-art and provoke discussion on the readiness of the recently developed computational tools to be used in the regulatory context for the chemicals and materials risk assessment.

Integrating data-mining and QSAR tools in SSbD.

Fons, Marta

Type of abstract: Oral
Subject area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.1. Tools and methodological approaches for human and environmental hazard assessment
Keywords: QSAR models, risk assessment, advanced materials, SSbD, life cycle

Brief description of the submission

The growing demand for advanced materials introduces challenges regarding safety and sustainability throughout life cycle. To address these issues, the Safe and Sustainable by Design (SSbD) approach promotes early-stage innovation integrating safety and environment considerations. In this context, the SUBBIMATT (Grant Agreement No. 101129911), funded under the European Union Horizon Programme, and DeCoRiS (INNTA2/2024/2), funded under IVACE+I “Incorporació” programme, projects focused on developing a workflow to facilitate comprehensive risk assessment in alignment with the SSbD framework. This workflow enables the extraction of experimental data and prediction of missing parameters using QSAR models. These in silico methods allow for efficient hazard evaluation while reducing the use of animal testing. Additionally, the system ensures alignment with regulatory frameworks such as REACH and CLP, facilitating the development of innovative materials that meet both safety and legislative requirements.

Abstract - Contribution details

The increasing demand for materials exhibiting advanced and smart properties has become critically important for the economic, environmental, and social development of contemporary societies. Nevertheless, this expanded application introduces significant challenges concerning safety and sustainability throughout the entire product life cycle. To effectively address these challenges, implementing strategies such as the Safe and Sustainable by Design (SSbD) is crucial, as it guarantees product safety and environmental sustainability from the earliest stages of development.

Within this framework, the SUBBIMATT (Grant Agreement No. 101129911), funded under the European Union Horizon Programme, and DeCoRiS (INNTA2/2024/2), funded under IVACE+I “Incorporació” programme, projects assume a pivotal role in driving innovative solutions. Both projects focus on developing a workflow engineered to facilitate comprehensive risk assessment in alignment with the SSbD framework. This strategy aims to systematically minimise risks associated with materials throughout their life cycle.

The proposed workflow enables the systematic extraction of experimental data and the efficient prediction of missing parameters using Quantitative Structure-Activity Relationship (QSAR) models. These in silico methodologies establish quantitative correlations between chemical structure and biological activity or toxicological endpoints, thereby significantly reducing the need for animal testing and facilitating the risk assessment process. Consequently, this approach supports a more rapid, precise, and SSbD-compliant hazard evaluation.

Furthermore, this system integrates regulatory frameworks, specifically the Classification, Labelling and Packaging (CLP) and Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulations, supporting alignment with legislative requirements for novel materials.

Low-cost particle sensor for workplace risk control

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Type of abstract: Oral

Subject area: T3.2. Industrial oriented exposure and release assessments models and tools

Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework

Subject sub-area: T3.2. Industrial oriented exposure and release assessments models and tools

Keywords: Low-cost sensors, Particle emissions, Occupational exposure assessment, Risk management, Safety culture

Brief description of the submission

This study evaluates the implementation of low-cost particle sensors for occupational exposure monitoring across four industrial settings: construction and demolition, liquid pump manufacturing, plastics recycling, and insulation material production. The sensors were deployed alongside high-cost reference instruments and gravimetric sampling to assess performance across diverse airborne particle environments.

The low-cost sensors showed strong correlations with reference data during moderate emission activities, but suffered from saturation under high particle number conditions, such as floor removal, underestimating ultrafine concentrations. In addition to quantitative data, qualitative findings from on-site observations and worker engagement provided insight into how real-time exposure feedback affected safety awareness and the adoption of protective behaviours.

The study demonstrates both the value and the current limitations of low-cost sensing technologies for exposure assessment and risk communication in dynamic industrial environments.

Abstract - Contribution details

Occupational exposure to airborne particles and fibres presents a significant health risk across various industrial sectors. While conventional gravimetric sampling methods provide reliable long-term averages, they fail to capture short-term peak exposure events. In contrast, real-time instruments offer better temporal resolution, but are often expensive and technically complex for routine workplace use.

To address this gap, this study evaluated the use of low-cost particle sensors (LCS) for exposure assessment and risk management across four industrial sites: 1) construction and demolition; 2) liquid pump manufacturing; 3) plastics recycling and compounding, and; 4) insulation material production. Alphasense OPC-N3 LCS were deployed alongside reference instruments (TSI OPS 3330), and filter-based samples were collected for gravimetric, morphological, and chemical particle characterization.

The LCSs performed well under certain conditions. For example, during plastic mixing operations, their PM_{10} readings showed strong agreement with OPS data ($R^2 = 0.9$), with low scatter and strong linearity. However, during tasks with high particle number concentrations such as dry sweeping and floor removal in the construction sector, the LCS showed clear signs of saturation, plateauing at concentrations around 400-500 particles/cm^3, well below the specified upper limit. This saturation behaviour likely contributed to substantial underestimation of ultrafine particle concentrations.

Additionally, qualitative data from site observations and employee engagement were collected to explore changes in safety practices and workplace awareness following sensor deployment. These insights offered valuable evidence on how use of LCS real-time data influenced risk perception and use of preventive measures. The implementation highlighted both the advantages and measurement limitations of LCS in occupational settings, particularly their underestimation of ultrafine particles and challenges under high particulate loads.

This work was conducted by the National Research Centre for the Working Environment and the Danish Technological Institute, with support from the Danish Working Environment Research Fund, in collaboration with industry partners.

Digital Tool for Safety & Sustainability screening

Shandilya, Neeraj (1), Dekkers, Susan (1), Braakhuis, Hedwig (1), van Someren, Eugene (1), Fransman, Wouter (1)

(1) TNO

Type of abstract: Oral
Subject area: T3.3.Tools and methodological approaches to assist the lifecycle assessment and sustainability
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.3.Tools and methodological approaches to assist the lifecycle assessment and sustainability
Keywords: Safety, Sustainability, Design, Screening, Innovation

Brief description of the submission

Screening safety and sustainability early in innovation helps design products that perform well, are cost-effective, address societal needs, and avoid harm to humans and the environment. Early screening enables companies to address concerns proactively, when design is still adaptable and investment is low. We present TNO's digital Safety and Sustainability by design (SSbD) assessment tool to support early-stage product development through multi-dimensional safety and sustainability screening, aligned with approaches such as EC-JRC's SSbD framework, WBCSD's Portfolio Sustainability Assessment, CEFIC's SSbD guidance, and OECD's Early4AdMa. It evaluates human and environmental safety, performance, cost, and socioeconomic impact early in innovation using minimal data, generating an SSbD score (C-- to A++) and flagging issues for further review. The output includes uncertainty ranges proportional to information gaps and follow-up advice(s). Its intuitive interface and actionable outputs enable its integration into the early stages of the innovation process, enabling responsible product innovation.

Abstract - Contribution details

Neeraj Shandilya: Conceptualization, Methodology, Formal analysis, Writing & Editing

Susan Dekkers: Conceptualization, Methodology, Review

Hedwig Braakhuis: Conceptualization, Review, Funding acquisition

Eugene van Someren: Review, software development

Wouter Fransman: Conceptualization, Funding acquisition, Supervision

Applying sLCA in Pharma and Nanomaterials

Scheper, Johanna K. (1), Wolf, Clemens (1), Reinfelds, Matiss (1), Falk, Andreas (1), García Molinero, Daniel (1)

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Type of abstract: Poster
Subject area: T3.3.Tools and methodological approaches to assist the lifecycle assessment and sustainability
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.3.Tools and methodological approaches to assist the lifecycle assessment and sustainability
Keywords: SSbD, social LCA, nanomaterials, advanced materials, pharma

Brief description of the submission

Step 5 of the Safe and Sustainable by Design (SSbD) framework addresses social and economic impacts but remains underdeveloped due to methodological and data-related challenges. This presentation introduces two Austrian research projects that explore practical pathways for implementing Step 5 in industry contexts. PHASE 5 focuses on the pharmaceutical sector, analyzing the status quo, identifying key social issues, and developing a tailored socio-economic assessment framework for advanced materials. SESAM evaluates both social and economic dimensions of SSbD in early innovation stages, particularly in nanomaterial development. It assesses tools for social LCA and economic analysis, operationalizes a methodological framework, and tests its applicability in a real-life case study. Together, the projects contribute sector-specific insights that advance the integration of socio-economic aspects into SSbD practices, supporting more responsible innovation in material-intensive sectors.

Abstract - Contribution details

Step 5 of Safe and Sustainable by Design (SSbD) focuses on assessing social and economic impacts. However, its implementation remains challenging due to the limited maturity and standardization of social Life Cycle Assessment (sLCA). In response, applied research projects using real-world case studies are essential to advance practical methodologies. This contribution presents two Austrian projects addressing these challenges in distinct industrial contexts.

PHASE 5 focuses on the pharmaceutical sector and begins with a systematic status quo analysis—mapping the SSbD research landscape, analyzing relevant case studies, and identifying key social issues. It provides an overview of existing assessment methods, with attention to data availability and maturity levels. Based on this, stakeholder groups and priority topics are defined, and a socio-economic evaluation framework tailored to pharma-specific advanced materials is developed.

SESAM evaluates both social and economic dimensions of SSbD implementation in early innovation phases. It conducts in-depth analyses of tools suitable for applying sLCA and related economic assessment approaches. The project operationalizes a methodological framework to evaluate these tools, followed by practical testing in a real-life case involving nanomaterial production. The project assesses the usability of methods and derives implementation-oriented recommendations.

Together, both projects contribute to filling methodological gaps and advancing the integration of socio-economic considerations into the SSbD framework, especially for sectors dealing with complex material innovations.

SunRise e-infrastructure for Sustainable Innovation

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(1) Greendecision, (2) Emerge

Type of abstract: Oral
Subject area: T3.3.Tools and methodological approaches to assist the lifecycle assessment and sustainability
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.3.Tools and methodological approaches to assist the lifecycle assessment and sustainability
Keywords: Decision support system, Safe and Sustainable by Design, Multi Criteria Decision Analysis, Sustainability

Brief description of the submission

SunRise e-Infrastructure is an advanced digital platform that helps European industries implement Safe and Sustainable by Design (SSbD) practices for chemicals and materials. Developed under the EU H2020 SunRise project, it supports the full innovation cycle through tiered assessments, secure data sharing, and collaboration across the value chain. Open, FAIR, and blockchain-enabled, it guides users toward safer, more sustainable products and generates a verifiable SSbD digital pass.

Abstract - Contribution details

The SunRise e-infrastructure is a cutting-edge digital platform developed under the EU H2020 SunRise project to support European industries in implementing Safe and Sustainable by Design (SSbD) approaches for chemicals and materials. Aligned with the European Chemicals Strategy for Sustainability and the Zero Pollution Action Plan, it translates the Safe and Sustainable Innovation Approach (SSIA) into practice, supporting all five steps of the EC-JRC SSbD framework.

This system enables tiered assessments and iterative feedback loops throughout the innovation process, following an Agile Stage-Gate model. It offers not only technical functionality but also serves as a collaborative environment for dialogue and information exchange among SMEs, large companies, academia, and regulators.

SunRise addresses real-world needs by integrating stakeholder input during its development. It supports cost-effective data generation, grouping for read-across, and assessment of safety, sustainability, and functionality at every innovation stage—guiding decisions such as "Go to development" or "Go to market."

Open and FAIR by design, the e-infrastructure is connected to the SUNSHINE database, ensuring access to high-quality environmental, health, and safety (EHS) data. Blockchain technology ensures secure, trusted data exchange across supply chains. Ultimately, it can generate an SSbD digital pass for each product, offering a verifiable record of compliance.

SunRise is a comprehensive, secure, and collaborative solution to accelerate the shift toward safer, more sustainable innovation in European industry.

Applying the SSbD Livestock Waste Valorisation

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Type of abstract: Oral
Subject area: T3.4. Policy vision and initiatives to support the SSbD framework implementation at industrial level
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.4. Policy vision and initiatives to support the SSbD framework implementation at industrial level
Keywords: SSbD Preliminary assessment Methodology Biorefinery

Brief description of the submission

SSbD ensures that chemicals and materials are both safe and sustainable. This study applies the SSbD to a biorefinery that converts livestock waste into bioenergy and bio-based materials, using a closed-loop process. A preliminary assessment with theoretical data marks the first SSbD stage; a full life-cycle approach addresses complexity, but data uncertainty remains until real operational data is obtained.

Abstract - Contribution details

SSbD is a framework to ensure that chemicals and materials are safe and sustainable for human health and the environment while promoting sustainability throughout their lifecycle. In this study, the SSbD methodology is adapted to the development of a biorefinery concept that transforms livestock waste into valuable products such as bioenergy and bio-based materials. The system operates in a closed loop, where by-products from one process become inputs for the next, maximizing resource efficiency and minimizing waste.

A preliminary assessment is conducted using theoretical data from key stakeholders, marking the first stage in the SSbD stage-gate methodology. The use of theoretical data means there is a high level of uncertainty, and further steps will require real operational data for refinement. Unlike standard SSbD approaches that focus on individual chemicals, this study proposes a full life-cycle approach to address the complexity of the biorefinery, where all processes are interconnected and multiple products are obtained.

The assessment includes four main steps. First, the intrinsic hazards of each substance are identified according to the REACH Regulation. Second, risks to human health and the environment during production and processing are evaluated, considering exposure and protective measures. Third, potential risks during the use of final products are assessed, assuming that substances are fully transformed into safe products such as biofertilizers and animal feed supplements. Finally,step 4 evaluates environmental impacts from raw material extraction to end-of-life, focusing on climate change, terrestrial acidification, and land use, and comparing results to traditional manure management. After applying the SSbD framework, the biorefinery achieves a score of 2, based on theoretical data that will need to be reviewed and updated throughout its lifecycle.

This study is part of the MANUREFINERY project, funded by HORIZON JU Innovation Actions under grant agreement No 101157679

SUBBIMATT: Bio-Inspired STMs for Future Energy Needs

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Type of abstract: Poster
Subject area: T3.5. Industrially oriented research projects
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: SSbD SmartTextileMaterials RiskAssessment

Brief description of the submission

The SUBBIMATT project ("Sustainable, Biobased, and Bio-Inspired Materials for Smart Technical Textiles") is a four-year EU-funded initiative under Horizon Europe, coordinated by Centexbel. It aims to develop innovative smart textile materials using biobased and bio-inspired technologies to meet current and future energy and sustainability needs. SUBBIMATT focuses on advanced materials —such as debondable adhesives, bio-polyurethane, and thermoresponsive polymers— for high-performance applications including shape-morphing building envelopes, automotive textiles, and breathable garments. These materials will enable functionalities like mechanical actuation, energy harvesting, and adjustable fabric openness. The project integrates Safe and Sustainable by Design (SSbD) principles, combining predictive modelling and experimental validation to ensure safety, performance, and environmental compatibility. A strong consortium of 14 European partners, including SMEs and large enterprises, supports the project's ambition to create next-generation sustainable smart textiles.

Abstract - Contribution details

The SUBBIMATT project - acronym for "Sustainable, Biobased, and Bio-Inspired Materials for Smart Technical Textiles" - was officially commenced on 1 September 2024, initiating an important EU-funded initiative focused on developing innovative and sustainable smart textile materials. The project aims to address both current and future energy needs by leveraging biobased and bio-inspired technologies to create materials that combine sustainability with high functionality. Coordinated by Centexbel, SUBBIMATT is part of the European Union's Horizon Europe program under the call HORIZON-CL4-2023-RESILIENCE-01-TWO-STAGE and will run for four years, concluding on 31 August 2028.

The core objective of SUBBIMATT is to develop advanced smart textile materials (STMs) that integrate biobased components, such as debondable adhesives, bio-polyurethane, and negative thermoresponsive materials. These materials will be used to produce high-end coated fabrics, nanomembranes, and shape memory filaments, which will serve as the foundation for bio-inspired smart textiles capable of mechanical actuation, energy harvesting, and adjustable fabric openness. The innovative outcomes of SUBBIMATT will be demonstrated through three key applications: shape-morphing building envelopes, automotive interior textiles, and advanced garments with adaptable breathability. The project also aims to integrate elements such as sensors, batteries, and supercapacitors sourced from other European projects, thus enhancing the overall functionality of the demonstrators and showcasing inter-project synergies.

The SUBBIMATT project applies a Safe and Sustainable by Design (SSbD) framework, ensuring that the materials developed are not only innovative and functional but also environmentally safe and sustainable. By combining predictive modeling with experimental characterization, the project aims to optimize the performance, safety, and energy-harvesting capabilities of the smart textile materials and their applications.

The consortium behind SUBBIMATT is a diverse and multidisciplinary group of leading organizations from across Europe. Centexbel coordinates the project and consists of 14 partners, including 3 SMEs and 4 large enterprises.

SSbD Microcapsules With EOs For Post-Harvest

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Type of abstract: Oral
Subject area: T3.5. Industrially oriented research projects
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: Safe and Sustainable by Design (SSbD) Post-harvest Microencapsulation Essential oils Antifungal protection

Brief description of the submission

Laurentia Technologies, in collaboration with ITENE Technological Center and Ca' Foscari University of Venice, will present the obtained results from the Laurentia Technologies Case Study within the framework of the SUNRISE project.

The main goal of the SUNRISE project is to develop an overarching Integrated Impact Assessment Approach (IIAA), based on life cycle thinking and designed to support Safe and Sustainable by Design (SSbD) decision making along supply chains of advanced materials (AdMa) and their products.

The Laurentia Technologies Case Study will be focused on the development of a solution to extend the shelf life of the fruit, through development of protective coatings that will provide antifungal properties. The materials responsible of those antifungal functionality will be natural essential oils microencapsulated with safe materials from natural sustainable resources.

Abstract - Contribution details

Safe and Sustainable by Design (SSbD) Bio-Based Microcapsules With Essential Oils For Post-Harvest Treatment

Alberto Lopera, Mariajosé López-Tendero, María Rivero, Sara Trabucco, Andrea Brunelli, Elisa Giubilato, and Elena Badetti.

Fresh fruit and vegetable consumption is in continuous growing due to their nutritional value. However, most of post-harvest management are based on synthetic chemicals that may have harmful effects to human health and nutritional value of fruits and vegetables. Therefore, using natural resources to post-harvest management would be a safer and more sustainable approach.

One of the natural resources and alternatives in post-harvest management are natural Essential Oils (EOs) of aromatic crops such as Clove, Lavender, Thyme, among others. However, EOs are volatiles, photosensitive, and degradable when exposed to temperature and light, which can affect its biological properties decreasing their bioavailability. An easy-to-prepare and low-cost way to protect EOs against degradation is microencapsulation with natural biopolymers, providing higher thermal stability and better colloidal stability of the EOs, as well as controlled release of the EOs.

In the present work, Laurentia Technologies, in collaboration with ITENE and UNIVE within the framework of the European Project SUNRISE, presents the design and physico-chemical characterization of Pectin-Gelatin microcapsules with EOs for apples post-harvest application. The main aim is to provide antifungal protection of apples, as a safer and more sustainable alternative to the current methods based on synthetic chemicals.

Bio-Based Nanocapsules with Antimicrobial Activity for Functional Coatings

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Type of abstract: Poster
Subject area: T3.5. Industrially oriented research projects
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: Bio-based polymers, Nanocapsules, Essential oils, Antimicrobial textiles, Sustainable coatings

Brief description of the submission

This contribution presents the development of sustainable antimicrobial nanocapsules (NCs) designed for functional textile coatings. Using bio-based and biodegradable polymers such as modified zein and poly(methylvinyl ether-co-maleic anhydride), essential oils like oregano and eucalyptus were encapsulated to enhance stability, control release, and prolong antimicrobial activity. The nanocapsules were synthesized via nanoprecipitation under green chemistry principles and optimized through chemical functionalization and silane crosslinking. The resulting NCs demonstrated narrow size distribution (PDI ~0.21–0.25), high colloidal stability (ζ-potential ~–30 mV), and efficient antimicrobial activity, particularly for oregano-loaded systems. Characterization was carried out using DLS, FTIR, SEM, and TGA. These NCs represent promising eco-friendly alternatives to synthetic antimicrobial agents for high-contact textile applications. Further work includes antiviral testing and performance evaluation on coated fabrics.

Abstract - Contribution details

Bio-Based Nanocapsules with Antimicrobial Activity for Functional Coatings

Nataliia HUDZENKO[1], Liudmyla GRYSHCHUK[2 3], Sergiy GRISHCHUK[2], Bernd Wetzel[1]
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Abstract

Each person contacts about 300 surfaces every 30 minutes, encountering up to 840,000 germs. Infectious pathogens are commonly found on surfaces like elevator buttons, door handles, and textiles in high-traffic areas such as hospitals, nursing homes, and daycare centers.

In the frames of SUSAAN-project were developed bio-based and biodegradable nanocapsules (NC), containing essential oils (EOs, oregano or eucalyptus) as antimicrobial (AN) active materials, that can be used as functional coatings to impart AN property to textiles. By encapsulating EOs in polymer shells made from zein or poly(methylvinyl ether-co-maleic anhydride), they can be protected from degradation, their activity can be prolonged, and their processing can be simplified. Chemical functionalization of shell polymers by amidation or aminoalkylation with further partially cross-linking with silane results in reduced polydispersity (PDI ~0.21–0.25) and NCs´ size (~220–300 nm), enhanced dispersion stability (ζ-potential ~-30 mV), improved AN substances release profile.

Oregano-loaded NCs with modified zein-shell demonstrated efficient triggered release and highest AN efficacy. NCs are

synthesized by nanoprecipitation methods based on "green chemistry" principles. Simplicity of the method allows effective performing of scale-up of the synthesis. Synthesized NCs were characterized by DLS, FTIR, SEM and TGA methods.

Developed NCs demonstrate potential as sustainable alternatives to synthetic ANs in high-contact textile surfaces. Ongoing studies include cytotoxicity evaluation, antiviral screening, and coating property assessment (e.g., adhesion, durability).

Keywords: Bio-based polymers, Nanocapsules, Essential oils, Antimicrobial textiles, Sustainable coatings

Acknowledgements

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PAINT'S ECOTOXICITY AND BIODEGRADABILITY ASSESSMENT

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Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: Antifouling paint, microplastics (MPs), ecotoxicity, biodegradability

Brief description of the submission

Ecotoxicological AND BIODEGRADABILITY ASSESSMENT of Biobased antifouling paints for marine applications (Project - NAUTILUS)

Biofouling is a significant issue in marine ecosystems, leading to economic costs for human aquatic activities. The use of antifouling paints contributes to the release of biocides as well as microplastics, which could pose an ecotoxicological impact on marine species. The NAUTILUS project aims to develop bio-based and biodegradable antifouling paints to reduce their environmental impact. These new bio-based paints were tested in laboratory microcosms and open sea environments, assessing their ecotoxicity and (bio)degradability compared to commercial antifouling paints.

Abstract - Contribution details

Biofouling is a problematic phenomenon to human aquatic activity, especially in marine ecosystems, due to the damage that causes to both dynamic and static infrastructures leading to serious economic costs. However, the use of antifouling paints on the boats contributes to the release of emerging pollutants (e.g., microplastic - MPs) thus contributing to potential ecotoxicological impacts in marine species. Since modern antifouling paints consist of polymer matrix coatings containing various types of biocides, potential concerns on aquatic ecosystems are coming from the biocide released as well as from the degradation of the polymeric matrix, thus potentially generating MPs. NAUTILUS project brings together industrial and academic partners compromised in the design of new biodegradable antifouling paints towards minimizing their impacts on the environment. In this context, the environmental impacts of the new biobased paints were investigated under laboratory settings (microcosms) as well as in open sea scenarios, compared to benchmark modified commercial antifouling paint results. At the microcosm scale, multi-species (at different trophic levels) ecotoxicity tests (assessment of their possible toxic effects), along with multi-monitoring of biodegradability capacity, were conducted. Moreover, identification and quantification of released and transformed substances from paints during the exposure in marine water of painted panels (simulating a boat’s hull). NAUTILUS consortium has successfully developed one biobased and biodegradable paint formulation, based on PHA polymeric matrix, which has demonstrated to not cause ecotoxicological effects in the tested marine organisms. Further improvements will be made to reach a similar functionality of the PHA-based paint to the commercial ones.

Importance of EAs along LC of nanocomposites

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Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: exposure, hazard, nanotubes, lifecycle, SWCNT

Brief description of the submission

Carbon nanotubes have outstanding properties that enable new applications such as high-performance concrete, super capacitors, improved conductive electrodes and inks, nanocomposites, etc. In polymers, the CNTs are used as additives to reinforce and enhance mechanical properties or to enable electrical/thermal conductivity. In this context, we conducted two case studies to investigate possible possible released of SWCNTs from polymer nanocomposites. Potential exposure to airborne SWCNTs was studied during two laboratory-scale case studies of epoxy resins and lithium-ion batteries (LIB) containing TUBALL in the polymer matrix and cathode materials, respectively. It is pointed out that TUBALL improves the mechanical properties of the epoxy resins for floor coating applications and the cycle stability and, consequently, the service life of LIBs. The samples containing TUBALL were subjected to mechanical stress to simulate abrasion during the use of epoxy resins for floor coating applications, while the TUBALL containing lithium-ion battery samples underwent mechanical pre-treatment.

Abstract - Contribution details

1st case study of epoxy resins, a tribometer was used to simulate mechanical ageing and abrasive wear during the use phase of a nano-enabled product containing SWCNTs-brand TUBALL™. 2e case study, LIBs were manually disassembled and the anode and cathode materials containing TUBALL™ were crushed by milling. To obtain information on occupational health and safety (OHS), STAT PEEL's material-selective Identifier C2-system was used to collect airborne particles, i.e. particulate matter and ultra-/fine particles, during the laboratory-scale experiments and measurement campaigns. Raman spectroscopy allowed for the quantification of TUBALL. Unique identifier a patented portable air sampler used during the experiments of the project DIAGONAL/SUNSHINE. This allowed us to obtain qualitative and quantitative information on the release of airborne CNTs for OHS purposes. In addition, SEM was used to obtain information on the nanofiber morphology. Case 1. Exposures during simulated abrasion testing :In this study, we investigated the potential release of TUBALL™ from epoxy floor coating. Case 2. Exposures during simulated recycling processes: During the simulated recycling processes on laboratory scale, the grinding of the LIB cell components, comprehensive aerosol measurements were performed. Which proved that these experiments have to be repeated on a laboratory scale, which cannot easily be upscaled to recycling facilities. Conclusions: TUBALL™, exhibits a distinctive morphology, behaviour during the LC-stages in comparison with other carbon nanotube types. This renders some standardised test models inapplicable. The data generated from the case studies conducted under the EC-projects DIAGONAL/SUNSHINE for the purposes of exposure assessment and SSbD indicate that the nanomaterial TUBALL™ is safe for use. To further confirm these findings, it is important to assess all the LC-stages of SWCNTs and their environmental pathways and potential exposure routes. The objective is to ensure responsible and safe use with meaningful risk management.

SSbD methodology for surface treatment sector

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Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: SSbD; Surface Treatment; Methodology development; Methodology

Brief description of the submission

The Safe and Sustainable by Design (SSbD) framework offers a solid foundation for assessing the risks and impacts of products and processes, originally focused on the chemical and materials sectors. To extend its application, the Cervera consortium's centers specializing in surface treatment adapted this methodology within the Surfera Plus project. CTME tailored the SSbD guidance, developed by Abbate et al., to address sustainability and occupational safety in surface treatment. Using two project demonstrators, the methodology's capabilities were tested, revealing critical points requiring refinement. Additionally, a socioeconomic impact evaluation method was created, incorporating life cycle costs, critical materials, and social Life Cycle Assessment (social LCA). The adapted methodology covers key steps in the surface treatment process, streamlining future framework application. Looking ahead, incorporating risks from individual unit processes is a potential enhancement, as the current method focuses primarily on intrinsic material risks, in line with Abbate et al.'s recommendations.

Abstract - Contribution details

The Safe and Sustainable by Design (SSbD) framework offers a solid foundation for comparing the risks and impacts of products and processes. Although currently focused on the chemical and material sectors, its principles are highly relevant and should be extended to other industrial fields. In these broader contexts, SSbD can guide the (re)design of products and production systems towards safer and more sustainable outcomes.

The Surfera Plus Network of Excellence is a project funded by the CDTI through the CERVERA 2023 Program, aimed at creating a Network of Excellence to valorize surface functionalization technologies for national, strategic, and socially impactful industrial sectors. The network includes the national technology centres AIN (Coordinator), TEKNIKER, CIDETEC, IDONEAL, and CTME. CTME has adapted the SSbD methodological guidance, originally developed by Abbate et al. for chemicals and materials, to the surface treatment sector. This adaptation establishes a design framework emphasizing sustainability and occupational safety within the sector. To develop the adapted methodology, the original guidance served as a starting point. Its capabilities and results were evaluated through two demonstrators developed within Surfera Plus. This testing identified critical areas needing intensified efforts or methodological adjustments. Furthermore, an evaluation method for socioeconomic impact was created, incorporating life cycle cost, critical materials, and social Life Cycle Assessment (social LCA).

The resulting methodology, based on Abbate et al.'s work, includes identified critical points, more concise approaches for certain steps, and a social assessment tailored to surface treatment. Except for the LCA step, a specific methodology was developed for all stages, streamlining SSbD application in this sector. As Abbate et al. recommend, the current approach considers only the intrinsic risks of materials; future improvements could integrate risks associated with individual unit processes.

Sustainability Assessment Framework for Textiles

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Type of abstract: Oral
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Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: Sustainability, Safe-by-design, Sustainability framework, Occupational exposure assessment, Risk management

Brief description of the submission

This study presents key challenges and solutions identified in BioFibreLoop project, which advances circular textile innovations aligned with the Safe and Sustainable by Design (SSbD) framework and the European Chemicals Strategy for Sustainability.

The project addresses industrial barriers such as hazardous substance substitution, lack of integrated assessment tools, and data gaps on chemical impacts across the life cycle. To overcome these, BioFibreLoop developed a comprehensive sustainability assessment framework that merges top-down alignment with the SSbD framework and Sustainable Development Goals (SDGs) with bottom-up stakeholder engagement.

The framework integrates Human and Environmental Risk Assessment, Life Cycle and Social Life Cycle Assessment, and Techno-Economic Assessment. It guides safety and sustainability evaluations across the product life cycle, with a focus on hazard avoidance, material efficiency, and recyclability – enabling continuous improvement and contributing to SDGs on climate action (SDG 13), sustainable industry (SDG 9), responsible consumption (SDG 12), and health (SDG 3).

Abstract - Contribution details

This study presents key industrial challenges and solutions emerging from the BioFibreLoop project, which develops circular textile innovations aligned with the Safe and Sustainable by Design (SSbD) framework and the European Chemicals Strategy for Sustainability.

Implementing SSbD in the textile sector reveals persistent systemic barriers: the substitution of hazardous substances without compromising performance, the lack of integrated tools for safety and sustainability assessment, and limited access to reliable data on chemical exposure, emissions, and end-of-life impacts (1–5). Balancing material innovation with regulatory compliance and economic viability adds further complexity.

To address these challenges, BioFibreLoop developed a comprehensive safety and sustainability assessment framework. This framework combines a top-down approach – built upon the SSbD framework and Sustainable Development Goals (SDGs) – with bottom-up engagement of industry and research stakeholders. It integrates Human and Environmental Risk Assessment (HRA/ERA), Life Cycle Assessment and Social Life Cycle Assessment (LCA/S-LCA), and Techno-Economic Assessment (TEA).

Designed on a flexible roadmap, the framework supports safety and sustainability evaluation across the entire product life cycle – from early-stage design to validation and demonstration. It promotes material efficiency, hazard avoidance, energy reduction, and recyclability. Real-world testing and harmonized methodologies enable identification of trade-offs, continuous improvement, and broader applicability.

The framework can help the textile sector to operationalize SSbD principles while contributing to several UN SDGs, including climate action (SDG 13), responsible consumption and production (SDG 12), sustainable industry (SDG 9), and good health and well-being (SDG 3).

We will share lessons learned, transferable insights, and practical recommendations for implementing SSbD-aligned innovation in industrial settings, with potential for replication beyond the textile sector.

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SSbD synthesis of Alkyl Polyglucosides for Paints

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Subject sub-area: T3.5. Industrially oriented research projects
Keywords: Paint Surfactant Safe and Sustainable by Design Alkyl Polyglucoside Miniemulsion

Brief description of the submission

"Safe and Sustainable by Design (SSbD) Process for the Synthesis of Alkyl Polyglucosides for Application as Paint Surfactants" presents one of the seven case studies from the ALCHEMIST European Project.

This case study involves Laurentia Technologies, Pinturas BLATEM, and Tekniker Centro Tecnológico and focuses on the development of safer and more sustainable methodologies for the synthesis of safer and more sustainable surfactants (as the Alkyl Polyglucosides) intended for use in paint formulations.

In this poster, we present: (i) an overview of the case study objectives and context, and (ii) the progress and key results achieved since the beginning of the project.

Abstract - Contribution details

Safe and Sustainable by Design (SSbD) Process for the Synthesis of Alkyl Polyglucosides for Application as Paint Surfactants

Surfactants as Alkylphenols ethoxylates (APEOs), including their degradation products nonylphenols (NPs) and fatty alcohol ethoxylates (FAEs), are often used in paint formulations. These substances are linked to reproductive health issues and act similarly to hormonal compounds that threaten nervous system and immune system. In that context, Alkyl polyglucosides (APGs), derived from natural sources, have been proposed as a Safe and Sustainable by Design (SSbD) alternative, offering much added advantages such as high biodegradability, lesser toxicity, ease of raw material availability, and easy applicability. The traditional chemical process for APGs production involves a multi-step and energy intensive process that requires the use of solvents, high temperatures, pressure, and fast removal of produced water to avoid hydrolyzation reactions, which results in high environmental impact and high market prices.

In the framework of the European Project ALCHEMISSTS, Laurentia, Tekniker and Blatem collaborate in the design of Safe and Sustainable processes for the synthesis APGs from different sugars (glucose, saccharose) and fatty alcohols with different number of carbons (from 8 to 10). A common approach based on the application of miniemulsions to isolate generated water from synthesized APGs is being applied. We present the results for 3 different catalysts able to reduce temperature and reaction time. In parallel APGs surfactants efficacy in paint application is also presented. Next project steps will be the study of enzymatic catalysts to achieve high reaction yields at room temperature processes.

Sustainability assessment of retrofits: lessons

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Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: Sustainability, risk assessment, life-cycle assessment, air-pollution, retrofit solutions

Brief description of the submission

The *European Green Deal* has a *Zero pollution ambition for a toxic free environment* "to protect Europe's citizens and ecosystems...", which includes actions to reduce particulate air-pollution matter (PM). The EU Horizon Europe project, AeroSolfd, developed three market-ready and Safe-and-Sustainable-by-Design (SSbD) retrofit solutions to limit PM from petrol engine exhaust, brake-wear emissions from commuter buses and exposure in semi-closed environments. An Overall Sustainability Assessment (OSA) framework with Sustainable Development Goals (SDGs) and target indicators identified by the EU and within the project were developed to assess the impact of the solutions. We present main results from the OSA and challenges encountered in the process of human and environmental risk assessment, social life-cycle assessment (S-LCA), environmental life-cycle assessment (E-LCA), and economic impact. Even at a market-ready innovation stage, it remains challenging to obtain comprehensive datasets for LCA and OSA assessments.

Abstract - Contribution details

The *Zero pollution ambition for a toxic free environment* in the *European Green Deal* aims "to protect Europe's citizens and ecosystems (...) and (...) prevent and remedy pollution from air, water, soil, and consumer products". The EU Horizon Europe project, AeroSolfd, targeted these issues by three market-ready and Safe-and-Sustainable-by-Design (SSbD) retrofit filtration solutions to limit particulate air-pollution matter (PM) from: petrol engine exhaust, brake-wear emissions from commuter buses, and exposure in semi-closed environments. An Overall Sustainability Assessment (OSA) framework was developed aligning with the Sustainable Development Goals (SDGs) and target indicators identified by the EU and within the project. The final OSA is based on human (general population, worker) and environmental risk assessment, social life-cycle assessment (S-LCA), environmental life-cycle assessment (E-LCA), and economic impact.

S-LCA showed that society perceives PM as a risk, wishes for action, and has a positive attitude towards the retrofit solutions. Testing showed that the tail-pipe and passive brake-wear filters can reduce emissions by 95-99% (by ultrafine particle number; PN) and 35-40% (PM_{10}), respectively. Air filter units demonstrated in an underground metro station and a bus depot reduced $PM_{2.5}$ by at least 20-40%. E-LCA showed important contributions towards SDG 3: Good Health and well-being; SDG 11: Sustainable cities and communities; SDG 14: Life below water; and SDG 15: Life on land. Despite the retrofit solutions reached an advanced innovation stage, it remains challenging to obtain comprehensive datasets for LCA and OSA assessments: Information may be confidential; it is challenging to obtain data from upstream suppliers and on potential recycling approaches; estimation of the impact on city PM-levels requires specific information on the fractional contribution from different traffic sources. Finally, the potential effect of PN reduction in tail-pipe emissions is uncertain due to a knowledge gap in epidemiological evidence for adverse health effects of ultrafine particles.

Simulation Tools For SSbD lubricants - SITOLUB

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(1) Tekniker

Type of abstract: Oral
Subject area: T3.5. Industrially oriented research projects
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: Lubricant, LCA, Toxicity, Functionality, Artificial intelligence

Brief description of the submission

Implementing SSbD in lubricant development requires input from multiple disciplines, increasing complexity and costs. The SiToLub project supports this process by offering AI-powered tools to pre-assess lubricant components for safety, performance, and sustainability. Its models help identify safer alternatives and streamline decision-making, enabling efficient formulation screening, regulatory compliance, and future-proofing against evolving regulations.

Abstract - Contribution details

Implementing Safe and Sustainable by Design (SSbD) principles in lubricant development requires collaboration among chemists, regulatory experts, sustainability teams, supply chain managers, and stakeholders such as end users and marketers. While this approach ensures simultaneous attention to safety and sustainability, it increases complexity, costs, and can slow innovation. The SiToLub project, funded under the HORIZON-CL4-2023-RESILIENCE-01 call, addresses these challenges by providing computational tools to pre-assess lubricant components—including base oils, additives, and formulations. These models predict key parameters such as toxicity, biodegradability, tribological performance, and life cycle sustainability (LCSA). SiToLub integrates Artificial Intelligence (AI) functionalities to identify safer, sustainable alternatives and support multi-criteria decision-making. By enabling time- and cost-efficient pre-screening of formulations, the platform helps ensure regulatory compliance and prepares products for future legislative changes. We will presents the SiToLub platform’s models and demonstrates their application in identifying and assessing Substances of Concern across different lubricant use cases.

2G_PROVEIL

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(1) BIOINICIA S.L.

Type of abstract: Any
Subject area: T3.5. Industrially oriented research projects
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: electrospinning, PPE, face masks, nanofibers, electret-free

Brief description of the submission

Next Generation Nanofiber-based Sensing PROVEIL PPE Masks for Extended Protection and Shelf-life (2G_PROVEIL acronym) project aims to develop, scale, and commercialize the second generation of the reusable PPE product, based on a virucidal nanofiber technology, tradenamed PROVEIL™. The PROVEIL technology was developed, patented, certified as FFP2 R D, won several awards in Spain, and sold in millions of units during the COVID-19 pandemic. The innovative second-generation PPE, 2G-PROVEIL, will focus on improving the design for optimal fitting, enhancing the filtration and breathability balance, reaching PPF3 and selecting the best EU-based materials to minimize inhalable contaminants.

It will also improve comfort, extend usability and shelf-life, enhance sustainability, and antimicrobial performance of the previously developed electret-free nanofiber-based filtration technology. Additionally, the new product will be equipped with a sensor to inform the user about proper fitting.

Abstract - Contribution details

The 2G_PROVEIL project aims to develop and commercialize next-generation reusable PPE masks based on PROVEIL™ nanofiber technology. Building on first-generation masks (FFP2 R D) successfully deployed during COVID-19, the new design will enhance filtration to FFP3, breathability, and antimicrobial performance while maintaining electret-free technology for durability and alcohol-based disinfection. The new masks will incorporate electret-free nanofiber filters with broad-spectrum antimicrobial properties (virucidal, bactericidal, and fungicidal) and mechanical filtration performance capable of reaching FFP3 standards. This design mitigates the degradation of filtration performance caused by humidity and enables repeated disinfection using alcohol–water sprays, significantly extending shelf-life and reusability. Key innovations include ergonomic improvements informed by anthropometric studies and the integration of smart sensors to monitor mask fit and ensure optimal sealing. These advancements address limitations of current PPE by combining high protection, extended shelf-life, and user comfort. The multidisciplinary consortium, coordinated by BIOINICIA SL with CSIC, FISABIO, and IIS La Fe, will validate prototypes through laboratory and clinical testing, achieving industrial-scale production targets (50,000 FFP2 masks, 25,000 FFP3 masks, 1,000 smart masks). By merging cutting-edge nanomaterials, sensor technologies, and sustainable manufacturing, 2G_PROVEIL will set new standards in respiratory protection, enhancing preparedness for future public health emergencies.

Funding

This work has received funding from the European Union under the EU4Health Programme, Grant Agreement No. 101203379 (2G_PROVEIL). Views and opinions expressed are those of the authors only and do not necessarily reflect those of the European Union or the European Health and Digital Executive Agency (HADEA). Neither the European Union nor HADEA can be held responsible for them.

SSbD for High-T Thermal Storage in CSP Systems

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Type of abstract: Oral
Subject area: T3.5. Industrially oriented research projects
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: SSbD, CSP, Concentrated Solar Power, molten salts, coatings,

Brief description of the submission

This presentation highlights the implementation of Safe and Sustainable by Design (SSbD) framework in the development of high-temperature thermal energy storage materials for next-generation concentrated solar power (CSP) systems. The work was carried out within the HELIOTROPE project,, funded under the EU's Horizon Europe programme. It focuses on the development of novel molten salts, stainless steel and nickel-based alloys, and various protective coatings designed for operation in CPS plants above 600 °C, thereby improving efficiency. Safety, environmental, and socio-economic factors were assessed early in the development process, with particular attention to hazardous substances and critical raw materials (CRMs). Key findings include the identification of nickel, cobalt, and lithium compounds as high-risk substances, prompting strategies for their substitution or reduction. The project demonstartes how integrating SSbD approach can guide material selection and process design in industrial energy technologies.

Abstract - Contribution details

transition to climate-neutral energy systems requires advanced, high-performance thermal energy storage (TES) solutions that have to be not only efficient but also safe and sustainable. In this context, the HELIOTROPE project, funded under the EU's Horizon Europe programme, is developing novel TES technologies for concentrated solar power (CSP) plants operating at temperatures above the current 600 °C threshold, increasing plant dispatchability. These innovations are grounded in the Safe and Sustainable by Design (SSbD) framework, aiming to integrate safety, environmental performance, and socio-economic viability from the earliest stages of materials development.

The project focuses on new high-temperature molten salt formulations, advanced metallic alloys, and protective coatings. Selection and development processes are guided by SSbD principles: reducing hazardous substances, minimizing critical raw material (CRM) dependency, improving recyclability, and lowering lifecycle environmental impact.

Preliminary safety and sustainability assessments revealed critical findings regarding material selection. Among the analyzed high-temperature molten salts (chloride and carbonate-based systems), stainless steel and Ni-based alloys, and protective coatings candidates (Fe50Cr and Ni20Cr High Velocity Oxygen fuel coatings, Ni electrodeposition and AlSi slurries), several hazardous substances were identified according to H1 criterion classification, criteria which is proposed by the framework itself, including nickel and cobalt compounds. CRMs (Critical Raw Materials) analysis identified lithium, cobalt, tungsten, manganese, and titanium as supply chain risk factors, with specific recommendations for material substitution or minimization strategies. The ex-ante LCA and techno-economic analysis conducted revealed potential environmental impact reductions through strategic material selection and process optimization.

Key strategies include replacing high-impact materials like lithium and cobalt, optimizing synthesis pathways for energy efficiency, and designing components with end-of-life treatments and circularity actions in mind.

This approach demonstrates how industrially relevant research can embed SSbD into the development of clean energy technologies.

Acknowledge: This project has received funding from the European Union's Horizon Europe research and innovation programme under the grant agreement No 101147455 (HELIOTROPE)

SSbD driven case studies - AlChemissts Project

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(1) ITENE

Type of abstract: Oral
Subject area: T3.5. Industrially oriented research projects
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.5. Industrially oriented research projects
Keywords: SSbD framework, Safe altenatives, risk assessment

Brief description of the submission

The AlChemiSSts project tests and demonstrates the applicability of the Safe and Sustainable by Design (SSbD) framework. This framework supports the development of innovative chemicals or materials to replace Substances of Very High Concern (SVHCs). These replacements are intended for high-impact markets, including surfactants, plasticisers, and flame retardants in value chains such as metalworking fluids (MWFs), lubricants, insulation foams and paints, safety boots and wellies, battery cases, and sports mats.

Abstract - Contribution details

The AlchemiSSts project will demonstrate the applicability of the Safe by Design (SSbD) framework (1) aiming at developing and implementing safer and more sustainable alternatives to surfactants, plasticizers, and flame retardants that, being present in daily life products pose a high risk for the human health and the environment, thus considered substances of very high concern (SVHC). To this end, up to seven case studies, accounting with the relevant actors in the value chain are proposed in the project, and they will serve as proof of concept to test the SSbD framework against within its different 5 steps.

The general objective of the project will be achieved by addressing specific goals such as the development of the alternative substances itself, the compilation of robust and reliable evidence for a Proof of Concept of the SSbD framework, the development of a certification methodology promoting the implementation of the SSbD concept in the industrial network. Another key pillar of AlchemiSSts project relies on the implementation of integrated approaches and tools to support safety, sustainability and social assessment based on interoperable FAIR data and models. In addition, robust data on sustainability indicators and information for assessing the impact of the outcomes of the project towards a suite of zero pollution targets will be delivered for each case. For all these relevant aspects, AlchemiSSts will be assisted by stakeholders to ensure social acceptance and economic of the foreseen innovative advance materials.

The project is organized in 10 Work Packages (WP), starting with the definition of the SSbD indicators that will guide the developments of the alternative substances, considering barriers to either achieve the market as well as meet SSbD criteria.

(1) https://publications.jrc.ec.europa.eu/repository/handle/JRC131878

Navigating through the SSbD Scoping Analysis

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Type of abstract: Oral
Subject area: T3.6. Industrial view and SSbD implementation success stories
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.6. Industrial view and SSbD implementation success stories

Brief description of the submission

This work presents a real-world case study implementing the Scoping Analysis developed by the Joint Research Centre within the Safe and Sustainable by Design (SSbD) Framework. The primary aim is to evaluate the practical applicability of the Scoping Analysis in guiding innovation processes. By applying the framework to a specific case, this study offers insights into how the iterative nature of the Scoping Analysis supports the development of safer, more sustainable, and technically sound innovations. The case study highlights how the framework steers decision-making and innovation practices toward responsible design from the early stages of product development. It also showcases how the SSbD approach ensures a balance between safety, sustainability, and performance. Furthermore, the study includes key lessons learned, and observed improvements, offering valuable input for further refinement and broader application of the SSbD Framework across various sectors and technologies.

Abstract - Contribution details

Safe-and-sustainable-by-design (SSbD) is an integral component of the European Chemicals Strategy for Sustainability (CSS) action plan which aims to reduce negative impacts on human health and the environment associated with chemicals, materials, products and services commercialized or introduced onto the EU market (EC 2020). This had led to a series of publications from the European Commission (EC) Joint Recent Centre (JRC). The aim of the SSbD framework is to support the design and development of safe and sustainable life cycles of chemicals and materials with research and innovation (R&I) activities. The currently under consultation revision of the Framework (Garmendia Aguirre et al. 2025) incorporates the scoping analysis introduced in the methodological guidance (Abbate, Garmendia Aguirre et al. 2024), which supports the contextualization of the assessment phase of the SSbD framework in R&I activities.

The Scoping Analysis builds on: i) the system definition, ii) the (re)design definition, iii) the definition of the system boundaries and iv) engagement with the actors along the life cycle. These three building blocks are necessary, but they can be implemented in a different order based on the industrial cases. Here a case study is presented on the practical application of the scoping analysis. Commercial flame retardants for polymers are currently the standard materials used in the automotive industry; however, they pose issues related to high persistence and allergenic potential. In this context, graphene oxide presents itself as a versatile material, as it can be functionalized with different additives of biological or natural origin to improve its properties and reduce the toxicity. The scoping analysis was applied to support the implementation of the SSbD for a graphene oxide functionalized with chitosan (N-acetylglucosamine), a benign biopolymer with flame retardant properties. This option does not use hazardous materials, reduces consumption of water in the production process, reuses material lost during production and minimizes occupational exposure.

Design of validation study for meat aging

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Type of abstract: Poster
Subject area: T3.7. Other
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.7. Other
Keywords: Aged Meat; Validation; alternative methods

Brief description of the submission

Aged meat undergoes controlled processes to enhance flavor and tenderness, primarily through dry or wet aging. Dry aging exposes meat to open-air conditions, intensifying flavor, while wet aging uses vacuum-sealing to retain moisture and produce a milder taste. According to EFSA, aged meat poses no greater microbiological risk than fresh meat if proper controls are maintained. Regulation (EC) No 853/2004 defines safety parameters for dry-aged beef. This study aims to design a validation framework for alternative aging methods to ensure safety standards equivalent to those in EU regulations. A literature review identified key parameters and methodologies. The proposed validation approach includes: (1) defining process parameters (time, temperature, airflow, humidity), (2) continuous monitoring, (3) microbiological control (e.g., Pseudomonas, Brochothrix thermosphacta), and (4) physicochemical and sensory analysis (pH, water activity). This framework supports food operators in safely implementing alternative aging techniques while maintaining regulatory compliance.

Abstract - Contribution details

Aged meat undergoes a controlled process to enhance its flavor and tenderness. There are two primary methods: dry aging and wet aging. Dry aging involves hanging the meat in a controlled, open-air environment, allowing enzymes and natural processes to break down muscle fibers, resulting in a rich, concentrated flavor. Wet aging involves vacuum-sealing the meat and storing it under refrigeration, which retains moisture and results in a milder flavor profile.

EFSA concluded that aged meat does not pose additional microbiological risks compared to fresh meat, provided specific process controls are adhered to. Regulation (EC) No 853/2004 outlines the process parameters for dry-aged beef, ensuring safety. If food operators age other types of meat or use different parameters, they must validate their processes to ensure safety.

Objective: This study aims to design a validation study for alternative meat aging methods, ensuring they meet safety standards comparable to those established in European regulation.

Material and Methods: A literature review was conducted to establish a robust foundation for the validation study. This review focused on identifying key parameters and methodologies used in previous studies to ensure the reliability and safety of alternative meat aging processes.

Results and Discussion: The proposed validation approach for alternative meat aging methods is based on four key steps: (1) Defining process parameters: time, temperature, air flow and relative humidity (2) Continuous process control, (3) Microbiological control: pathogenic psychrophilic bacteria, Pseudomonas, Brochothrix thermosphacta, total psychotrophic count and lactic acid bacteria (4) Physicochemical and organoleptic control: water activity and pH. Validated process parameters for various alternative aging methods have been proposed. Conclusion: This validation study approach ensures food safety and provides essential guidelines for food operators to apply alternative meat aging methods in compliance with regulations. By following these steps, operators can confidently produce aged meat that is both safe and of high quality.

Prevalence of Yersinia enterocolitica in Meat

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Type of abstract: Poster
Subject area: T3.7. Other
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.7. Other
Keywords: Yersinia; Slaugterhouse; pork meat; tonsils

Brief description of the submission

Yersinia enterocolitica, a zoonotic pathogen linked to yersiniosis, is the fourth most common zoonosis in the EU. It is mainly associated with pork, as pigs can carry the bacterium asymptomatically in their tonsils and intestines, potentially contaminating carcasses during slaughter. This study, conducted in the Valencian Community (June 2023–March 2025), assessed the prevalence of Y. enterocolitica in carcasses, tonsils, and meat products using PCR (ISO/TS 18867:2015). Among 199 samples, prevalence was 37.7% in tonsils, 20% in meat products, and 15.4% in carcasses, with significantly higher rates in tonsils (p=0.006). Tonsil prevalence was lower than in previous Spanish studies, while meat product prevalence was higher. A correlation was found between slaughterhouse sanitary status and carcass contamination, emphasizing the need for strict hygiene measures to reduce microbial risk.

Abstract - Contribution details

Yersinia enterocolitica, a zoonotic pathogen responsible for yersiniosis, is the fourth most common zoonosis in the European Union according to EFSA. This facultative anaerobic and psychrotrophic bacillus is primarily associated with pork, as pigs can be asymptomatic carriers and harbor the microorganism in their tonsils and intestines, potentially contaminating carcasses during slaughter. The objective of this study was to evaluate the prevalence of Y. enterocolitica in carcasses and tonsils at slaughterhouses, as well as in meat and meat products, and to relate its presence in carcasses to the sanitary status (SS) of the slaughterhouse. The study was conducted in slaughterhouses and retail establishments in the Valencian Community as part of official controls carried out by Veterinary Services (June 2023 to March 2025). To assess the prevalence of Y. enterocolitica, 199 samples were analyzed (65 carcasses, 69 tonsils, and 65 meat and meat products) using PCR, following the adapted ISO/TS 18867:2015 standard. The SS was evaluated in 9 slaughterhouses using official control forms, which classify establishments into categories (A–E) based on regulatory compliance. Results showed a prevalence of 37.7% in tonsils, 20% in meat and meat products, and 15.4% in carcasses, with tonsil prevalence significantly higher (p=0.006). No significant differences were found between meat products and carcasses. The prevalence in tonsils was lower than previously reported in Spain, while the prevalence in meat and meat products was higher than in other studies. Additionally, results indicate that the SS of the slaughterhouse correlates with the prevalence of the microorganism in carcasses, highlighting the importance of implementing strict hygiene measures to reduce its presence.

Principle to Practice: Making Sust. Meas. in SSbD

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Type of abstract: Oral
Subject area: T3.7. Other
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.7. Other
Keywords: Sustainability Assessment; Safe and Sustainable by Design (SSbD); Indicator Development; Reflexive Governance; qualitative indicators

Brief description of the submission

What does sustainability mean when it must be made measurable? This presentation introduces a qualitative indicator set developed specifically for assessing sustainability within the Safe and Sustainable by Design (SSbD) framework. Rather than starting from a fixed definition, our indicator set was built from the ground up—through a structured process of literature review, conceptual consolidation, expert consultation, and internal refinement. The result is a set of more than hundred 'yes/no' indicators spanning environmental, social, and economic dimensions, designed for early-stage innovation in chemicals and advanced materials. Importantly, the development process itself became a way of engaging with sustainability's contested meaning: by deciding what to ask, we were already shaping what counts. The contribution reflects on how assessment tools are not merely technical instruments but performative acts that co-produce the very concept they aim to evaluate—raising broader questions about governance, normativity, and the role of measurement in sustainability transitions.

Abstract - Contribution details

Within the European Commission's Safe and Sustainable by Design (SSbD) framework, sustainability serves as a central objective—but one whose meaning remains open, contested, and in need of clarification. This paper presents the development of a qualitative indicator set designed to assess the sustainability of chemicals and advanced materials at early stages of innovation. Developed from scratch through a structured process of literature review, internal synthesis, and expert consultation, the resulting >100 qualitative indicators span environmental, social, and economic dimensions, and are structured to reflect both product- and company-specific considerations across different life-cycle stages. Rather than applying a pre-defined notion of sustainability, the development process itself became a way of engaging with the concept's meaning. Each decision about what to ask, how to formulate indicators, and which dimensions to prioritize shapes not only the assessment framework but also the implicit understanding of what "safe and sustainable by design" entails. Guided by a negative orientation—focusing on the identification of risk-increasing practices—the approach enables structured assessment without prematurely fixing the concept's normative content.

This dual function of the indicator set—as both an assessment tool and a conceptual lens—highlights the performative nature of sustainability. Indicators do not merely measure; they co-construct the object of evaluation. We argue that such indicator development must be understood as a reflexive and political process, one that navigates the tension between the practical need for measurability and the conceptual openness necessary to keep sustainability a critical and evolving category.

Upcycled TiO_2 Coatings: SSEbD Sunscreen Strategy

Manfredini, Stefano (1), Cesa, Elena , Ziosi, Paola, Baldini, Erika, Gugel, Irene, Marchetti, Filippo, Costa, Stefania, Costa, Anna, Fornara, Dario, Culha, Mustafa

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Type of abstract: Oral
Subject area: T3.7. Other
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.7. Other
Keywords: Titanium-dioxide nanoparticles Safe-/Sustainable-/Effective-by-Design (SSEbD) Upcycled food-by-product coatings Phototoxicity & eco-toxicity suppression Nano-sunscreen UV filters

Brief description of the submission

Titanium-dioxide nanoparticles (TiO_2 NPs) are prized in sunscreens for their transparency and broad-spectrum UV protection, yet their photocatalytic reactivity raises safety and eco-toxicity concerns. Guided by Safe-, Sustainable- and Effective-by-Design (SSEbD) principles from the SbD4Nano and SUNRISE programmes, we engineered TiO_2 NPs with biobased surfactants upcycled from food-industry by-products. The coatings create a stable, protective shell that quenches reactive-oxygen-species generation and prevents particle release, while unexpectedly boosting SPF/UVA-PF performance. Comparative assays confirmed significant reductions in in vitro phototoxicity, zebrafish embryo mortality and algal growth inhibition versus uncoated controls. The approach delivers a scalable, circular-economy route to next-generation UV filters that balance consumer safety, environmental stewardship and high efficacy, offering a concrete template for regulatory-aligned nano-sunscreen design.

Abstract - Contribution details

Upcycled TiO_2 Coatings: SSEbD Sunscreen Strategy

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Safety and sustainability concerns are refocusing scrutiny on titanium-dioxide nanoparticles (TiO_2) in sunscreens. While these particles provide transparent, broad-spectrum UV shielding, ingestion, inhalation and dermal-penetration risks persist. Drawing on Horizon programmes SbD4Nano and SUNRISE, we operationalised the Safe, Sustainable and Effective-by-Design (SSEbD) paradigm. TiO_2 NPs were coated with amphiphilic molecules upcycled from food-industry waste, generating durable shells that quench photocatalysis, limit dissolution and curb particle release under UV irradiation. Unexpectedly, the bio-based coating also boosted SPF and UVA-PF values, demonstrating that safety upgrades can enhance performance. Our methodology spans material selection, surface functionalisation, detailed physico-chemical characterisation, hazard screening and performance benchmarking, offering an end-to-end example of practical SSEbD implementation. OECD-aligned assays comparing coated versus uncoated particles revealed sharp reductions in reactive-oxygen-species formation, keratinocyte phototoxicity, zebrafish embryo mortality and algal growth inhibition. A streamlined life-cycle screen showed lower environmental impact via waste valorisation, reduced energy demand and extended filter longevity. Together, these findings validate a scalable route to next-generation nano-sunscreens that balance consumer protection, regulatory compliance and circular-economy goals, delivering a transferable blueprint for safer nanomaterial design across cosmetic and biomedical sectors.

Insight from Mixmatter project's Delphi Consultation

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Type of abstract: Oral
Subject area: T3.7. Other
Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.7. Other
Keywords: Circular Bioeconomy Bio-based Products Waste Valorization Policy Levers Delphi Consultation

Brief description of the submission

The presentation will showcase the Mixmatters project, a Horizon Europe initiative tackling the inefficient management of mixed agri-food biowaste, which currenly contributes to 3% of EU greenhourse gas emissions. It will hightlight and integrates, AI-driven system for biowaste valorization, featuring modula separation units, a multiproduc biorefinery, and a digital decision-support tool.

A key focus isthe SSbD framework, emphasiziing policy levers (e.g incentives, certifications) and social acceptance via Delphi consultation with policiymakers, industry, and citizens. Results reveal gaps in decentralized waste policies and the need or public-private collaboration to scale bio-based products.

The tal will concluude with actionable steps to align innovation with EU Green Deal goals, underescoring how ciruluar bioeconomy solutions can reduce emission, enhance resource efficiency, and foster consumer trust thorugh transparency and education.

Abstract - Contribution details

The MixMatter project presentes an innovative approcah to transforming agri-food biowaste into hight-vale products through a SSbD framework. Funded under Horizon Europe, this initiativa addresses critical innefficiencies in biowaste management, where 75% of mixed organic waste is currently landfilled or incinerated, contributing significantly to greenhouse gas emissions.

Our integrated solution combines AI-driven modutar separation units with a multi-purpose biorefinery (Valorisation Hub) and a digital decision-support system to optimize reosurce recovery. The system produces valuable outputs including bioactive compounds, biodegradable plastics, and nutrient-rich ingredients, fully aligned with circular economy principles.

A Key innovation lies in our policy-driven methodoloy, which employs DELPHI CONSULTATIONs engagins public authorities, industrial leader, and citizens across eight Eu memeber states.The research reveals the crucial importance of economic incentives such as tax breaks and the need for standarized certifications to accelerate market adoption. It also identifies significant gaps in policiies supporting decentraized biowaste systems highlighting the urgen requirement for regulatory innovation. Public surveys demonstrate strong demand for transparency, with 80% of respondents prioritizing safety guarantees and clear sustainability labeling.

The project implements a quadruple-helix governance model involving public, private, academic, and civil society stakeholders to ensure scalable solutions. These efforts directly support the EU Green Deal and Bioeconomy Strategy objectives. The anticipated impacts include a 20% reduction in GHG emissions from waste streams and 50% increase in material re use rates, while establishing a replicable blueprint for industrial SSbD integration.

This presentation will share actionable insights for policymakers and businesses, demonstrating how to bridge the gap between technological innovation and societal acceptance to accelerate Europe's transition toward a zero-waste bioeconomy. The finidngs underscore the vital role of collaborative governance, evidence-based polictymaking, and public engagement in achieving sustainalbe change.

ICCRAM: implementing the SSbD framework

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Subject area: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subject sub-area: T3.7. Other
Keywords: SSbD Framework, methodological approaches, ICCRAM

Brief description of the submission

ICCRAM (University of Burgos) applies a multidisciplinary approach to Safe and Sustainable by Design (SSbD), combining expertise in toxicology, sustainability, material science, biotechnology, computational modelling, and regulatory science. With extensive experience in EU-funded projects, ICCRAM supports the full SSbD workflow—from early-stage material design to sustainability integration. Based on this knowledge, ICCRAM has developed a structured SSbD pathway that merges experimental and computational tools, including toxicology testing, Life Cycle Assessment (LCA), and FAIR data management. This integrated approach ensures that safety and sustainability are embedded from the earliest stages of innovation. By aligning with regulatory standards and advancing reproducible methods, ICCRAM fosters responsible research and supports the development of safer, more sustainable technologies across diverse sectors.

Abstract - Contribution details

The International Research Center in Critical Raw Materials for Advanced Industrial Technologies (ICCRAM) at the University of Burgos (UBU) brings a multidisciplinary approach to Safe and Sustainable by Design (SSbD), integrating expertise in toxicology, sustainability, biotechnology, material science, computational modelling, and regulatory frameworks. ICCRAM actively contributes to the development and implementation of SSbD strategies in various EU-funded projects, with a strong focus on the early-stage hazard and sustainability assessment of advanced materials and emerging technologies.

ICCRAM has the capacity and experience to address all SSbD framework steps from chemical and material design to the integration of safety and sustainability. Based on this expertise, ICCRAM has developed its own structured SSbD pathway, which integrates key methodologies and tools into a streamlined and reproducible workflow.

Our approach integrates experimental and computational methods, including toxicology assessment, Life Cycle Assessment (LCA), and FAIR data management, ensuring that safety and sustainability are embedded from the earliest stages of innovation. By aligning with regulatory expectations and international standards, ICCRAM implementation of the SSbD approach fosters responsible innovation and support the development of safer, more sustainable technologies.

How LCA Shapes the SSbD4CheM Approach

Pérez Sánchez Fruela (1)

(1) ITENE

Tipo de comunicación: Oral
Área temática: T3.3.Tools and methodological approaches to assist the lifecycle assessment and sustainability
Área temática: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subárea temática: T3.3.Tools and methodological approaches to assist the lifecycle assessment and sustainability
Palabras clave: SSbD, LCA, sustainability, chemicals, socio-economic

The European Green Deal and the Chemicals Strategy for Sustainability highlight the urgent need to develop chemicals that are both safe and sustainable by design (SSbD). The SSbD4CheM project contributes to this vision by developing tools and methodologies to support the design and assessment of chemicals across their entire life cycle. Within this framework, Life Cycle Assessment (LCA) plays a central role in evaluating the environmental performance of chemical products and processes, from raw material extraction to end-of-life.

This presentation will provide a brief overview of the SSbD4CheM project and focus on the contribution of LCA to its objectives. Specifically, it will discuss how LCA supports the integration of sustainability criteria early in the chemical design process, helping to identify potential trade-offs and guide safer and greener innovation. The talk will also highlight the challenges of applying LCA to emerging substances and novel design approaches, where data gaps and uncertainty are common.

By embedding life cycle thinking into the SSbD framework, SSbD4CheM aims to ensure that improvements in safety do not come at the expense of environmental sustainability. Ultimately, the project seeks to contribute to a harmonised and practical implementation of the Safe and Sustainable by Design concept for the chemical sector in Europe.

SSbD driven Flame Retardants. AIChemiSSts Project

Rivero García María (1)
(1) ITENE

Tipo de comunicación: Oral
Área temática: T3.7. Other
Área temática: T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework
Subárea temática: T3.7. Other
Palabras clave: Flame retardants, SSbD, Green chemistry, Material innovation, Toxicity reduction

Flame retardants (FRs) are essential additives for improving fire safety in applications such as construction, electronics, and transport. However, many conventional FRs are classified as Substances of Very High Concern (SVHCs) under the REACH Regulation, due to their persistence, bioaccumulation, and toxicity to human health and the environment. The urgent need to replace these hazardous substances with safer alternatives aligns with the European Commission's Safe and Sustainable by Design (SSbD) framework, introduced in 2022 to guide the development of materials that are both functional and sustainable throughout their life cycle.

Within this context, the AIChemiSSts Project aims to demonstrate the applicability of the SSbD framework to design and develop innovative, safe, and sustainable flame retardants as alternatives to SVHCs. By integrating safety and sustainability considerations from the earliest stages of research and development, the project promotes a holistic, life-cycle approach that minimizes health and environmental risks while maintaining performance and circularity. This initiative contributes to advancing the EU's goals for green innovation, chemical safety, and a circular economy, promoting the implementation of the SSbD methodology in high impact industrial sectors.

agenda
OCTOBER 21st

CONGRESS AGENDA

9:00 - 10:30	Room La Harinera		Opening
10:30 - 12:00	**Room La Harinera** T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics Chair: José A. González	T1.1 Analytical techniques for the determination of PFAS and micro(nano)plastics	Hyperspectral Imaging of Microplastics in Tap Water - Joan Josep Carvajal (Universitat Rovira i Virgili) Microplastics – Thermoanalysis vs Spectroscopy - Patricia Fernández (Eurofins) Validation of Microplastic Methods in Water - Rocío Rodríguez (University of Cadiz) PFAS Analysis in Wastewater, Sludge & Waste - Mónica Berrios (AGQ LABS)
	Room Polivalente T2. Innovation and opportunities of sensing technologies in agrifood value chains Chair: Josep Vicent Mercader	T2.2 Innovation and opportunities for detection technologies in agri-food value chains	Portable semi-automated HAB Toxins´ Monitoring - Begoña Espiña (International Iberian Nanotechnology Laboratory) GENE-UP® TYPER:fast L.monocytogenes source tracking - David Tomás (BioMérieux) Identifying cinnamon by terpene synthase sequence - Lenka Fialova (BMO University of Technology) Photonic Sensing Systems: PHOTONGATE Project - Amadeu Griol (Polytechnic University of Valencia)
	Room Factoría T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework Chair: Maidá Domat	**KEY NOTE : Irantzu Garmendia (European Commission Joint Research Centre)**	
		T3. 1 Policy vision and initiatives to support the SSbD framework	Navigating through the SSbD Scoping Analysis - Mónica Martinez (European Commission Research Centre) Active Nanomaterials: A Regulatory Approach - Gianmarco Calafiore (Intertek Italia) Insight from Mixmatter project's Delphi Consultation - Miguel Mares (Valencia Innovation Capital)
12:00 - 12:30	Coffee Break		
12:30 - 14:00	**Room La Harinera** T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics Chair: Alba Hernández	T1.1 Analytical techniques for the determination of PFAS and micro(nano)plastics	Monitoring Microplastics in Complex Wastewater - Amparo Fernández (Captoplastic) SEIRA using resonant antennas for PFAS detection - Alberto Villar (Tekniker) PFAS: From the Regulation to The Analytical Solutions - Flavia Cozzolino (Food Contact Center SRL) Advanced Pyrolysis Techniques - José A. González-Pérez (IRNAS-CSIC) Microplastics Emissions from a Coastal WWTP - Víctor Hernando (University of Vigo)
	Room Polivalente T2. Innovation and opportunities of sensing technologies in agrifood value chains Chair: Beatriz Vallejo	T2.2 New technologies for pathogen detection and food safety analysis in agri-food value chains. T2.3. New technologies for allergenic substances and harmful chemicals detection and monitoring in agrifood value chains	LAMP EC-Sensor for L. monocytogenes detection in food - Ane Rivas (Gaiker) Amoebae as CRB vectors in Hospital WW - Carla Machí-Camacho (IIAMA-UPV) Legionella: advanced molecular detection in water - Patricia Soler (EMIVASA) 16S-Based Microbial Risk Prediction in Meat Industry - Fernando Lorenzo (CHRISTEYNS) Immunosensing of Biotoxins. The Case of Patulin - Josep Vicent Mercader (IATA-CSIC)
	Room Factoría T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework Chair: Carlos Fito	T3.2 Tools and methodological approaches for assessing human and environmental risks	QSAR for Evaluating NMs Coatings (Eco)toxicity - Enrique Llobet (ProtoQSAR) Integrated Methodology for Robust Property Prediction - Matteo Carisi (Greendecision) Human-Relevant Toxicity: PCTS within IATA Framework - Bella Manshian (Sciensano) Integrating data-mining and QSAR tools in SSbD - Marta Fons (Protoqsar) A novel High throughput bio-membrane sensor - Lawrence Andrew Nelson (University of Leeds)
14:00 - 15:00	Lunch		

agenda
OCTOBER 21st

CONGRESS AGENDA

15:00 - 17:00	**Room La Harinera** T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics Chair: Patricia Fernández	**KEY NOTES: Alba Hernández (Autonomous University of Barcelona)**	
		T1.2. Human Health and Environmental Risks Assessment methodologies	Plastic additives in Microplastics - Mª Virtudes Martínez (IMDEA Agua)
			EC in water: application to hospital effluents - Laura Díaz-Esplá (Labaqua)
			Emerging contaminantes and the One Health Framework - José A. González (IRNAS-CSIC)
			MPs effects on bioconcentration of PFASs in E. eels - Julián Campo (CIDE)
			Adverse health impact of micronanoplastics - Irene Barguilla (Autonomous University of Barcelona)
	Room Polivalente T2. Innovation and opportunities of sensing technologies in agrifood value chains Chair: Alejandro Hernández	T2.3 New technologies for pathogen detection and food safety analysis	Multiplexed immunochemical assays for contaminants - J.Pablo Salvador (Nb4D, IQAC-CSIC)
		T2.4 Molecular techniques for fraud detection	Food fraud detection using next generation sequencing - Beatriz Vallejo (Lab. Tec de Levante)
		T2.5 EU policies and trends	IoT node for monitoring NH3 levels in livestock farms - Adrià Marcos (NanoChronia)
		T2.6 Other	Understanding Packaging Scorecard - Etienne Cabane (Food Packaging Forum)
			Real-Time Biosensor Monitoring for Water Safety - Iván Iglesias (Sensactive)
			Carbon based Electrochemical Platforms for Sensing - Paulo Roberto de Oliveira (INAM-UJI)
	Room Factoría T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework Chair: Keld Alstrup	**KEY NOTE: Tomasz Puzyn (QSAR Lab)**	
		T3.2 Tools and methodological approaches for assessing human and environmental risks	Safety Evaluation for TiO2 Nanomaterials - Valentín Diez (University of Burgos)
			Regulatory readiness of in silico NAMs - Carlos Fito (UG & QSAR Lab)
			Low-cost particle sensor for workplace risk control - Ana Sofía Fonseca (NFA)
			Importance of EAs along LC of nanocomposites - Gunther Van Kerckhove (OCSiAI Europe Sarl)
			Sensor Network for PM Monitoring under IT Events - Maidá Domat (Universidad de Oviedo)
19:00	Acitvity		
21:00	Gala Dinner		

agenda
OCTOBER 22nd

CONGRESS AGENDA

8:30 - 9:00	Room La Harinera		Reception
9:00 - 11:00	**Room La Harinera** T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics Chair:Laura Diaz-Esplá	T1.2. Human Health and Environmental Risks Assessment methodologies	PFAS in Air: Regulatory Status+Analytical Advances - Juanjo Rodríguez (Eurofins)
			Virtual sensors for detection of contaminants in WWTP - Francisco Ample (SAV)
			Mapping AMR hotspots in a sewage system - Clara Díaz-García (Labaqua)
			MACHSENSE project - Cristian Abarca (Simetría)
			Effects of PS nanoplastics on endocrine disruption - Mónica Lucía Torres (ISCII)
		T1.3 Human exposure to PFAS and micro(nano)plastics	From Sea to Safe: Cold Microfiltration Power - Ana Brotons-Canto (Quinto Lab.)
	Room Polivalente T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics Chair:José Antonio Díaz	**KEY NOTE: Etienne Cabane (Food Packaging Forum)**	
		T1.4 Treatment and removal technologies	Prevention of micro and nano plastics in rivers - Socorro Vázquez (Leitat)
			Microplastics sampling using aquarium pumping systems - Amaia Mendoza (UPV/EHU)
			BMRex- Membranes to capture and degrade microplastics - Alber Serra-Compte (Cetaqua)
		T1.5 New analytical techniques and sensor-based approaches	Portable Cytomegalovirus test using nanomaterials - Estela Climent (IDM UPV y ILS La Fe)
			Molecular Gate Biosensor for P. aeruginosa Detection - Andrea Torres (IDM)
	Room Factoría T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework Chair:Tomasz Puzyn	**KEY NOTE: Mark Wiesner (Duke University)**	
		T3.2 Tools and methodological approaches to assist in life cycle assessment and sustainability	SUNRISE approach to establish methods for EHS impact - Itziar Polanco (Gaiker)
			Digital Tool for Safety & Sustainability screening - Susan Dekkers (TNO)
			SunRise e-infrastructure for Sustainable Innovation - Matteo Carisi (Greendecision)
			How LCA Shapes the SSbD4CheM Approach - Fruela Pérez (ITENE)
			Future approaches to support the analysis of the environmental impact of Advance Materials (Debate)
11:00 - 11:30	Coffee Break		
11:30-13:30	**Room La Harinera** T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics Chair:Arantxa Ballesteros	**KEY NOTE: Ana Isabel Cañas (ISCIII-CNSA)**	
		T1.3 Human exposure to PFAS and micro(nano)plastics	Environmental Plastics Affect β-hCG and SDC1 - Lorenzo Ippoliti (University of Rome)
			HDPE and PET MPs as Vectors of Microbial Pathogens - Itziar Polanco (Gaiker)
		T1.4 Treatment and disposal technologies	Green Extractants for PFAS Removal - Valentín Diez (University of Burgos)
			Cost Benefit and Feasibility of PFAS Remediation - Ioannis Spyropoulos (Lomartov)
			Scalable Microplastic Capture in WWTP Processes - Amparo Fernández (Captoplastic)
	Room Polivalente T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics Chair:Etienne Cabane	T1.5 New analytical techniques and sensor-based approaches	CNTA tools for monitoring emerging food risks - Laura Sánchez (CNTA)
			Smart sensing for indoor formaldehyde control - María Figols (Inbiot)
			Monitoring microbiological risks in drinking water - Inés Girón-Guzmán (IATA-CSIC)
			Modular Digital Twin for Small-Scale WWTPs - David De Miguel (ITCL Technology Centre)
			Antibiotic resistance: The role of WWTPs - Juan Antonio Villaescusa (Lab. Tec de Levante)
			H.pylori in drinking water: EU Project NIAGARA - Lola Beltrán (Gamaser - Global Omnium)

agenda
OCTOBER 22nd

CONGRESS AGENDA

11:30-13:30	**Room Factoría** T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework Chair:Matteo Carisi	T3.2 Tools and methodological approaches in life cycle assessment and sustainability	SSbD for High-T Thermal Storage in CSP Systems - Gemma Mendoza (Tekniker)
			Simulation Tools For SSbD lubricants - SITOLUB - Francesco Pagano (Tekniker)
		T3.3 Lessons learned from industry-oriented research projects	SSbD driven case studies under the AIChemissts Project - Carlos Fito (ITENE)
			Upcycled TiO_2 Coatings: SSEbD Sunscreen Strategy - Stefano Manfredini (University of Ferrara)
			Sustainability Assessment Framework for Textiles - Biase Liguori (NFA)
			Sustainability assessment of retrofits: lessons - Keld Alstrup Jensen (NFA)
13:30 - 14:30	Lunch		
14:30 - 17:30	**Room La Harinera** T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics Chair:Amparo Fernández	T1.4 Treatment and disposal technologies	Microplastics and additives emission in agroecosystem - Isabel Domarco-Sagra (IMDEA Agua)
			Micro/Nanoplastics Removal by Membrane Bioreactor - Imane Fellahi (IMDEA Agua)
			Advanced Filtration for PFAS and Micropollutants - Luis Antonio Hernández (Mecana AG)
			Photocatalysis for the degradation of CPE in water - Jaume Cotolí (Global Omnium)
			Effective Photocatalyst to Remove Microplastics - Francisco Bosca (ITQ)
			Ulva Macroalgae for Remediation and Biomass Recovery - Henoc Pérez (Inescop)
			A microplastic removal filter based on biometrics - Ángela Baeza (Global Omnium)
			AQUA2VAL: Circular Water Innovation in Valencia - Jorge García (AINIA)
	Room Polivalente T1. Risk assessment, monitoring and control of emerging contaminants and substances of concern: pfas, micro and nanoplastics Chair: Lola Beltrán	**KEY NOTE: Paloma Crespo (ISCIII-CNSA)**	
		T1.5 New analytical techniques and sensor-based approaches.	Early Detection Methods for Pathogens in Wastewater - Clara Bretas (Simetría)
			Size matters: analysis of plastics in the enviroment - Laura Rodríguez-Lorenzo (INL)
			CPS: Ceramic Passive Samplers - Evgeny Bulatov (IDAEA-CSIC)
			New low cost microplastic monitoring approaches - Jose Antonio Diaz (ITENE)
		T1.6 EU policies, regulatory requirements, and trends	EU Policies on Emerging pollutants in Drinking Water - Elrik Du Saillant (UT Semide)
		T1.7 Other	Overcoming Social Barriers to PFAS Remediation - Mihaela Mirea (LOMARTOV)
			From data to recycled plastic compliance - Melania Gómez-Martínez (CADEL RECYCLING LAB S.L)
			ARGs detection in sewage via qPCR and Metagenomics - Miguel Alejandro Pérez (IIAMA-UPV)
	Room Factoría T3. Industrial challenges and solutions to implement the safe and sustainable by design (SSbD) framework Chair: Francesco Pagano	T3.3 Lessons learned from industry-oriented research projects	Principle to Practice: Making Sust. Meas. in SSbD - Lasse Steffens (BOKU University)
			Applying the SSbD Livestock Waste Valorisation - Sandra Roche (ITA)
			SSbD methodology for surface treatment sector - Diego Pascual (CTME)
			Paint´s ecotoxicity and biodegradability assessment - Patricia Solórzano (Leitat)
			2G_PROVEIL - Miriam González (Bionicia)
			SSbd Microcapsules with EOs for Post-Harvest - Alberto Lopera (Laurentia)
17:30 - 18:30	Closing		

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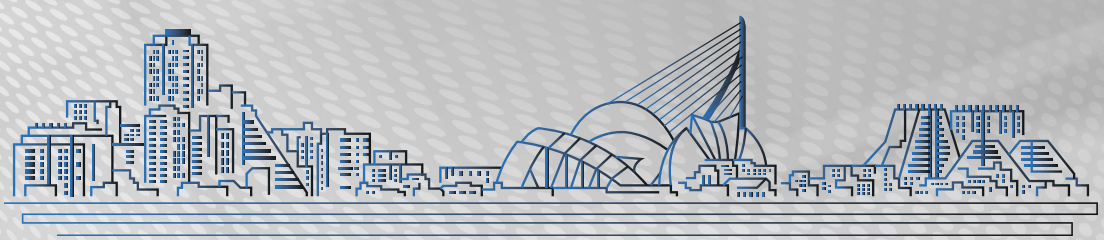

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