BOOK OF ABSTRACTS

Safety4Diet

Risk Assessment in Food Safety

November 13th and 14th, 2025

Salón de Grados

Faculty of Pharmacy and Food Sciences

Pre-registration (limited capacity) www.uv.es/safety4diet

Safety4Diet Research Group

Analytical Chemistry Department, University of Valencia

Jeroni Muñoz building. C/ Dr. Moliner 50, 46100-Burjassot, Valencia

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Finally, we extend our profound appreciation to the Scientific Committee for their invaluable contributions, expertise, and commitment to maintaining the high scientific standards of the congress. Special thanks are also due to the Organizing Committee for their tireless efforts and dedication in ensuring the smooth and successful execution of the event.

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PROLOGUE

It is with immense pleasure that the Organizing Committee presents the Book of Abstracts of the II Workshop of Safety4Diet, a meeting dedicated to the Risk Assessment in Food Safety.

This scientific event took place on November 13th and 14th, 2025, within the academic setting of the Faculty of Pharmacy at the University of Valencia. We wish to highlight that the realization of this workshop was made possible through the funding provided by the Conselleria d'Educació, Universitats I Ocupació through the project CIAICO/2022/217 and CIAORG/2024/067, to whom we extend our sincere gratitude for their support of research and knowledge transfer.

This volume not only contains the detailed program designed for the congress but also compiles all the scientific contributions made. The program was meticulously conceived to ensure that all conferences and sessions were attractive, multidisciplinary, and intrinsically interesting for all participants and attendees.

The central focus of this second workshop was directed toward innovation, entrepreneurship, and methodologies developed in recent years within the field of food safety. We primarily addressed population risks derived from dietary exposure to contaminants, presenting both novel and innovative methods for the determination of contaminants in food, as well as the various methods and methodologies for risk calculation or even mitigation strategies. By doing so, we aim to actively contribute to Global Food Safety, a topic of vital importance given the essential role of food in society.

One of the greatest successes of this gathering was its distinct international character, reflected in the participation of prestigious institutions that greatly enriched the discussions. These included contributions from the Institute of Agrochemistry and Food Technology (IATA-CSIC), the Food Safety Research Institute of the Valencian Community (FISABIO-Public Health), and the valuable perspective of Official Control for Food Contact Materials from the Public Health area. On the international front, we were honored to receive contributions from the University of Gdansk (Poland), the NOVA University of Lisbon (Portugal), and Wageningen University (The Netherlands).

This book compiles all the contributions presented, in both oral and poster format, serving as a testament to the high scientific level and the fruitful collaboration experienced over the two days.

We hope this book will become a valuable consultation tool for the scientific community and a tangible reminder of the vibrant collaboration held in Valencia.

The Organizing Committee

II Workshop of Safety4Diet

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9:45	**Opening Ceremony** • Yolanda Moliner. Head of the Analytical Chemistry Department • President of Organizer Committee of the Safety4Diet Congress
S.1.	**Chair: Francesc A. Esteve-Turrillas**
10:00	**The role of food safety monitoring in the risk assessment of chemical contaminants** • ***Olga Pardo Marín***, Analytical Chemistry Department, University of Valencia
10:30	**The Spanish Agency for Food Safety and Nutrition (AESAN): The role of its scientific committee in evidence-based decision making** • ***Houda Berrada Ramdani***, Preventive Medicine and Public Health, Food Sciences, Toxicology and
11:00	***Coffee break and poster viewing***
11:30	**Exploring the role of the gut microbiome as an auxiliary liver to deal with food contaminants** • ***Josep Rubert Bassedas,*** Wageningen University & Research, The Netherlands
12:00	**Assessment of the bioaccessibility of organophosphorus flame retardants (PFRs) in edible insects (*Acheta domesticus* and *Tenebrio molitor*)** • ***Cristina Juan García***, Preventive Medicine and Public Health, Food Sciences, Toxicology and Forensic Medicine Department, University of Valencia
12:30	**Classification of food products using vibrational spectroscopy and machine learning** • ***David Pérez-Guaita***, Analytical Chemistry Department, University of Valencia
13:00	**Immunoanalytical methods for the detection of mycotoxins in food** • ***Daniel López Puertollano***, Organic Chemistry Department, University of Valencia
S.2.	**Chair: Olga Pardo Marín**
15:00	**Green approaches in food sample preparation: from solvents to smart sorbents** • ***Justyna Płotka-Wasylka***, Gdańsk University of Technology, Gdańsk, Poland
15:30	**The effect of greening solid microextraction phases. The case of alkylphenols determination in water samples** • ***Daniel Gallart Mateu***, Analytical Chemistry Department, University of Valencia
16:00	**Determination of zearalenone in beer samples using front-face fluorescence and 3D-printed devices** • ***Gonzalo de Joz Latorre***, Analytical Chemistry Department, University of Valencia
16:30	**Official control on food contact materials in the way of addressing food safety** • **Claudia Mc Allister Bykaluk**, Food Safety Area, Public Health Directorate of Valencian Government

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November 14, 2025: Risk assessment

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10:30	**Estimating the health burden attributable to exposure to mycotoxins: a quantitative assessment tool** • ***Carla Teles Martins***, Universidade NOVA de Lisboa, Portugal
11:00	**Risk assessment of acrylamide exposure from popcorn on the Spanish market** • ***Albert Sebastià Duque***, Preventive Medicine and Public Health, Food Sciences, Toxicology and Forensic Medicine Department, University of Valencia
11:20	***Coffee break and poster viewing***
11:50	**Occurrence and risk assessment to perchlorate in foodstuff of the Spanish market** • ***Paula Ponz-Perelló***, Analytical Chemistry Department, University of Valencia
12:20	**Overview of the results of the CIAICO2022/2017 project** • ***Francesc A. Esteve-Turrillas***, Analytical Chemistry Department, University of Valencia

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ORAL PRESENTATIONS

O.1

The role of food safety monitoring in the risk assessment of chemical contaminants

Olga Pardo Marín

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Abstract

Food remains a significant source of human exposure to chemical contaminants, which can unintentionally make their way into commodities worldwide. These substances may be introduced into food during various stages of production, processing, or transportation, or they may arise from environmental pollution. Among the most relevant contaminants found in food and animal feed are natural toxins like alkaloids and mycotoxins, as well as environmental pollutants such as polychlorinated biphenyls (PCBs), dioxins, and persistent chlorinated pesticides. Other harmful substances include brominated flame retardants, heavy metals such as arsenic, cadmium, lead, and mercury, and process-related contaminants like acrylamide and furan.

To safeguard public health and ensure food safety, robust monitoring systems are essential for detecting these chemical contaminants. Effective food safety monitoring helps assess the risks posed by contaminants in the food supply chain, thereby ensuring regulatory compliance and protecting consumers. A critical piece of this regulatory framework within the European Union is Regulation (EU) 2023/915, which sets maximum allowable levels for specific contaminants in foodstuffs. This regulation plays a key role in harmonizing food safety standards across EU member states. The data generated through monitoring and testing not only ensures compliance with this regulation but also supports exposure assessments and toxicological studies, which are necessary for a comprehensive risk evaluation.

Food risk assessment is a pivotal tool in protecting consumer health. In assessing the risk of food contaminants, understanding human exposure is a fundamental component. Dietary exposure assessment integrates food consumption data with the concentration levels of chemicals found in food. Traditionally, the approach to evaluating human exposure to chemicals has been focused on one chemical and one exposure route at a time. However, it is increasingly recognized that both humans and animals are exposed to numerous chemicals on a daily basis, through multiple channels including food, water, air, dust, and soil. This multi-route exposure complicates risk assessments and necessitates more holistic approaches to understanding the cumulative impact of chemicals on human health.

As global food systems become more complex, the challenge of ensuring food safety will require continued advancements in monitoring technologies, regulatory frameworks, and risk assessment methodologies. Integrating new scientific knowledge about the cumulative effects of chemical exposures and improving international

cooperation on food safety standards will be essential steps in minimizing the risks posed by chemical contaminants in food.

Keywords: food safety, chemical contaminants, risk assessment, Regulation 2023/915, public health.

Acknowledgements: This work has been supported by the Conselleria d'Educació, Universitats i Ocupació from Generalitat Valenciana project CIAICO2022/217.

References

(1) Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006. (2023). Official Journal of the European Union.

O.2

The Spanish Agency for Food Safety and Nutrition (AESAN): The Role of Its Scientific Committee in Evidence-Based Decision Making

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Abstract

Risk assessment in food safety requires the integration of data from multiple disciplines, including microbiology, toxicology, nutrition, and food technology. The Spanish Agency for Food Safety and Nutrition (AESAN) is the national authority responsible for ensuring food safety, promoting healthy nutrition, and protecting consumer interests in Spain. Its actions are grounded in scientific evidence and aligned with the principles and frameworks established by the European Food Safety Authority (EFSA) and the European Commission. At the heart of AESAN's mission lies its Scientific Committee, an independent and multidisciplinary advisory body composed of experts from diverse fields such as toxicology, microbiology, nutrition, analytical chemistry, and food technology. The Committee provides rigorous scientific opinions that support the Agency's risk assessment activities and guide evidence-based policy decisions. These opinions and reports, which are publicly available on AESAN's website, in the Journal of the AESAN Scientific Committee (1), and in English in Food Risk Assess Europe (2) contributing to the transparency and credibility of regulatory actions.

This presentation will describe the structure and functioning of AESAN and its Scientific Committee, the process through which scientific opinions are developed, and the mechanisms that ensure independence and scientific integrity. Finally, the talk will reflect on the importance of evidence-based decision making in food safety governance, highlighting how scientific advice contributes to informed policies, public trust, and consumer protection within the European framework.

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(2) Food Risk Assess Europe (FRAE). https://efsa.onlinelibrary.wiley.com/journal/29401399

O.3

Exploring the role of the gut microbiome as an auxiliary liver to deal with food contaminants

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Abstract

Emerging experimental evidence suggests that toxins can induce alterations in gut microbiota, altering composition and activity, and potentially affecting host homeostasis. However, data from human studies are scarce, and it is unclear whether these compounds affect the gut microbiome or whether the microbiome has the capacity to detoxify them. The relationship between food contaminants and the gut microbiome is an area of increasing scientific interest, as it highlights the complex interactions that impact human health. Contaminants, such as mycotoxins, can affect the composition and function of the gut microbiome, leading to various health implications.

To address this challenge, we investigate the digestion of toxins and residues in various food matrices. Once we understand the biological fate of these compounds in the gastrointestinal tract, we then expose the gut microbiome to them. We study the capacity of microbial communities to detoxify these compounds by exploring the metabolites released and markers of microbial stress.

Acknowledgements: MYCOLON - A mechanistic approach to map the interplay of mycotoxins and gut epithelium towards colorectal cancer risk.11PRI24N – FWO.

O.4

Assessment of the bioaccessibility of organophosphorus flame retardants (pfrs) in edible insects (*acheta domesticus* and *tenebrio molitor*)

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Abstract

Chemicals found in food can be intentionally added, such as additives, and non-intentionally added, which refers to contaminants. The presence of organophosphorus flame retardants (PFRs) in food can occur during the food production chain including storage, transportation and processing methods. In fact, several foods could be contaminated with PRFs during the food treatment processes and packaging, as shown by recent studies (Campone et al., 2010; Poma et al., 2017 and 2019). Also, studies in novel foods, such as edible insects, have highlighted the presence of PFRs. Two edible insect species (Acheta domesticus and Tenebrio molitor), authorized for the market in the EU, have shown a detectable presence of PFRs. However, the possible bioaccessibility of PFRs for humans after enzymatic and pH digestion has never been assessed. The aim of this work was to investigate the bioaccessibility of PFRs in these two insect species by simulating an in vitro gastrointestinal digestion using the INFOGEST method (Brodkorb et al., 2019). Fifteen PFRs were investigated and only triethyl phosphate (TEP), triphenyl phosphate (TPHP), tris(2-chloroethyl) phosphate (TCEP), tris(1-chloro-2-propyl) phosphate (TCIPP), tris(2-butoxyethyl) phosphate (TBOEP) were detected in digested fractions. The highest bioaccessible values were observed for TEP (68% by 1,2 ng/g) and TCEP (72% by 0.6 ng/g) in T. molitor and TBOEP (50% by 13.1 ng/g) in A. domesticus. The observed concentrations suggest that the risk of adverse health effects from targeted PRFs via insect consumption is unlikely.

Keywords: phosphorus flame retardants, edible insects, bioaccessibility, in vitro.

Acknowledgments: This work has been supported by the Conselleria d'Educació, Universitats i Ocupació from Generalitat Valenciana, project CIAICO2022/199. Juan C. would like to acknowledge the fellowship programm from Spanish Ministry of Science, Innovation and Universities, "Estancias de profesores e investigadores sénior en centros extranjeros incluido el programa "Salvador de Madariaga" 2019" to develop a research project in the Toxicological Centre of the University of Antwerp.

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O.5

Classification of food products using vibrational spectroscopy and machine learning

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Abstract

Recent advances in vibrational spectroscopy—driven by major instrumental improvements and, above all, by the rise of powerful machine learning and chemometric methods—have greatly expanded its analytical reach. These developments now allow the extraction of rich compositional and structural information from complex spectra, making vibrational spectroscopy a versatile and data-intensive tool across a growing number of industries. Among these, infrared (IR), near-infrared (NIR), and Raman spectroscopy have rapidly emerged as indispensable techniques in food analysis. Their ability to provide real-time, non-destructive, and reagent-free characterization has positioned them as powerful alternatives to conventional analytical methods. In the specific context of food safety, they offer new opportunities for rapid contamination detection, authentication, and quality monitoring throughout the production chain. This presentation will provide an overview of the principles, instruments, and applications of vibrational spectroscopy in food safety. Emphasis will be placed on the integration of chemometrics and machine learning, which have been key to transforming spectral data into meaningful chemical and physical information. The talk will conclude with two illustrative case studies: (1) the analysis of milk aging and (2) the identification of apricot varieties, demonstrating the broad potential of these methods to support safer and more transparent food systems.

O.6

Immunoanalytical methods for the detection of mycotoxins in food

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Abstract

The research line of the Habtenics group is framed within the field of food quality and safety. We develop rapid analytical methods based on monoclonal antibodies as detecting biomolecules for the determination of contaminants and chemical residues. Our goal is to promote the use of immunochemical methods as reliable analytical tools to improve the chemical quality and safety of food and feed.

Our studies aim to provide official agencies, immunodiagnostic companies, and the agri-food industry with easy-to-use and affordable analytical methods for on-site food control, thereby reducing consumer exposure to potentially hazardous chemicals.

Our scientific strategy focuses on generating a wide collection of high-performance immunoreagents for both regulated and emerging chemical contaminants through innovative chemical approaches that enhance antibody affinity and/or specificity. As a result of our work, we have developed antibodies for about 40 structurally diverse analytes, including mycotoxins, pesticides, antibiotics, hormones, cyanotoxins, and pharmaceuticals (1–3).

Acknowledgements: Agroalnext/2022/028; PID2021-125721OB-C21/C22; Severo Ochoa CEX2021-001189-S

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O.7

Green approaches in food sample preparation: from solvents to smart sorbents

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Abstract

Sample preparation remains a critical step in food analysis, directly influencing the accuracy, reproducibility, and sustainability of analytical workflows. Conventional extraction methods often rely on toxic organic solvents and multistep procedures that generate significant waste and energy consumption. In recent years, the principles of Green Analytical Chemistry have driven a paradigm shift toward more sustainable sample preparation strategies—emphasizing miniaturization, automation, and the replacement of hazardous materials with safer and renewable alternatives.

Among the emerging solutions, deep eutectic solvents (DESs) have gained considerable attention due to their tunable physicochemical properties, low toxicity, and simple synthesis from natural components. These versatile systems can function both as green solvents for liquid-phase extraction and as functional sorbent materials in solid-phase or dispersive microextraction formats. Their dual role opens new opportunities for developing integrated, solvent-saving approaches particularly suitable for complex food matrices.

Another promising example involves the application of cryogels—macroporous, highly permeable materials with exceptional sorption capacity and reusability. Their structural tunability make them powerful tools for the selective extraction and purification of analytes from food samples.

This presentation will highlight the importance of sustainable sample preparation in food analysis and discuss recent advances involving DESs and cryogels as next-generation materials that bridge the gap between solvent-based and sorbent-based green extraction technologies.

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O.8

The effect of greening solid microextraction phases. The case of alkylphenols determination in water samples

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Abstract

The increasing concern over the environmental persistence and endocrine-disrupting effects of alkylphenols (APs) such as 4-nonylphenol (4-NP), 4-octylphenol (4-OP), and 4-tert-octylphenol (4-tOP) has driven the need for sustainable and sensitive analytical approaches for their determination in water. Two analytical strategies applied to the alkylphenols determination in water samples have been compared from the perspective of Green Analytical Chemistry (GAC): (i) the development of a conventional solid-phase extraction (SPE) method for large-scale environmental monitoring across Spain, and (ii) the design of a novel magnetic solid-phase microextraction (MSPE) system using a polymeric magnetic nanocomposite (MHSHC@PLA@C_{18}) synthesized from hawthorn seed waste and recycled silica. The SPE procedure before gas chromatography-mass spectrometry (GC-MS), based on C_{18} sorbent and BSTFA derivatization, achieved low detection limits and revealed the ubiquitous presence of APs in Mediterranean water bodies, with 4-OP being the most prevalent. The magnetic solid phase extraction (MSPE) previous to GC-MS method introduced a sustainable alternative to conventional sorbents, providing efficient extraction with comparable limit of detection values and accuracy values spanning a range between 91 and 116%, and the possibility of sorbent reuse for at least five cycles without significant efficiency loss. From a GAC perspective, the combined approach demonstrates progress toward more eco-efficient analytical practices, reducing solvent and sample consumption, valorizing agro-waste materials, and minimizing hazardous reagent use. The sustainability assessment using the AGREE metric yielded scores of 0.41 and 62.5 for traditional SPE and for MSPE, respectively, confirming the enhanced greenness of the solid phase developed. In the same way, the evaluation of both methodologies by employing the AGREEprep, MoGAPI, RAPI index and the BAGI metrics shown that the modification of solid extraction phases increase positively their sustainable character. Finally, regarding the innovation grade evaluated through the Violet Innovation Grade Index (VIGI) shown that these modifications are positively appreciated by the scientific community.

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O.9

Determination of zearalenone in beer samples using front-face fluorescence and 3D-printed devices

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Abstract

The detection of trace contaminants in food matrices remains a pressing challenge in food safety, due to the potential health risks. Among all contaminants, zearalenone (ZEN) is a mycotoxin produced by filamentous fungi that frequently contaminate cereal crops such as maize, wheat, and barley (1). Owing to its high thermal stability and persistence during food processing and storage, ZEN frequently enters the food chain and has been detected in cereal-based products, including flour, bread and beer (2). Chemically, ZEN acts as a xenoestrogen capable of binding to estrogenic receptors, thus disrupting endocrine function and potentially inducing reproductive disorders in animals and humans (3). Accurate and sensitive detection of this mycotoxin is therefore essential to ensure food quality.

This study presents the development of an analytical platform for the detection of ZEN using magnetic molecularly imprinted polymers (MMIPs) and custom-designed 3D-printed devices for front-face fluorescence (F^3S). For this purpose, the MMIP was synthesized by integrating Fe_3O_4 nanoparticles with a ZIF-8 shell and a methacrylate-based imprinted polymer. Characterization was performed by FTIR, XRD, SEM, and EDX analysis. The prepared materials were used in magnetic dispersive solid-phase extraction (mdSPE) to load ZEN before sensing. Then, the materials loaded with ZEN were magnetically adhered in the 3D-printed F^3S sensor for direct detection on solid surface without elution steps. mdSPE and sensing parameters were optimized, achieving high selectivity. The developed system exhibited good RSD values (<10%), high recoveries in beer samples (up to 92%) and a limit of detection of 0.38 µg/L. These results demonstrate the potential of integrating MMIPs with F^3S 3D printing devices to obtain a cost-effective, easy to use and selective sensor of ZEN mycotoxin in liquid food matrices.

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O.10

Official control on Food Contact Materials: on the way of addressing food safety

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Abstract

Food contact materials - such as packaging, utensils, containers, coatings and other materials intended to come into contact with food - represent a critical link in the food chain. If such materials are not properly regulated and controlled, there is a risk that harmful substances (migrants, contaminants, non-authorised additives) may transfer into food, thereby endangering consumer health, compromising food safety and undermining consumer trust. It is therefore essential that official controls be applied comprehensively and systematically to food contact materials.

The regulation of official controls in the European Union is grounded in Regulation (EU) 2017/625 of the European Parliament and of the Council. This Act establishes a harmonised framework for the performance of official controls and other official activities in relation to food and feed law, animal health and welfare, plant health, and the rules on food contact materials.

Regulation (EU) 2017/625 requires competent authorities to carry out official controls regularly, on a risk basis and with appropriate frequency, including inspections, audits, sampling, testing, verification of compliance, and action in case of non-compliance. These official controls are important for protecting consumer health by ensuring compliance with legislation as well as maintaining integrity of the internal market.

In Comunidad Valenciana the control of food contact materials is done in accordance with the Multiannual National Control Plan. Some results of 2024 Food Contact Materials Control programme are resumed.

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Plan Nacional de Control de la Cadena Alimenticia 2021-2025

Plan de Seguridad Alimentaria de la Comunidad Valenciana

O.11

Mycotoxins in the food chain: mechanistic insights into toxicity and risk assessment for sustainable food safety.

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Abstract

The contamination of stored food has revealed the presence of some of the most harmful natural contaminants known: mycotoxins. These compounds contaminate a wide range of food commodities, and the co-exposure of populations to multiple mycotoxins is an issue that cannot be overlooked [1]. Several key events associated with the toxic effects of mycotoxins have contributed to the description of Adverse Outcome Pathways (AOPs), which help bridge knowledge gaps, identify biological targets, and guide the development of testing methods for chemical risk assessment. The AOP framework is a conceptual construct that facilitates the organization and interpretation of mechanistic data across multiple biological levels, integrating evidence from various methodological approaches, including *in silico*, *in vitro*, and *in vivo* assays [2, 3]. Predictive models that incorporate information on complex biological interactions tend to exhibit greater biological relevance and reliability for hazard and risk assessment than those based on simplified assumptions. However, due to the complexity of many toxicological processes, single AOPs are often insufficient to fully capture the mechanisms involved [4]. Consequently, AOP networks have been developed to better understand the interconnected events contributing to toxicity, particularly under complex exposure scenarios. In this context, the present study explores the use of an *in vitro* alternative method to investigate the key event of pro-inflammatory response. This is achieved by quantifying two immunological mediators—interleukin 6 (IL-6) and tumor necrosis factor alpha (TNF-α)—using ELISA in SH-SY5Y cells exposed to two mycotoxins: gliotoxin (GTX) and ochratoxin A (OTA) [5]. Despite the growing development of inflammation-centered AOP networks, accurately predicting toxicological outcomes related to inflammation remains challenging. Continued refinement of these models is essential to strengthen their role in protecting human health and the environment.

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O.12

Estimating the health burden attributable to exposure to mycotoxins: a quantitative assessment tool

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Abstract

Worldwide, billions of people are at risk and millions fall ill every year as a result of unsafe food due to chemical and microbiological contamination. It is estimated that more than 23 million people in the WHO European Region fall ill from unsafe food every year (WHO, 2015). Foodborne diseases can undermine gains in life expectancy, as they lead to morbidity, to reduced quality of life and contribute to economic losses (WHO et al., 2015). The impact of exposures to food contaminants can be estimated by using a common metric to express the burden of disease, the Disability-Adjusted Life Years (DALY). DALYs are a composed metric that measure the health gap from a life lived in perfect health and quantify this health gap as the number of potentially healthy life years lost due to morbidity, disability and mortality. A disease or a risk factor accounting for a higher number of DALYs has a higher public health impact (Devleesschauwer et al., 2014). Aflatoxins (AFTs) are genotoxic and carcinogenic food contaminants causing hepatocellular carcinoma, the third leading cause of cancer deaths worldwide. In 2015, WHO estimated the burden of disease associated with exposure to AFTs and concluded that this exposure corresponds to 636,869 Disability-adjusted Life Years (DALYs) at global level. The present study aims to assess the burden of disease attributable to exposure to AFT in Europe, considering the exposure data gathered by EFSA (EFSA, 2020) and data from available scientific publications. A deterministic and a bottom-up approach was developed to estimate the health impact of the exposure to AFTs for adult population through the calculation of DALYs associated to the number of estimated extra-cases of hepatocellular carcinoma (HCC) for the European countries. The results obtained under this study give a ranking perspective when compared to other foodborne diseases and constitute an imperative support to risk managers in the establishment of preventive policy measures that contribute to ensure public health protection.

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O.13

Risk Assessment Of Acrylamide Exposure From Popcorn On The Spanish Market

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Abstract

Snack consumption, including popcorn (*Zea mays everta*), is increasing in Spain. Popcorn is susceptible to acrylamide (AA) formation, which occurs through the Maillard reaction between reducing sugars (like glucose) and amino acids (like asparagine) when heated above 120 °C. The International Agency for Research on Cancer (IARC) classifies AA as a probable human carcinogen. The European Food Safety Authority (EFSA) links AA exposure to an increased risk of cancers and neurotoxic effects. Data on AA content in Spanish commercial popcorn is scarce, despite EU regulation (2017/2158) stressing the need for monitoring.

This study monitored AA content in 91 popcorn samples collected across Spain, categorized by flavor and cooking method. Samples were analyzed using solid-liquid extraction (SLE) and LC-MS/MS. The mean AA concentration was 277 ± 119 g kg^{-1}, with 100% incidence. While flavor showed no significant difference, the cooking method was critical: microwave cooking notably increased AA levels. Notably, 87% of samples exceeded the reference limit of 150 g kg^{-1} set for maize-based breakfast cereals.

The estimated daily intake (EDI) of AA ranged from 0.011 to 0.045 g kg^{-1} day^{-1}. Risk was assessed using the Margin of Exposure (MOE), where values below 10,000 suggest potential public health concern. A critical finding was the MOE being below 10,000 for Harderian gland tumors in the child population (30 kg body weight) in both realistic (6,000) and pessimistic (4,000) scenarios. This study, the most comprehensive to date, emphasizes the importance of cooking methods and highlights the need for stricter monitoring and regulatory controls to minimize AA exposure, especially for vulnerable populations.

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O.14

Occurrence and risk assessment to perchlorate in foodstuff of the Spanish market

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Abstract

Perchlorate is a ubiquitous contaminant originating from both natural and anthropogenic sources, such as fertilizers and water disinfection byproducts (1, 2). Its presence in the food chain is a significant public health concern due to its inhibition of thyroid iodine uptake, which can disrupt hormone production (3, 4, 5). In response, European authorities have established stringent maximum limits (MLs) for perchlorate across diverse food matrices (6).

This study aimed to develop and validate a rapid, sensitive, and robust analytical method for quantifying perchlorate in food, and subsequently, to apply this method in a dietary exposure assessment.

The proposed method consists in a modified QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe) methodology. The procedure involves an acetonitrile extraction followed by a dispersive solid-phase extraction (dSPE) clean-up using C18 and graphitized carbon black (GCB) sorbents. Final determination was performed by liquid chromatography with a HILIC-OH5 column coupled to tandem mass spectrometry (LC-MS/MS). This approach offers significant advantages over traditional ion chromatography (IC) methods by reducing complex sample preparation, minimizing matrix interferences, and lowering solvent consumption.

The method was validated according to official guidelines, demonstrating excellent analytical performance. It achieved strong linearity ($R^2 \geq 0.99$), high precision (RSD ≤ 20 %), and satisfactory accuracy (recoveries 70–110%) across various food matrices, fulfilling all the criteria stablished at the European legislation (7). Analysis of market food samples revealed that a significant percentage contained quantifiable perchlorate levels, with 4 samples (3.5 %) exceeding the ML set by the European Union, reinforcing the need for continuous monitoring.

Furthermore, a dietary exposure assessment was conducted using the Hazard Index (HI) and the established Tolerable Daily Intake (TDI) of 1.4 µg / kg (b.w.) per day (3). The assessment indicated that while average intake is generally within safe limits, certain population groups may be at risk of exceeding the TDI.

In conclusion, this validated LC-MS/MS method provides a precise, efficient, and reliable tool for the routine monitoring of perchlorate in food, supporting regulatory

compliance and risk management. Our findings underscore the importance of continued surveillance to ensure consumer protection.

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O.15

Overview of the results of the CIAICO2022/2017 project

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Abstract

In this communication we overview the main results obtained in the Consolidated Research Groups Project entitled "Dietary Risk Assessment of Emerging Environmental Contaminants (Safety4Diet)" financed by the Conselleria d'Educació, Universitats i Ocupació from Generalitat Valenciana (CIAICO2022/2017). Over the three years of the project, its general objectives have been successfully achieved. New methodologies based on Green Analytical Chemistry were developed and validated for the determination of emerging substances in food and drinking water, including perchlorate, haloacetic acids, alkylphenols, pyrrolizidine, tropane and ergot alkaloids, and emerging mycotoxins like citrinin and sterigmatocystin. These analytical approaches were subsequently applied to field samples of food and water, enabling the assessment of human exposure to emerging contaminants through diet. Finally, the project addressed the evaluation of the potential risks associated with this exposure, providing a comprehensive framework for understanding and managing the impact of these contaminants on public health.

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P.1

POSSIBLE MYCOTOXIN INHIBITION BY POLYPHENOLS IN PLANT-BASED MEAT ALTERNATIVES: A CORRELATION STUDY IN PORTUGUESE SAMPLES

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Abstract

Plant-based meat alternatives (PBMAs) are a growing trend in Europe, yet their safety profile must consider mycotoxin occurrence along supply chains rich in cereals, pulses and spices. Mycotoxins such as ochratoxin A (OTA), enniatins (ENNs), moniliformin (MON), tenuazonic acid (TEA) and tentoxin (TTX) are present in plant-based matrices, while PBMAs also contain polyphenols added via ingredients or extracts that may modulate fungal growth and toxin biosynthesis. The aim of this study was to test whether polyphenol content in PBMAs is associated with co-occurrence or inhibition of mycotoxins. Commercial PBMAs from Portugal were analysed. Mycotoxins were extracted with a QuEChERS method, while polyphenols were extracted by ultrasound-assisted extraction using EtOH:H_2O (1:1, v/v). Both mycotoxins and polyphenols were quantified by a validated LC–MS/MS method. Pairwise Spearman's rank correlations (two-tailed) were computed between each mycotoxin and each polyphenol. Significance was set at $p < 0.05$. One consistent inverse association was found: isoquercitrin correlated negatively with OTA ($\rho = -0.563$, $p = 0.039$), suggesting suppression of OTA-producing fungi in the ingredients of PBMAs. In contrast, syringic acid correlated positively with TTX ($\rho = 0.740$, $p = 0.003$), and rutin and quercetin correlated positively with TEA ($\rho = 0.584$, $p = 0.044$ and $\rho = 0.595$, $p = 0.022$, respectively) and quercetin also with TTX ($\rho = 0.647$, $p = 0.012$). Formulations rich in plant extracts and spices tend to carry both higher polyphenol levels and higher presence of mycotoxins, pointing to co-occurrence from common inputs. Studies[1,2,3] reported that phenolic acids such as chlorogenic, caffeic or ferulic and flavonols can attenuate toxin production of mycotoxin-producing fungi. In conclusion, PBMAs contain a broad variety of polyphenols and show mycotoxin contamination. Inverse associations were observed in some pairs (isoquercitrin and OTA, $\rho = -0.563$). Whereas higher levels of flavonoids and phenolic acids tended to co-occur with *Alternaria* toxins (i.e. TEA, TTX), reflecting ingredient-driven co-exposure.

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P.2

DIFFERENTIAL CELLULAR EFFECTS OF SUBCYTOTOXIC VERSUS CYTOTOXIC BEAUVERICIN CONCENTRATIONS IN SH-SY5Y NEUROBLASTOMA CELLS

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Abstract

Beauvericin (BEA) is an emerging cyclic depsipeptide produced by fungi of the genera *Fusarium* and *Beauveria* (Hasuda & Bracarense, 2024). This study investigated the effects of BEA on human neuroblastoma SH-SY5Y cells exposed to concentrations ranging from 0.39 to 12 µM. Concentrations between 0.39 and 2.5 µM maintained cell viability above 80%, as previously reported by Agahi et al. (2020), whereas exposure to 3–12 µM reduced viability to 50–60% (Moyano-López et al., 2025). Reactive oxygen species (ROS) production was monitored over 120 min using the 2′,7′-dichlorodihydrofluorescein diacetate (H_2-DCFDA) probe, while cell cycle distribution (G_0/G_1, S, and G_2/M phases) and cell death by apoptosis or necrosis were analyzed after 24 and 48 h of exposure by flow cytometry. ROS production exhibited a sustained increase at 12 µM (12–32%), whereas lower concentrations (0.39–6 µM) caused transient elevations during the first 45 min. The proportion of cells in the G_1 phase increased with BEA concentrations between 0.39 and 6 µM, reaching up to 15.25% above control levels, while the S and G_2/M phases decreased across all concentrations tested. The apoptotic-necrotic population increased up to 3 µM BEA, and the necrotic fraction showed a dose-dependent rise. After 48 h, the G_1-phase distribution resembled that observed at 24 h, although the reductions in the S and G_2/M phases became more pronounced. Significant increases in apoptotic and apoptotic-necrotic populations were detected at 3 and 12 µM, whereas lower concentrations and 6 µM primarily induced necrosis, suggesting a dose-dependent transition mediated by oxidative stress. Overall, these results indicate that BEA induces concentration-dependent cellular responses. Subcytotoxic doses transiently modulate ROS levels and cell cycle progression without affecting viability, whereas cytotoxic concentrations trigger sustained oxidative stress, leading to apoptotic and necrotic cell death and resulting in irreversible oxidative stress-mediated cellular damage.

Keywords: Beauvericin, SH-SY5Y cell line, cell death, oxidative stress, *in vitro.*

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P.3

Lateral-Flow ImmunoChromatographic Assay for monitoring of emerging homotropanic cyanotoxins in environmental water samples

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Abstract

Homotropanic cyanotoxins are alkaloids with a characteristic 9-azabicyclo[4.2.1]nonane skeleton produced by cyanobacteria, present at water bodies worldwide. The most relevant homotropanic cyanotoxins due to their toxicity and presence in environmental samples are anatoxin-a, homoanatoxin-a, dihydroanatoxin-a, and dihydrohomoanatoxin-a (**Figure 1**). The high acute oral toxicity of dihydroanatoxin-a and dihydrohomoanatoxin-a,[1] as well as their presence in environmental samples, particularly during the spring,[2] suggest that they represent relevant, emerging contaminants requiring close attention from organizations responsible for ensuring human health and animal welfare.

Currently, the recommended analytical technique for determining these cyanotoxins in samples is liquid chromatography coupled with high-resolution mass spectrometry. Nowadays, antibody-based techniques are considered complementary analytical strategies to instrumental methods when a high number of analyses must be performed in a short time, or when on-site testing and/or analysis in low-resource settings is needed. A Lateral-Flow ImmunoChromatographic Assay (LFICA) for the rapid detection of dihydroanatoxin-a and dihydrohomoanatoxin-a in water samples was developed; and validated with lake and river spiked samples.[3]

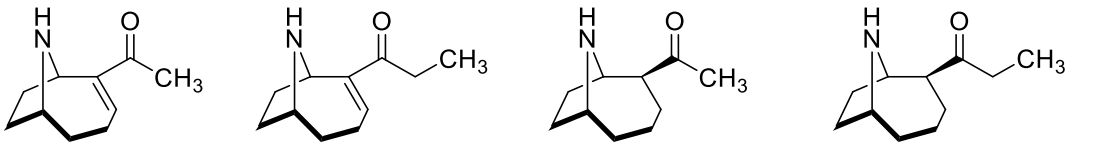

Figure 1. Chemical structures of homotropanic cyanotoxins.

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P.4

DETERMINATION OF PER- AND POLYFLUOROALKYL SUBSTANCES IN FOOD USING LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY

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Abstract

Per- and polyfluoroalkyl substances (PFAS) are an emerging class of persistent organic pollutants (POPs) that have raised increasing concern in the scientific community due to their high persistence, toxicity, and environmental bioaccumulation (1,2). Structurally, PFAS are composed of a hydrophobic alkyl chain of variable length bonded to a hydrophilic terminal group, such as a carboxylic acid or sulfonic acid. The unique physical and chemical properties of PFAS confer them hydrophobic and oleophobic characteristics, temperature resistance, and friction reduction to a wide range of products, which makes them valuable for many industrial uses. Humans can be exposed to PFAS through ingestion, inhalation, and skin contact, representing a certain risk to human health (3). The risk associated with the presence of PFAS in food has led to the need to establish Commission Regulation (EU) 2023/915, which sets maximum level for meat, fish, and eggs (4).

The objective of this study is to develop and validate an analytical method for the determination of 20 PFAS in whole eggs, including the four compounds regulated in the current legislation (PFOS, PFOA, PFNA, and PFHxS). The proposed method involves ultrasound-assisted solid-liquid extraction with acetonitrile, followed by purification using dispersive solid-phase extraction (d-SPE) and quantification of the target analytes by ultra-high-performance liquid chromatography coupled to high-resolution mass spectrometry (UHPLC-Q-Orbitrap-HRMS).

The methodology was successfully validated for 20 PFAS (PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUdA, PFDoA, PFTrDA, PFBS, PFPeS, PFHxS, PFHpS, PFOS, PFNS, PFDS, PFUdS, PFDoS, PFOSA) in terms of linearity ($R^2 \geq 0.991$), selectivity (MB < 30 % LOQ), limits of detection (0.020-0.202 μg kg^{-1}) and quantification (0.067-0.668 μg kg^{-1}), accuracy (87-125 %), and precision (RSD ≤ 20 %). The validated method was subsequently applied to five commercial chicken egg samples. In all samples, the four PFAS currently regulated by the European Union were found at non-quantifiable levels, indicating compliance with existing legislation. Nevertheless, several other PFAS were detected and successfully quantified.

In conclusion, the validated methodology is applicable as a routine method in the food industry or in laboratories in charge of the official controls, in order to monitor compliance with the maximum level set by European Union legislation. However, further research and systematic data collection on PFAS levels in eggs are essential to evaluate current contamination levels, identify trends over time, and support science-based regulatory decisions.

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P.5

Synthesis of an ergometrine hapten and production of antibodies and bioconjugates targeting ergot alkaloids

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Abstract

Ergot alkaloids are a large family of mycotoxins, mainly produced by the fungus *Claviceps purpurea*, which share a common tetracyclic ergoline ring system (Figure 1) and are substituted at the C8 position. Therefore, each alkaloid has two epimeric forms, the pharmacologically active *R* "-ine" form and the inactive *S* "-inine" form, which can be converted into the R form under certain conditions. The European Commission has currently established maximum permitted levels in food for ergocornine, ergocristine, ergocryptine (α- and β- forms), ergometrine, ergosine and ergotamine, as well as their corresponding 8-*S* epimers.

Given the high specificity of antibodies, the main challenge in developing immunoassays for the analysis of ergot alkaloids in food and feed is obtaining receptors capable of recognizing both families of epimers. This research aimed to synthesize an ergometrine derivative, to produce monoclonal antibodies against ergot alkaloids, and to evaluate their binding affinity and specificity.

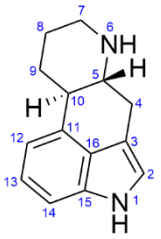

Figure 1. Ergoline ring system.

P.6

Lateral-flow immunochromatographic assay for the on-site and rapid detection of zearalenone in cereals

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Abstract

Zearalenone (ZEN), a macrocyclic β-resorcyclic acid lactone, is a mycotoxin produced by Fusarium species. It is classified as an estrogenic compound because of its structural similarity to naturally occurring estrogens, and it induces adverse effects in humans and other animals. ZEN is one of the most prevalent mycotoxins worldwide, and it is frequently found in corn, wheat, barley, and other cereal grains, and occasionally in milk, meat, and eggs [1]. Its high prevalence and adverse health effects have led the European Commission to set maximum levels between 50 and 400 µg/kg in cereals, while a more restrictive limit of 20 µg/kg applies to processed cereal-based foods destined for consumption by infants and children [2]. of Immunochemical methods are widely accepted in laboratories worldwide for the determination mycotoxins in food and feed. The Lateral-Flow ImmunoChromatographic Assay (LFICA) has become a widely used diagnostic tool due to its simplicity and rapid results, providing outcomes within 10-15 minutes, and including all necessary reagents within a single strip, thus allowing on-site detection [3]. In this study, a colloidal gold-based LFICA in a competitive format was developed and validated for the rapid semi-quantitative detection of ZEN in cereals. Visual observation of the test strip indicated a visual detection limit of 10 µg/kg for ZEN in spiked cereal samples, while analysis using a conventional desktop scanner yielded an IC_{50} value of 0.11 ng/mL in assay buffer.

P.7

Development and validation of a methodology for the determination of emerging mycotoxins exposure through urine samples analysis

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Abstract

Mycotoxins are toxic secondary metabolites produced by certain filamentous fungi that can contaminate foods and feeds, particularly under favorable temperature and humidity conditions. Their presence poses significant risks to human and animal health [1]. According to the Rapid Alert System for Food and Feed (RASFF), mycotoxins constituted the most frequently reported contaminant category in Europe in 2024 [2]. Among the numerous mycotoxins, citrinin (CIT) has been reported as a nephrotoxic compound by the European Food Safety Authority (EFSA) [3], while sterigmatocystin (STG) has demonstrated hepatotoxic, nephrotoxic, and mutagenic effects [4]. Due to the toxic effects observed and their prevalence in the food chain, the development of sensitive analytical methodologies to determine human exposure is essential. The analysis of mycotoxins in urine allows for the assessment of recent exposure; furthermore, it is a non-invasive and easily collected biological matrix, making it commonly used for human biomonitoring studies.

The aim of this research was the development and validation of a fast, simple, and sensitive methodology for the simultaneous determination of CIT and STG in human urine samples. Different sample treatment procedures were evaluated, including dilute-and-shoot, solid-phase extraction (SPE), and a QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe) based methodology. The QuEChERS approach was ultimately selected due to its high recovery rates and reproducibility. Analysis was performed using high-performance liquid chromatography coupled with tandem mass spectrometry (HPLC-MS/MS). The method was fully validated in terms of linearity, sensitivity, accuracy (expressed as recovery), and intra-day and inter-day precision, fulfilling all criteria established in relevant European legislation [5]. The method demonstrated satisfactory linearity and precision, and achieved high sensitivity with limits of quantification (LOQs) of 2.5 pg/mL for CIT and 0.75 pg/mL for STG.

The validated method was applied to twenty human urine samples. STG concentrations were below the limit of detection (LOD) in all samples, with the exception of one sample which showed trace levels below the LOQ. Conversely, 20% of the samples (n=4) showed quantifiable CIT levels, with concentrations ranging from 9 to 28 pg/mL. Based on the data obtained from the urine analysis, the estimated daily intake (EDI) of CIT was calculated, and a preliminary risk assessment was performed. The results indicated that the detected CIT levels do not pose a significant toxicological risk for the

studied Spanish population. However, it must be noted that for a comprehensive risk assessment, the metabolites of both mycotoxins should also be investigated.

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P.8

Preliminary results on the determination of Pyrrolizidine, Tropane and Ergotic alkaloids via ultra high-performance liquid chromatography tandem mass spectrometry

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Abstract

Pyrrolizidine alkaloids (PAs) and tropane alkaloids (TAs) are secondary metabolites produced by several species of plants. PAs have been classified by the EFSA as hepatotoxic [1] and by the IARC as possible carcinogenic agents [2] causing several health issues such as hepatic veno-occlusive disease. TAs have been classified as neurotoxic [3] causing anticholinergic syndrome. Ergot alkaloids (EAs) are mycotoxins produces by several fungi of the genus *Claviceps,* commonly affecting crops and cereal products [4]. The consumption of EAs can lead to toxic effects, commonly known as ergotism, which manifests with convulsive and gangrenous symptoms [5]. The potential health problems and the presence of these contaminants in the food chain have led the European Union to set maximum limits in certain food products, established at Commission Regulation 2023/915 [6].

The presence of these contaminants in food and their potential toxicity has enhanced the urgency to develop analytical methodologies for evaluate the occurrence of these compounds in food. The aim of this study is to develop a methodology for the determination of 28 PAs, 2 TAs, and 12 EAs, species in foodstuff. This selection of chromatographic conditions has been carried out by the analysis of standard solutions using ultra high-performance liquid chromatography-tandem mass spectrometry (UHPLC-MS/MS). Several chromatographic parameters such as different mobile phases, chromatographic columns and gradients have been tested to enhance the sensitivity and chromatographic resolution of the methodology. In addition, MS/MS parameters such as collision energy, scan time or tube lens have been optimised, obtaining a high sensitivity with LODs between 0.1 and 2.4 µg/L. Also, preliminary tests for the use of a clean-up step based on dispersive solid phase extraction have been performed to evaluate the effect of the most commonly used sorbents, including C18, PSA, GCB and Z-SEP, where C18 and PSA gave the best recovery rates.

In conclusion, an efficient and highly sensitive analytical method has been tuned for 28 PAs, 2 TAs, and 12 EAs with UHPLC-MS/MS and the reliability of different sorbents has been tested for future food analyses, with positive results for C18 and PSA.

Acknowledgments Conselleria d'Educació, Universitats i Ocupació de la Generalitat Valenciana, proyecto CIAICO2022/217.

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P.9

Urinary Biomonitoring of Mycotoxins in Spanish Adults: Health Risk Evaluation

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Abstract

Mycotoxins, a group of naturally occurring secondary metabolites produced by fungi, are globally widespread and pose a serious risk to human health due to their toxicological effects, including carcinogenic, mutagenic, and neurotoxic properties [1]. Exposure occurs through the consumption of contaminated foods or animal-derived products from livestock fed with contaminated feed. Aflatoxins (AFs), zearalenone (ZEN), and ochratoxin A (OTA) are among the most widespread mycotoxins, while emerging compounds such as alternariol (AOH), alternariol monomethyl ether (AME), citrinin (CIT), and sterigmatocystin (STER) are gaining increasing attention due to their potential health impacts [2,3]. This study analysed 492 first-morning urine samples from adults, aged 18 – 65 years, in the Valencian Community, Spain, to evaluate internal exposure to twelve mycotoxins and assess the potential health risks associated with such exposure. Samples were analysed using a "dilute-and-shoot" approach followed by ultra-high-performance liquid chromatography coupled to tandem mass spectrometry (UHPLC-MS/MS) [4]. AFs were the most frequently detected, with a geometric mean (GM) of 1.17 ng/mL and a 95th percentile (P95) of 6.04 ng/mL. AOH, present in 63% of samples, showed high concentrations (GM: 0.98 ng/mL; P95: 4.74 ng/mL). Probable daily intakes (PDIs) were estimated from urinary concentrations to support risk assessment process. Corresponding Hazard Quotients (HQs) and Margins of Exposure (MOEs) were calculated, along with Hazard Index (HI) and total Margin of Exposure (MOET) to evaluate the risk associated with mycotoxin mixtures. The results derived from these indicators suggest that potential health risks cannot be excluded.

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P.10

Evaluation of ochratoxin A content in fermented and roasted beverages using affinity 3D-printed polypropylene platforms

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Abstract

Mycotoxins have attracted considerable attention due to their widespread occurrence in food and feed, and their potential to pose serious health risks to both humans and animals. Among them, ochratoxin A (OTA), produced mainly by Aspergillus and Penicillium species, is one of the most prevalent and toxic. OTA is commonly found in cereals, coffee, dried fruits, wine, and spices, and is known for its nephrotoxic, immunosuppressive, and potentially carcinogenic effects. Consequently, to safeguard public health, the development of reliable and highly sensitive analytical methods for detecting and quantifying OTA in food matrices is essential for ensuring food safety. This work presents the development of extraction platforms based on 3D-printed devices modified with aptamer functionalized metal–organic frameworks (MOFs) for the selective extraction of OTA. Dispersive solid-phase extraction (dSPE) was firstly evaluated using various MOFs, among which the carboxylate-functionalized UiO-66 was selected due to its low retention of OTA, making it a suitable candidate for posterior functionalization with the aptamer. In this regard, an amino-terminated aptamer was immobilized onto the surface of UiO-66 via electrostatic interactions, resulting in an aptamer-modified MOF (Apt@MOF). The resulting Apt@MOF was characterized, and several parameters (such as loading and elution solvents, extraction and desorption times, among others) that affect the extraction efficiency of dSPE were carefully investigated. Next, the Apt-MOF was then incorporated onto 3D-printed supports and applied for the selective isolation of OTA from wine, beer and coffee.

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Development of functionalized resins for protein extraction

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Abstract

This study reports the development and evaluation of polymeric supports fabricated by masked stereolithography (MSLA) 3D printing for protein retention applications. A commercial ABS-like resin was modified with up to 40% pentaerythritol tetrakis(3mercaptopropionate) (PETMP) and 5% trimethylolpropane triacrylate (TRIM), yielding structures with functionalizable surfaces due to the presence of sulfur groups. Gold nanoparticles (AuNPs) were subsequently anchored to these surfaces to enhance biomolecular interactions. Additive manufacturing enabled the production of geometrically precise and reproducible pieces, demonstrating its potential as a versatile platform for biointeraction studies. Scanning electron microscopy (SEM) confirmed the uniform distribution of AuNPs on the optimized formulations. The adsorption capacity of the printed supports was evaluated using bovine serum albumin (BSA) as a model protein through Bradford assays, revealing significantly higher retention in AuNPfunctionalized supports (80%) compared to unmodified ones (21%). These results highlight the potential of MSLA-based 3D printing for creating customizable, functional materials for biotechnological and sensing applications. Future developments could extend this approach toward food-related uses, such as the fabrication of reusable biosensing platforms for detecting allergens, monitoring proteinbased contaminants, or assessing food freshness, thereby contributing to safer and more efficient food quality control systems.

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P.12

Sustainable extraction platforms modified with metal-organic frameworks for the analysis of estrogens in milk samples

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Abstract

In recent years, the presence of chemical contaminants in food matrices such as milk has become a major concern due to their potential impact on human health. Therefore, it is essential to develop analytical devices that are efficient, low-cost, and sustainable for the detection of these compounds in complex samples. Metal–organic frameworks (MOFs) have shown great potential as sorbent materials because of their high porosity, tunable surface area, and chemical stability. However, their direct use in dispersive extraction methods can be problematic due to material loss and the need for additional separation steps. To overcome these limitations, functional devices can be fabricated using readily available materials such as filter paper, which is easy to modify and highly resistant, or through additive manufacturing technologies like fused deposition modeling (FDM) 3D printing, which enables precise and reproducible designs. In this study, paper-based and 3D-printed supports coated with MOFs were developed and applied as extraction devices for contaminant determination in milk samples. A preliminary dispersive solid-phase extraction (dSPE) screening was performed to select the MOF with the best analytical performance, which was then incorporated into both device types. Their extraction efficiencies were compared, demonstrating the feasibility of these functional supports for efficient analyte isolation in complex dairy matrices.

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Development of a 3D-Printed aptamer-based fluorescent sensor for the detection of Ara h1

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Abstract

Food allergies are a growing public health concern, with peanut allergy being one of the leading causes of anaphylaxis, and Ara h1 serving as one of its major allergens. This rise in incidence highlights the need for reliable analytical methods to detect and quantify food allergens, where aptamers show great potential. These single-stranded oligonucleotides can be chemically modified to enhance stability, enable fluorescent labeling, or facilitate immobilization on various platforms, making them ideal for developing rapid, sensitive, and cost-effective biosensors for allergen detection in complex food matrices.

3D printing enables rapid, single-step fabrication of complex devices from diverse materials. In our study, stereolithography (SLA) was implemented. This technique relies on photopolymerization, where UV light cures a liquid resin layer by layer. Modifying resins with monomers like glycidyl methacrylate (GMA) allows the introduction of reactive functional groups, enabling further chemical customization of printed structures for advanced applications.

In this work, we explored the application of modified aminated aptamers anchored to a fluorescent molecule while making use of customized 3D pieces for the detection of one of the main peanut allergens, Ara h1.

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Determination of the allergen Ara h1 in food matrices using a fluorescent aptamer

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Abstract

Food allergies pose a significant threat to public health. Among a myriad of allergenic foods, peanuts have received substantial attention due to the dangers associated with this condition. Peanut allergy can be potentially life-threatening, with anaphylaxis being its most severe symptom. This pathology has increased both in number and severity, also appearing earlier in life. Affecting around 1 % of the population in the United States and 0.5 % in Spain, it is one of the primary triggers of anaphylaxis worldwide [1, 2]. Particularly, Ara h1 is a major peanut allergen, and is commonly used to monitor peanut contamination. Therefore, there is a rising need to develop analytical methods for detecting and quantifying allergens in food matrices and aptamers show great potential in meeting this need. Compared to the conventional approaches, aptamers offer a reliable, fast and cost-effective alternative. These single-stranded oligonucleotide sequences are highly versatile and can be chemically modified, allowing them to acquire a variety of new characteristics suitable for diverse applications. Fluorescence-based techniques, particularly using aptamers labeled with FAM (a fluorescent derivative of fluorescein), allow simple, sensitive, and rapid protein quantification without the need for target labeling. This approach demonstrated strong potential for detecting and quantifying allergens in food matrices.

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P.15

Rapid sensory methodologies for the formulation of a beverage with functional potential

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Abstract

In recent years, fruit- and vegetable-based beverages have shown greater commercial acceptability, leading to the functional foods category becoming one of the main focuses in new product development processes at an industrial level (1). Chayote (Sechium edule (Jacq.) Swartz) is a vegetable belonging to the squash family. It is underutilized and characterized by its simple flavor, low calorie content, high water content, and as an important source of vitamins. In addition, it has been attributed with diuretic, antihypertensive, and anti-inflammatory properties (2). On the other hand, turmeric (Curcuma longa L.) is a plant native to the tropical region of South Asia. It is used as a food flavoring, a dye for fabrics, and is noted for its antioxidant, anti-inflammatory, anticancer, and antimicrobial properties (3).

Sensory evaluation is a series of techniques applied to quantitatively and qualitatively measure the sensory reaction of consumers or judges to stimuli associated with product parameters. It is considered to act as a bridge between the areas of research and product development, connecting the chemical characterization of the product with consumer perception (4). Affective sensory tests, such as the Likert scale and Just About Right (JAR), are related to measuring the degree of satisfaction and acceptance of the product, for which untrained consumer panels are used (5).

The objective was to develop a chayote and turmeric-based beverage formulation by applying mixture design methodology and sensory analysis as a means of optimization, initially using a sensory satisfaction analysis (Likert scale) to discard formulas and subsequently applying a JAR (Just About Right) scale to evaluate the sensory attributes and acceptability of each of the 12 formulations generated from the design of experiments with mixtures.

The study showed a relationship between the composition (%m/m) of the turmeric infusion in the drink and the percentage of consumer dissatisfaction, based on the Likert scale. Through the analysis of penalties on the JAR scale, acidity and sweetness were established as modulating attributes of acceptability, impacting between 2 and 4 points on a hedonic scale of 9.

Finally, through numerical optimization, with the objective functions being to maximize acceptability and achieve a fair rating (value equal to 3) for the attributes of sweetness and sensory acidity, the optimal formula for the beverage was selected, with a composition of 33.5% chayote, 25% turmeric infusion, 23.5% lemon juice, and 18.0%

sugar. This formula obtained an overall acceptability rating of 7.06 points out of a total of 9.

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P.16

Synthesis of Magnetic Hydrochar from Hawthorn Seeds for the Determination of Fluoroquinolones in Chicken Meat Using Magnetic Solid-Phase Extraction, Liquid Chromatography and UV detection

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Pharmaceuticals in biological matrix have been an environmental issue since the 1994s (1). An important but often ignored aspect is the fate of antibiotic residues that reach the environment by different pathways. In this work, magnetic hydrochar from hawthorn seeds was successfully synthesized via the hydrothermal method and used as an adsorbent in magnetic solid-phase extraction (MSPE) for the separation of trace fluoroquinolone antibiotics (Ciprofloxacin and Delafloxacin) in chicken meat, followed by analysis using high-performance liquid chromatography (HPLC) with UV detection. The synthesized adsorbent was characterized using different techniques, including Fourier Transform Infrared (FTIR), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The separation of fluoroquinolone antibiotics was carried out on a C18 column using isocratic elution. The mobile phase consisted of acidified water (1% formic acid, pH 3) and acetonitrile in a 16:84 ratio. Various parameters influencing extraction efficiency were studied and optimized. Under the optimized conditions, the method provided excellent linearity, with the coefficient of determination (R^2) ranging from 0.9992 to 0.9995. Spiked recoveries were also high, ranging from 82.1% to 98.6%, with a relative standard deviation (RSD) of less than 4.5%.

Keywords: magnetic solid phase extraction (MSPE), carbon nanotubes, fluoroquinolones, chicken meat, HPLC-UV.

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P.17

Mitigating uncertainty: workshop safety in dietary risk assessment for food contamination control

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Abstract

Food contamination poses one of the most persistent challenges in public health and food toxicology.

Whether through chemical residue, biological agents, or environmental pollutants, contaminants can compromise both food safety and consumer health.

The credibility of Dietary Risk Assessment (DRA) -the systematic evaluation of human exposure and associated health risk- depends not only on accurate toxicological data but also on safe and controlled laboratory practices during assessment.

A workshop safety framework ensures that each analytical stage-from sampling and preparation to data processing -maintains Data integrity, minimizes cross-contamination, and preserves the chain of Data custody.

Errors introduced through unsafe handling, poor calibration, or mishandling of contaminated materials can amplify Uncertainty factors (UFs) and distort risk conclusion.

Incorporating Standard Operating Procedures (SOPs), validation checkpoints, and strict contamination control measures is therefore essential to maintain both scientific credibility and public confidence in food safety evaluations.

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References:

CTIAA- Technical center for food industries provides a directory of Algerian food companies.

Kompass Directory – business directory with a full category for Aleria's food industry.

Sim Group – large producer of floor, semolina, pasta, couscous, and animal feed.

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