

INTERNATIONAL CONFERENCE ON MICRO AND NANO-PLASTICS IN THE AGRI-FOOD CHAIN













Faculty of Agriculture, Food and Environmental Sciences

Università Cattolica del Sacro Cuore, Piacenza, Italy 10-12 September 2023

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Foreword

Plastic materials have been for decades part of our daily life, bringing several advantages to the quality of our lives. In the last years several concerns were however raised about their possible environmental, toxicological and ecotoxicological impacts. Plastic materials are indeed in most cases highly resistant to degradation processes, leading to their accumulation in the environment. Physical and biological agents can disaggregate plastics and bioplastics into micro- and nanoplastics, which pose potential toxicological and ecotoxicological issues.

While plastic contamination in aquatic environments has been studied for decades, only recently the scientific community shifted its focus to terrestrial environments. Plastics and bioplastics contamination can affect physical, chemical and microbiological functions of soils. Crops can take up plastic particles as a gateway to the food chain, leading to toxicological effects that are still being investigated and clarified. Since plastics are an unavoidable component of agri-food chains, understanding the risks and developing mitigation strategies is crucial.

AGRIFOODPLAST, the 1st International Conference on micro- and nano-plastics in the agri-food chains, is gathering international experts for a state-of-the-art assessment of micro and nanoplastics in the soil-plant-food-human chain. We have received a strong feedback from the scientific and stakeholders community, with more than 130 delegates from around the World gathering in Piacenza to discuss various aspects of micro- and nano-plastics science, including fate and modelling in terrestrial environments, impact on soil functions, exposure assessment in food, toxicological and ecotoxicological effects in the agri-food chain, the available remediation technologies and a One-Health approach for assessing associated risks.

On behalf of the organizing committee, I welcome you to AGRIFOODPLAST and I wish you a fruitful and successful experience, that shall pave the way for a series of international events devoted to the studies of micro and nanoplastics in agricultural systems.

Prof. Edoardo Puglisi Conference Chair Faculty of Food, Agriculture and Environmental Science Università Cattolica del Sacro Cuore

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Conference Sessions

Session 1	Fate & modelling of micro- and nano-plastics in terrestrial environments
Session 2	The soil plastisphere: degradation processes, interactions with other stressors and impacts on soil functions
Session 3	Exposure assessment of micro- and nano-plastics in foods
Session 4	Toxicological and ecotoxicological impacts of plastics and bioplastics in the agro-food chain
Final Workshop	A One-Health approach for risk assessment of micro- and nano-plastics

Schedule of the Event

Sunday 10th September

15.00-18.00	Registration
18.00-18.15	Opening Ceremony
18.15-19.15	Opening Keynote Lecture Damia Barceló : <i>"Microplastics in terrestrial</i> <i>aquatic environments: green analytical protocols,</i> <i>and sustainable solutions"</i>
19.15-21.00	Welcome Dinner Party

and risks

Monday 11th September

Session 1 – Fate & modelling of micro- and nano-plastics in terrestrial environments

	Chairs: Moritz Bigalke, Alberto Frache, Luca Nizzetto
08.30-09.00	Keynote Lecture
	Luca Nizzetto : "Confronting uncertainties of models for plastic releases, fate and transport"
09.00-10.30	Selected Oral Presentations
	Marion Yvin, Mikaël Kedzierski, Maët Le Lan, Samuel Mondy, Stéphane Bruzaud: "Degradation and end-of-life of biodegradable plastic mulches in soils"
	Delphine Cirederf Boulant , Isabelle Deportes, Stéphane Bruzaud, Mikaël Kedzierski: <i>"Microplastic contamination of</i> organic fertilisers applied to agricultural soils"
	Leah Mupas Segui , Sarah Baulch, Paola Paruta, Julien Boucher, Emilia Jankowska, Margaret Murphy, Richard Thompson, Jim Palardy, Richard Bailey, Winnie Lau:

"Evaluating policy solutions to address microplastic emissions to land"

Tommaso Nacci, Francesca De Falco, Fannie Burgevin, Winnie Courtene-Jones, Antoine Buchard, Richard C. Thompson, Ilaria Degano, Francesca Modugno: *"Studying the fate of biodegradable mulch films in the environment"*

Vincent Ojijo, Sudhakar Muniyasamy, Asanda Mtibe, Nomvuyo Nomadolo, Maya John, Osei Ofosu, Rakgoshi Lekalakala, John Letwaba, Omotola Esther Dada: "Biodegradable Mulch Films Development: A case study for Africa"

Amna Zia, **Zulfiqat Ahmad Saqib**: "Distribution characteristics of microplastics in agricultural soils in two cities of Pakistan"

10.30-11.00 Coffee Break and poster session

Session 2 – The soil plastisphere: degradation processes, interactions with other stressors and impacts on soil functions

	Chairs: Noureddine Bousserrhine , Maria Cristina Cocca , Fabrice Martin-Laurent
11.00-11.30	Keynote Lecture
	Moritz Bigalke : <i>"100 or 10.000 microplastics kg⁻¹:</i> What are the problems with analyzing MP concentrations in soils?"
11.30-13.00	Selected Oral Presentations
	Marta Elisabetta Eleonora Temporiti , Lidia Nicola, Solveig Tosi: "The fungal assemblage in soil polluted by plastics. Biodiversity, metabolism, and degradation potential"
	Sara Guerrini , Martina Mazzon, Paola Gioacchini, Daniela Montecchio, Claudio Ciavatta, Claudio Marzadori:

"Biodegradable plastics: effects on soil functionality an	d
fertility"	

Christian Tötzke, Boyana Kozhuharova, Nikolay Kardjilov, Sascha E. Oswald: "Non-destructive detection and visualisation of microplastics in sandy soils by a novel 3D imaging approach"

Bandini Francesca, Filippo Vaccari, Agata Gallipoli, Camilla Braguglia, Edoardo Puglisi: "*Exploring Bioplastic Degrading Microorganisms for Enhanced Biodegradation and Sustainable Waste Management*"

Giuseppe Proietto Salanitri, Paolo Riccobene, Fabiana Convertino, Anna Chiara Dell'Acqua, Evelia Schettini, Giuliano Vox, Pierfrancesco Cerruti, Sandro Dattilo, Sabrina Carola Carroccio: "*Release into the soil of additives contained in biodegradable mulching films during their life of use*"

Guido Zampieri, Ginevra Giangeri, Gabriele Ghiotto, Alessandro Satta, Diego Penzo, Silvia Zanatta, Elisabetta Bergantino, Michele Modesti, Stefano Campanaro, Laura Treu: "*Plastic metabolisation potential of the environmental microbiome following long-term exposure*"

13.00-14.00 Lunch

14.00-14.30 Invited Lecture

Elena Rovesti: "The work of European Food Safety Authority in the risk assessment of micro and nanoplastics in food"

14.30-15.00 Invited Lecture

Lauren Weir: "Cultivating Plastic: Agriplastics, Grocery Retailer supply chains and Regulatory Loopholes: Focus on the UK"

15.00-16.00 Flash poster presentations

Chairs: Maurizio Avella, Iteb Boughattas, Alexsandra Tubic,

Selene Chinaglia: "Analysis of the microplastic emission potential of polymeric materials"

Medina Veliu: "Application of analytical pyrolysis for the molecular fingerprinting of polymers (PE, PET, PP, PS and PVC) within natural organic matter matrices used for rooftop farming"

Chiara Gnoffo: "Optimization of pyrolysis-gas chromatography/mass spectroscopy parameters in order to obtain nanoplastics calibration curves"

Filippo Vaccari: "The short-term effect of microplastics in lettuce involves size- and dose-dependent coordinate shaping of root metabolome, exudation profile and rhizomicrobiome" Federica Piergiacomo: "Do microplastics offer a suitable surface for antibiotic resistance spread into the open environment?"

Anna Vanessa Alves: "Agri-Plast - Production Organization and Innovation for the Reduction of Agricultural Plastics" Flavia Capuozzo: "Preliminary survey on the occurrence of microplastics in marketed clams (Tapes semidecussatus)." Krystina Duswald: "New Spectroscopic Techniques and Machine Learning for Microplastic Identification"

Gokhan Tuncelli: "The effect of different types of microplastic and acute cadmium exposure on the Mediterranean mussel (Mytilus galloprovincialis Lamarck, 1819)"

Sara Patrucco: *"Microplastics contamination in ruminant feeds: an emerging issue for livestock sector"*

Hager Elboghdady: "Microbial acclimation of thermophilic anaerobic digestate enhances biomethane production and biodegradation of polylactic acid in combination with organic wastes."

Kate Schofield: "HERA-MP - Establishment of a holistic environmental risk assessment for microplastics in the terrestrial environment using the study of environmentally relevant particles - ECO61"

16.00-16.30

Coffee Break and poster session

16.30-18.00	Session 3 – Exposure assessment of micro- and nano- plastics in foods
	Chairs: Margherita Ferrante , Mohamed el Banni , Joaquim Rovira
16.30-17.00	Keynote Lecture
	Gea Oliveri Conti : "Microplastics: the invisible and underestimated risk in the food chain"
17.00-18.00	Selected Oral Presentations
	Nora Exposito , Jordi Sierra, Maria I. Arnone, Salvatore D'Aniello, Ignasi Gairin, Patricia Prado, Jaume Folch, Marta Schuhmacher, Joaquim Rovira: " <i>Marine invertebrates</i> <i>interaction with microand nanoparticles particles: size and</i> <i>morphology influence on ingestion-egestion</i> "
	Benedikt Hufnagl , Eva Cseperke Vizsolyi, Martin G. J. Löder, Christian Laforsch, Kristina Enders, Robin Lenz, Dieter Fischer, Yuliya Voronko, Gabriele Eder, Michael Washüttl: "Microplastics detection in food and beverages – Fast data processing and visualization approaches for μFTIR hyperspectral imaging based on machine learning"
	Federica Di Giacinto , Ludovica Di Renzo, Giuseppina Mascilongo, Valentina Notarstefano, Giorgia Gioacchini, Elisabetta Giorgini, Tanja Bogdanovic, Sandra Petricevic, Eddy Listes, Federica Conti, Chiara Profico, Gabriella Di Francesco, Gianfranco Diletti, Miriam Berti, Carla Giansante, Nicola Ferri: "Detection of microplastics, polymers and additives in mussels and large pelagic fishes in the Adriatic Sea"
	Claudia Favara , Margherita Ferrante, Paola Rapisarda, Maria Castrogiovanni, Antonio Cristaldi, Eloise Pulvirenti, Oliveri Conti Gea, Maria Fiore: "Evaluation of microplastics in pigs samples intended for human consumption"
19.30	Bus pick-up for Gala dinner
20.00	Gala Dinner

Tuesday 12th September

Session 4 – Toxicological and ecotoxicological impacts of plastics in the agro-food chain

	Chairs: Francesca Bandini , Dimitrios Karpouzas , Gea Olivieri Conti
08.30-9.00	Invited Lecture
	Giulia Carcasci : "The work of the Food and Agriculture Organization of the United Nations to improve the sustainability of plastics used in agriculture and their alternatives" FAO
09.00-9.30	Keynote Lecture
	Esperanza Huerta Lwanga : "Risk assessment of microplastics along the terrestrial food chain"
09.30-10.30	Selected Oral Presentations
	Sam van Loon, Klára Šmídová, Laura Zantis, Sylwia Adamczyk, Sannakajsa Velmala, Shin Woong Kim, Matty Berg and Kees van Gestel: "Effects of starch-PBAT blend microplastics on plant growth, soil organisms, microbial functioning and soil physicochemical properties in a mesocosm study"
	Iteb Boughattas , Filippo Vaccari, Leilei Zhang, Francesca Bandini, Begona Bigas-Moreno, Omayma Missawi, Sabrine Hattab, Marouane Mkhinini, Luigi Lucini, Edoardo Puglisi, Mohamed Banni: " <i>Coexposure to environmental</i> <i>microplastic and the pesticide 2,4-dichlorophenoxyacetic</i> <i>acid (2,4-D) induce distinctive alterations in the metabolome</i> <i>and microbial community structure in the gut of the</i> <i>earthworm Eisenia Andrei</i> "
	Chayma Alaya, Iteb Boughattas, Ilef Romdhani, Yossra Missaoui, Sonia Gaaied, Mohamed Banni, Sabrine Hattab :

"Microplastic in agriculture soils irrigated with treated waste waters: ecotoxicological effects using Lumbricus sp."

Giovanni Milani, Mireya Viviana Belloso Daza, Daniela Bassi, Claudia Cortimiglia, Marianna Bozzetti, Pier Sandro Cocconcelli: "*Microplastic mediated transfer of Tetracycline resistance: unveiling the role of mussels in marine ecosystem*"

- 10.30-11.00 Coffee Break and poster session
- 11.00-11.30 Keynote Lecture

Joana Correia Prata: "Impact of airborne and foodborne microplastics on human health"

11.30-12.30 Selected Oral Presentations

Serena Ducoli, Stefania Federici, Andrea Zendrini, Paolo Bergese, Laura E. Depero: *"True-to-life nanoplastics for toxicological and ecotoxicological studies"*

Tania Martellini, **Alessandro Russo**, Alessandra Cincinelli, Saul Santini, Cristiana Lofrumento, Matteo Baini, Samuele Ciattini, Luca Conti, Francesca Mostardini, Luca Mercatelli, Dimitrios Karpouzas, Alberto Ugolini: "*Bioplastic on marine sandy shores: degradation by supralittoral talitrid amphipods*"

Nicolas Beriot, Raul Zornoza, Esperanza Huerta Lwanga, Violette Geissen: "*Plastic mulch and pesticides residues effects on the lettuce growth*"

Paola Pontecorvi, Simona Ceccarelli, Fabrizio Cece, Simona Camero, Elena Niccolai, Giulia Nannini, Giulia Gerini, Enrico Romano, Amedeo Amedei, Cinzia Marchese, Francesca Megiorn: "Assessing the impact of Polyethylene Nano/Microplastic Exposure on Human Vaginal Keratinocytes"

12.30-13.00 Awards and closing cerimony

13.00-14.00	Lunch
14.00-15.00	Meeting of the organizing committee, organization of
	the next conference and future steps

Final workshop – A One-Health approach for risk assessment of microand nano-plastics (Papillon-Minagris-PRIORITY stakeholders meeting) -Hybrid event free of charge

15.30-18.30	Chairs: Julie Ingram (MINAGRIS Horizon project), Stefania Federici (PRIORITY COST action), Luca Nizzetto (PAPILLONS Horizon project)
	Supporting co-chairs: Edoardo Puglisi , Filippo Vaccari , Honor Mackley-Ward (MINAGRIS), Adalgisa Martinelli (PAPILLONS)
PART 1	Brief complementary presentations from MINAGRIS and PAPILLON EU project partners with updates on research about micro and nanoplastic impacts on soil and ecosystem health, and a short introduction to the COST Action PRIORITY
PART 2	Scene-setting invited lectures, followed by Q&A
	Ettore Capri : <i>"A roadmap for micro and nanoplastics risk assessment: lessons to be learned from plant protection products "</i>
	Margherita Ferrante: "Standardisation of methods for micro and nanoplastics quantification. The experience with patented food methods and the potential transfer to soil analyses "
PART 3	Interactive in-person session: Risk Assessment Roadmap, Method Standardisation and Research gaps to be met for policy development

Keynote Speakers

Damia Barceló Cullerès – Opening Keynote Lecture



Damia Barceló Cullerès is Full Professor at IDAEA-CSIC, Spain. Since 2008 Director at the Catalan Institute for Water Research (ICRA). His main expertise cover the analysis, fate, risk and removal of emerging contaminants and microplastics from water, sewage epidemiology of drugs and proteins. Since 2010 he is listed as highly cited scientists (ISI Highly Cited), with more than 1600 publications indexed in Scopus, a Hirsch-Index of 139 and total number of citations over 90,000.

Microplastics in Terrestrial and Aquatic Environments: Green Analytical Protocols, Vectors of Pharmaceuticals and Risk to Biota

Plastic pollution is nowadays a global and ubiquitous problem everywhere: marine environment, sand beaches, wastewaters, surface waters, soils, sludges, sediments, biota, food and air. Plastic is part of our daily life and worldwide we use 4 trillion plastic bags annually and 1 million plastic bottles every minute. Microplastics (MPs) are directly released into the water or formed by degradation of Macroplastics. Plastic litter enters the marine environment from diverse points and diffuse sources and it can be transported through rivers long distances before being deposited in the bottom of seas. Few studies suggest that river litter can contribute up to 40% of all marine litter input, being estimated over 1.2-2.5 million tonnes of plastic every year (1, 2). MPs amount in soils globally is estimated between 1.5 to 6.6 Million Tons, being China with 660 KiloTons of MPs in soils the number one in the list. The main reason has been attributed to the irrigation of the agricultural fields with wastewater. The estimation of MPs in soils of Spain and Italy is 38 and 28 KiloTons respectively due to the increasing reuse of water for agriculture as a consequence of water scarcity in the Mediterranean region. The total amount of MPs present in soils and solid organic wastes around the globe is probably higher than the amount of MPs present in the surface of the oceans (2, 3). MPs, as many other contaminants, can percolate through the agricultural soils and reach the groundwater table (4). Having said that, this presentation will cover in the first part different aspects of MPs and Macroplastic litter pollution in terrestrial environment as well coastal waters, rivers, sediments and lakes. Case studies of MPs pollution in several coastal environments, sediments and catchments of China, Saudi Arabia, India, Europe and Australia will be reported (2, 5, 6). The second part of this lecture will discuss Green Analytical Chemistry (GAC) protocols for the analysis of MPs in water (7). GAC issues will be discussed in all steps of the method (i) sampling, (ii) sample preparation and (iii) identification and quantification measures can be taken to make the method more environmentally friendly and sustainable, safer for the operator by assessing their greenness through Analytical Eco-scale and AGREE metrics among others. The following part of this lecture will describe as well MPs as vectors of pharmaceuticals such as non-steroidal anti-inflammatory drugs (NSAIDs) or, psychiatric drugs that can sorb to MPs surface (8). During COVID-19 pandemic clearly excessive use and consumption of single-use plastics (including personal protective equipment such as masks and gloves) occurred (9). Lastly, it is expected that MPs will affect communities, biological diversity, and ecosystem processes (10). As regards to toxicity of MPs that is expected that smaller MPs and NPs particles will be more toxic to organisms. Many aquatic organisms are used for biomonitoring programs being possible to obtain quantitative information about the state of health of the ecosystem. Bivalves such as Mytilus galloprovincialis were used (11). This is part of the so-called "mussel-watch" program for MPs but we will mention its presence and effects in lakes too (12). To this end I would like to highlight few recommendations to mitigate plastic pollution: (i) law and waste management strategies, such as exploring new removal technologies and avoid landfilling (ii) more education, outreach and awareness, (iii) increasing monitoring and risk assessment to better understand the threat to biodiversity and (iv) further innovative research lines like the development of bioplastics to replace single use plastics (SUPs). In short, MPs and Macroplastics need the involvement of the scientific community, stakeholders, plastic producers and politicians to minimize the global risk.

References

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2.Bianying Zhou et al., Microplastics in agricultural soils on the coastal plain of Hangzhou Bay, east China: Multiple sources other than plastic mulching film, *Journal of Hazardous Materials*, 368(2020)121814.

3.Yanting Zhou, et al., Microplastics as an underestimated emerging contaminants in solid organic waste and their biological products: Occurrence, fate and ecological risk, *Journal of Hazardous Materials*, 445(2023)130596.

4.Jihye Cha, Jin-Yong Lee and Rogers Wainkwa Chia, Microplastics contamination and characteristics of agricultural groundwater in Haean Basin of Korea, *Science of the Total Environment*, 864 (2023) 161027.

5. Gabriella F. Schirinzi et al., Riverine anthropogenic litter load to the Mediterranean Sea near the metropolitan area of Barcelona, Spain, *Science of the Total Environment*, 714 (2020) 136807.

6.Yolanda Picó, Vasiliki Soursou, Ahmed H. Alfarhan, Mohamed A. El-Sheikh, Damià Barceló, First evidence of microplastics occurrence in mixed surface and treated wastewater from two major Saudi Arabian cities and assessment of their ecological risk , *Journal of Hazardous Materials*, 416(2021)125747.

7. Damià Barcelo and Yolanda Picó, Analysis of microplastics and nanoplastics: how green are the methodologies used? *Current Opinion in Green and Sustainable Chemistry*, 31 (2021) 100503.

8.Lucia H.M.LM. Santos, Sara Rodriguez-Mozaz and Damià Barceló, Microplastics as vectors of pharmaceuticals in aquatic organisms-An overview of their environmental implications, *Case Studies in Chemical and Environmental Engineering*, 3 (2021) 100079.

9. Ana L. Patricio Silva et al., Increased plastic pollution due to COVID-19 pandemic: Challenges and recommendations, *Chemical Engineering Journal*, 405 (2021)126683.

10. Evgenios Agathokleous, Ivo Iavicoli, Damià Barceló, Edward J. Calabrese, Ecological risks in a 'plastic' world: A threat to biological diversity? *Journal of Hazardous Materials*, 417 (2021)126035.

11.Francesca Provenza, et al., Mussel watch program for microplastics in the Mediterranean sea: I dentification of biomarkers of exposure using *Mytillus galloprovinciallis, Ecological Indicators*, 142 (2022)109212.

12.Paolo Pastorino, et al., Microplastics in biotic and abiotic compartments if highmountain lakes from Alps, *Ecological Indi*cators, 150 (2023)110215.

Luca Nizzetto – Session 1



Dr Luca Nizzetto, PhD, is a Lead Scientist at the Norwegian Institute for Water Research. He has experience in environmental assessment and modelling for chemical and plastic pollution. Since 2021, is the coordinator of the EU-funded project PAPILLONS (Plastics in Agricultural Production: Impacts, Lifecycle and Long-term Sustainability). He founded the International Knowledge Hub Against Plastic Pollution (IKHAPP.org) for independent scientists to combat plastic pollution globally.

Confronting uncertainties of models for plastic releases, fate and transport

Soils, and especially agricultural soils, are main recipients of microplastic pollution that can both accumulate posing a risk for the ecosystem and crop quality, or be transferred to aquatic ecosystems. Knowledge gaps about the rate of these processes ha shindered assessments of microplastic risk and distribution. In this study we empirically assess predictions of microplastic land-to-water transport obtained from a mechanistic model operating at a catchment scale. The model accounts for climate, hydrology, soil/microplastic erosion and sediment/microplastic transport. It assimilates the latest knowledge on microplastic behavior in soil and stream water as a function of particle size, shape and density generating daily predictions of microplastic flows and concentrations. We report here the first model calibration and assessment against empirical data from a case study in Spain (the prevalently agricultural catchment of the Henares river), whereby consistent measurements of microplastics in water, sediments, wastewater effluents, and sewage sludge (as a terrestrial source) were available. We predict microplastic concentrations in stream water and sediments with typical errors below a factor of 2 and 10, respectively-in both case within the uncertainty boundaries of the measurements. Export of microplastics from soil and river sediments fluctuates strongly due to precipitation variability. A time-averaged retention efficiency index was calculated showing that soils and river sediments typically retain 20-50% of the microplastic input over a multiannual period. Efficient land runoff and larger inputs of microplastics to the system, compared to those accounted for by the available measurements of sources are needed, to justify stream water and river sediment concentrations.

Moritz Bigalke – Session 2



Moritz Bigalke is professor for soil mineralogy and soil chemistry at the Technical University of Darmstadt in Germany. His research focuses on the biogeochemistry of contaminants in soils to contribute towards the preservation of essential soil functions. He primarily investigates the fate of trace metals and plastics particles at macro, micro and nano sizes within the soil system, their interactions with the soil solution and their uptake by plants.

100 or 10.000 microplastics kg-1: What are the problems with analyzing microplastic concentrations in soils?

Microplastic is classified a pollutant of environmental concern, however, until now we know very little about the actual microplastic concentrations occurring in soils. While there are a number of studies reporting concentrations, the values reported show a very high variability, even for comparable samples and same size of particles analyzed. This variability can be partly explained by the nature of microplastic being a xenobiotic substance which has no natural occurrence but might occur in very high concentrations at locations with specific inputs and by the fact that the particulate material shows a very high variability in the environment. However, it is also due to the fact that the differences in the methods to sample, extract and analyze the microplastics may cause concentration variations of several orders of magnitude for the same sample. We will give examples how the different parameters of microplastic extraction and analysis by Fourier Transform Infrared Spectroscopy may influence the results. In particular, the sampling of soil, the chemicals and procedure used for MP extraction, the size of MP considered for analysis, the analytical device, the particle recognition, the data analysis as well as the thresholds selected for a positive MP recognition can have a significant influence on the results. In this talk I will discuss the potential influence of the individual steps of the result of the analysis of microplastics.

Esperanza Huerta-Lwanga – Session 4



Esperanza Huerta-Lwanga is a senior researcher in Soil Physics and Land Management group with 15 years of experience in soil ecology. She has published more than 40 articles in international scientific journals, focusing in soil health assessment in natural and managed areas. Expert on microplastics pollution through the terrestrial ecosystem she has been invited as key-note speaker at several international forums

Risk assessment of microplastics along the terrestrial food chain

Microplastics, plastic particles smaller than 5 mm, are mainly found in the soils of agricultural systems due to the type of practices that there are implemented. Soil organisms are affected when microplastics are present in soils. Once soil organisms such as earthworms, or snails ingest microplastics, they lose weight, they have affectations in the digestive system. And finally they die. Studies done in laboratory and on field conditions have shown that microplastics represent an environmental risk. According to the type of plastic, the concentration and the time of exposure is the effect found in soil organisms. Investigations also revealed that there is stress on soil organisms when microplastics are found in soils. In brief, soil diversity is jeopardize with microplastics, and microplastics are transferred along the terrestrial food chain, when earthworms are polluted with microplastics, certainly also birds and other earthworm's feed vertebrates are polluted.

Joana C. Prata – Session 4



Joana C. Prata, DVM Msc, is a researcher who studies the effects of contaminants on human, animal, and environmental health. She has published more than 40 papers, presented over 20 communications, and reviewed over 300 papers and 8 scientific project proposals. She is a guest editor to Environments and is editing a book for Elsevier and is on the Editorial Board of Water Emerging Contaminants and Nanoplastics, and edited an upcoming book on One Health for Elsevier. She has been invited to multiple

panels as a project reviewer and policy advisor.

Impact of airborne and foodborne microplastics on human health

Besides being particles, microplastics (≤ 5 mm) exhibit a complex chemistry that depends on the polymer, additives, its degradation, and the adsorption of environmental chemicals. Microplastics can also be used as a substrate by various organisms ,including pathogens. Human exposure to microplastics is expected since they are ubiquitous in environmental matrices. The main routes of exposure are the digestive and the respiratory system. A small percentage of Microplastics (especially those <150 µm in size) may be translocated and transported to internal organs. In these organs, they can induce toxicity due to oxidative stress, pro-inflammatory effect, and the release of toxic leachates. Microplastics will then be removed by the reticuloendothelial system and released back into the lumen of the digestive system, being eliminated in the faeces. However, current knowledge is still limited on how the different properties of microplastics relate to the effects observed during toxicity assays.

Gea Oliveri Conti – Session 3



Gea Oliveri Conti is researcher at the Department of Medical. Surgical Sciences and Advanced Technologies of the University of Catania, Italy. Her research interests concern studies of environmental health risks by a hygiene and public health. Coauthor of the first patent for micro and nanoplastics in environmental matrices, and author of > 144 scientific papers in ISI journals on various topics in toxicology, ecotoxicology, environmental epidemiology and hygiene. She is an expert

consultant as epidemiologist for EU-NETVAL JRC-project and FAO for microplastics in food and environment.

Microplastics: the invisible and underestimated risk in the food chain

Plastic pollution poses a threat to ecosystems, wildlife, and the livelihoods of people around the world. If we continue our current path, there will be more plastic than fish in the sea by 2050. Microplastics (MPs) classification is size dependent, and the micro (<10 μ m) and nanoplastics (<1 μ m) are the most dangerous for their capability to be absorbed in the tissues and cells. The food web is completely involved in plastic pollution. Several aspects of microplastics in foods were debated in the last FAO report, but all data are, however, underestimated. The current methodologies applied in microplastic extraction and detection do not permit the extraction and recovery of all microplastics, including nanoplastics. These limits affect the quality of a large part of the data available today in literature. Honey, tap water, mineral bottled water, fruit, pork meat, sugar, table salt, vegetables, fish, and all foods used by humans are affected by MPs pollution representing a hazard to human health due to the last demonstrated human health effects, thank some last experimental studies.

Invited Speakers

Elena Rovesti – EFSA – Session 1

Elena Rovesti is a Chartered Environmental Scientist currently working as a Scientific



Officer in the Feed and Contaminants unit at the European Food Safety Authority in Parma (Italy) where she is primarily responsible for coordinating working groups of experts for the elaboration of risk assessments for the presence of undesirable substances in food and feed. Her main expertise is on contamination characterisation, fate and transport of contaminants, risk assessment modelling and remediation, starting from extensive field work.

The work of European Food Safety Authority in the risk assessment of micro and nanoplastics in food

In 2016, the EFSA Panel for Contaminants in the Food Chain (CONTAM Panel) published a statement on the presence of microplastics and nanoplastics in food, with particular focus on seafood. The Panel acknowledged that there was no legislation for microplastics and nanoplastics as contaminants in food. Methods were available for identification and quantification of microplastic in food, however occurrence data were limited. In contrast to microplastics, no methods or occurrence data in food were available for nanoplastics. It was noted that microplastics can contain on average 4% of additives and that plastics can adsorb contaminants, of both organic as well of inorganic nature. Based on a conservative estimate, the presence of microplastics in seafood would have a small effect on the overall exposure to additives or contaminants. It was also observed that toxicity and toxicokinetic data were lacking for both microplastics and nanoplastics to perform a human risk assessment. The CONTAM Panel recommended that analytical methods be developed for nanoplastics, further developed for microplastics and standardised in order to assess their presence, identity and to quantify their amount in food. Furthermore, guality assurance should be put in place and demonstrated. For micro and nanoplastics, occurrence data in food, including effects of food processing, should be generated. Research on the toxicokinetic and toxicity, including studies on local effects in the gastrointestinal (GI) tract, was considered to be needed as was research on the degradation of microplastics and potential formation of nanoplastics in the human GI tract.

Giulia Carcasci - FAO - Session 4



Giulia Carcasci is an Italian professional holding a MSc in Environmental Sciences. Giulia has worked in Europe, United States and Latin America, and is specialized in project management on circular economy, solid waste and plastics. From 2017 to 2021 she has been working as a JPO for the Inter-American Development Bank in Washington DC. She now works with FAO in Rome on the sustainable management of plastics in agriculture.

The work of the Food and Agriculture Organization of the United Nations to improve the sustainability of plastics used in agriculture and their alternatives

In 2021 FAO released the report "Assessment of agricultural plastics and their sustainability: A call for action", highlighting the pervasive use of plastics in agrifood systems, which results in 12.5 million tonnes of plastics being used every year in plant and animal production. While the use of plastics products can increase yields and improve efficiency, the lack of systematic collection and inadequate management has resulted in the accumulation of plastic waste in the environment, with negative impacts on ecosystems and potentially human health. Solutions to this issue require simultaneous implementation of policies, technologies, and sustainable practices. The Report identified alternatives and interventions based on the 6R model: Refuse, Redesign, Reduce, Reuse, Recycle, and Recover. To support Member States and other stakeholders in improving the management of plastics used in agrifood systems, FAO is developing a Voluntary Code of Conduct on the sustainable use of plastics in agriculture, and is bringing this subject to the meetings of the Intergovernmental Negotiating Committee to develop an international legally binding instrument on plastic pollution, including the marine environment.

Lauren Weir – EIA – Session 2



Lauren Weir is an Ocean Campaigner at the Environmental Investigation Agency, with a specific focus on plastic policy within the UK and EU region. She holds an MSci in Palaeobiology from University College London and an Msc in Environmental Policy and Regulation from the London School of Economics and Political Science. She joined EIA in 2021, having previously worked in climate change and marine conservation research and advocacy roles.

Cultivating Plastic: Agriplastics, grocery retailer supply chains and regulatory loopholes in the United Kingdom (UK)

Scientific evidence outlining the environmental and human health harms posed by agriplastic use, whilst growing, is already firmly established. Translating this evidence into actionable solutions is required. Both government policy as well as industries across global food supply chains have a responsibility in enacting this. Using the United Kingdom as a case study, the Cultivating Plastic report series outlines the role of grocery retailers in agriplastic use, initiatives undertaken by industry to date in addition to highlighting regulatory loopholes that must be addressed. This includes an analysis of the UK food supply chain and current policy measures, surveying of the UK grocery retail sector on their supplier initiatives, particular harms faced by agricultural workers, criminality and mismanagement with regards to agriplastic waste and considerations to account for with regards to the use of alternative products (namely biodegradable plastics and sludge).

Ettore Capri – Workshop



Ettore Capri is Full Professor in Agricultural Chemistry at Università Cattolica del Sacro Cuore. His research work concerns the ecotoxicology, environmental chemistry and consumer risk from pesticide, nutrient, heavy metals and trace elements. In the last years its main research is focusing on how to integrate the risk from the environment to the human and, how to bridge the science and policy.

Expert in pesticide risk assessment, he has worked for several years in the EFSA Plant Protection Products panel.

A roadmap for micro and nanoplastics risk assessment: lessons to be learned from plant protection products.

More than 80 years have elapsed since synthetic pesticide were introduced in agriculture on large scale for controlling pests and other disease vectors. During the period in which pesticide use has become widespread research has contributed to a better understanding of its implications. Unfortunately, some of this knowledge was gained rather late. Although chemical knowledge was important it was realized that simplistic approaches to pest control neglect many environmental, ecotoxicological and have human toxicological implications. Mandate safety tests revealed some of the potential for adverse effects. Consequently, it has become necessary to re-evaluate approaches to the design of pesticide molecules on the basis of recent outcomes and information about the behaviour and effects of the pesticide monitored in the environment. Such knowledge has changed not only the perception of citizen community but also the policy and its attitude towards the acceptability of new molecules. It became clear that the risk and benefits of pesticide use must be evaluated continuously. Progress was done and a successful organization involving European Commission, Parliament and scientists was structured. However, although the regulations have attempted to engage with the scientific progress, they sometime face difficulties in attempting to agree on adequate protocols and guidelines. This results in increasing complexity which stakeholders find challenging. EFSA is strongly working in the direction to address as much as possible the weaknesses of the system. The lesson to be learned is that an effective risk system must be based on a combination of scientific disciplines and their proper coordination and interactions with a large and diverse population of stakeholders.

Margherita Ferrante – Workshop



Margherita Anna Letizia Ferrante is Full Professor of Hygiene at Università degli Studi di Catania and Director Responsible for the Laboratory of Environmental and Food Hygiene. She is member of the "Environment and Health Task Force" of the National Ministry of Health and is member of the management of the Society of Hygiene and Preventive Medicine (SItI) in the Sicily Board. She has developed a patented method for microplastics quantification in foods.

Standardization of methods for micro and nanoplastics quantification. The experience with patented food methods and the potential transfer to soil analyses.

Contamination from micro and nanoplastics, in addition to environmental matrices, affects food products in an important way, which thus become one of the main sources of human exposure. The exposure concerns both the effects that reactive monomers in the molecular structure and the chemicals associated with plastics could have on human health. It is therefore increasingly necessary to find valid and reproducible methods for assessing the risk associated with the agri-food chain and for its reduction. For this purpose, our research group has patented a method that has been validated for the research of micro and nanoplastics in agri-food products and subsequently also for research in the soil. This method, based on extraction system without filtration and on determination methods that also can detect nanoparticles, allows to measure all the plastic particles contained in the analyzed samples. The method applied for the search for micro and nanoplastics in various food products and soils opens new exposure scenarios and allows for a more precise assessment of the amount of microplastics dispersed in the environment and in food but also in animal and human biological samples. The study of the pathways within living organisms will allow us to establish the effects of these contaminants more precisely and to evaluate systems for reducing and minimizing the risk for humans.

Selected Oral Presentations

Abstracts of the Selected Oral Presentations

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