

PLASTIC' 2020

1^{as} JORNADAS SOBRE CONTAMINACIÓN POR PLÁSTICOS

Retos científicos,
empresariales y legislativos

27 Y 28 DE OCTUBRE

#PLASTIC2020_IDAEA

Salón de Actos, CID-CSIC
C/Jordi Girona 18-36. Barcelona



Libro de Abstracts



PLASTIC'2020

10h-10h05 **Bienvenida. Ethel Eljarrat** (Organizadora de PLASTIC'2020)

10h05-10h25 **PLENARIA: Casos de éxito en la aplicación de la economía circular a los materiales plásticos. Sergio Giménez** (AIMPLAS)

Chairmans: Marta Llorca y Melissa Faria

10h25-10h40 **Análisis rápidos y automatizados de microplásticos mediante el empleo de un sistema de imagen química infrarroja basado en un láser de cascada cuántica. Fernando Tobalina** (Agilent Technologies)

10h40-10h55 **Development of a method for microplastics analysis in waters, beaches and sediments. Case study: Mediterranean coastal area. Nora Expósito** (Universitat Rovira i Virgili)

10h55-11h10 **Suspected screening of Micro(nano)plastics in the Ebro Delta (Mediterranean Sea). Marinella Farré** (IDAEA-CSIC)

11h10-11h25 **The use of precision cut tissue slices (PCTS) to evaluate the effects of Triclosan exposure in Mytilus galloprovincialis. Alejandra Gilabert** (IDAEA-CSIC)

11h25-11h45 Pausa

Chairmans: Cristina Postigo y Maria Vila

11h45-12h **Effects of biomicroplastics in water systems. Marta Llorca** (IDAEA-CSIC)

12h-12h15 **Organophosphate esters in edible fish from the Mediterranean Sea. Berta Sala** (IDAEA-CSIC)

12h15-12h30 **Air and dust indoor concentrations of flame retardants in Spanish Environments. Roser Esplugas** (Universitat Rovira i Virgili)

12h30-12h45 **Estimación de la exposición a OPEs y HFRs de trabajadores de reciclaje de residuos electrónicos mediante pulseras de silicona y camisetas. Andrea Peris** (IDAEA-CSIC)

12h45-13h **Estimating phthalate exposure at the population level by the analysis of wastewater: case-study within thirteen Spanish cities. Iria González** (Universidad de Santiago de Compostela)

13h-13h30 **SESIÓN de PÓSTERS .**

Chairmans: Angeliki Karanasiou



PLASTIC'2020

PRESENTACIONES ORALES



PLASTIC'2020

Casos de éxito en la aplicación de la economía circular a los materiales plásticos.

S. Giménez, E. Verdejo

Con el objetivo de reducir la contaminación derivado a la mala gestión de los materiales plásticos desde AIMPLAS trabajamos en una serie de estrategias que inciden en optimizar el uso de los plásticos y en la mejora de la gestión de los materiales plásticos. Estas estrategias pasan desde el concepto de ecodiseño, el desarrollo de nuevos materiales, hasta la gestión final del residuo incluyendo el reciclado del producto.

En la ponencia veremos ejemplos como:

Ecodiseño y funcionalidad del producto. Como el caso del proyecto C-SERVEES que tiene el objetivo de impulsar una Economía Circular eficiente en el uso de los recursos en el sector eléctricoelectrónico mediante el desarrollo de nuevos modelos de negocio circulares.

Gestión de residuos. Como el proyecto URBANREC que ha implementado buenas prácticas relacionadas con la reutilización, as estrategias de recogida selectiva y la valorización de materiales como plásticos, espumas, textiles y madera.

Desarrollo de bioplásticos y composites sostenibles. Como los proyectos ECOBIONET o BIOVEGE que ha desarrollado films y mallas provenientes de los residuos agrícolas o el proyecto RECUBIO que ha permitido obtener filmes multicapa compostables.

Procesos de reciclado mecánico. Como el proyecto CLIPP tecnología de descontaminación por fluidos supercríticos y que permite eliminar contaminantes de una forma eficaz.

Procesos de reciclado Químico. Proyecto ECOMETHYLAL, a partir de mezclas de distintos plásticos y mediante la tecnología de hidro gasificación catalítica con plasma se obtiene el metilal para su uso en forma de disolventes o como materia prima para la producción de nuevos plásticos o el proyecto RECIPAM enfocado al reciclado de filmes multicapa.

Uso de reciclado, como proyecto POLYMIX que ha consistido en la producción de innovadoras mezclas asfálticas con materiales plásticos reciclados procedentes de neumáticos, perchas y tapones.



PLASTIC'2020

Análisis rápidos y automatizados de microplásticos mediante el empleo de un sistema de imagen química infrarroja basado en un láser de cascada cuántica.

D.P. Robey, F.J. Tobalina

La investigación de partículas de microplásticos en muestras de interés medioambiental requiere de la medida del tamaño, forma e identidad química de cada partícula individual presente en las muestras. Además, dado que se estima que son las partículas de menor tamaño las que podrían tener una mayor relevancia biológica, existe un gran interés en extender este tipo de análisis a las partículas en la escala de tamaños cercana a las pocas micras. Desafortunadamente, las técnicas tradicionales basadas en la inspección visual microscópica resultan demasiado lentas, requieren una mano de obra manual intensiva y están sujetas a errores de interpretación por parte de los analistas. Como resultado, los investigadores están poniendo la mirada en las técnicas de espectroscopía vibracional, al resultar químicamente más específicas y poder ser acopladas a herramientas de análisis microscópico, para poder realizar el análisis de las partículas a mayores velocidades.

En este sentido, los microscopios de barrido espectral pueden adquirir espectros vibracionales tras ser guiados por imágenes visibles para determinar la identidad química de las partículas, además de sus formas y tamaños. Pero, aun así, estos instrumentos tienen limitaciones. Los microscopios Raman tienen la limitación de la fluorescencia de muchas de las partículas, mientras que los microscopios FTIR con detectores de array generan una gran cantidad de información redundante o toman datos en zonas sin interés en los espacios entre las partículas. Por último, la gran cantidad de datos almacenados generados por estos microscopios generan importantes desafíos relacionados con el procesamiento de la información y su almacenamiento.

Dado que la espectroscopía IR es una técnica muy adecuada para el análisis de polímeros y microplásticos, el empleo de una técnica alternativa que permita generar y focalizar toda la energía IR en la muestra, puede solucionar gran parte de estas limitaciones empleando técnicas existentes. Un láser de cascada cuántica (QCL) es un láser semiconductor sintonizable que genera luz en las regiones del infrarrojo medio conocidas comúnmente como la zona de la huella dactilar. Este tipo de fuente luminosa permite focalizar de forma estrecha un haz de luz infrarroja brillante exactamente en el centro de cada una de las partículas, permitiendo una identificación rápida y precisa de las mismas en la escala de las micras. En esta comunicación, presentamos algunos resultados de estudios realizados con el empleo de un espectrómetro infrarrojo que emplea un QCL para la caracterización y cuantificación de microplásticos.



PLASTIC'2020

Development of a method for microplastics analysis in waters, beaches and sediments. Case study: Mediterranean coastal area.

N. Exposito, J. Rovira, J. Sierra, J. Folch, M. Schuhmacher

The Mediterranean Sea is one of the areas most impacted by microplastics (MPs) (0.15-0.31 items/m³) with a total annual plastic contribution of approximately 100,000 tons; 50% of these are originated from land based sources and 30% comes from riverine systems. MPs due to their small size and reassembly as a prey can be ingested by fish and mollusc with negative effects and possible risks to human health by bioaccumulation through food chains. The uncertainty of the effects of MPs through food web is due, in part, to the lack of standardized methods allowing the quantification of their accumulation in the environment and organisms.

This work aims to optimize a method for characterizing and quantifying MPs (from 20 to 5,000 μ m) in sandy beaches, sandy marine sediments and seawaters. The analytical method includes a pre treatment with different steps such as sieving, visual sorting, density separation, Fenton reaction and Nile red staining. For the identification of the type of polymer and the quantification of the number of MPs, spectroscopic techniques and Microscopic Fluorescence were used, respectively. Samples were collected on 30 sites along Tarragona coast with different degrees of anthropogenic pressures (urban, petrochemical, maritime transport).

The results show that in all samples (sand, sediment, and seawater) MPs were detected as particles and fibres. Polyamide, polyester and synthetic cellulose like ball fibres were found associated with plankton and sediment. In sediments, there was an average of about 5,400 MPs/kg and on the beaches 8,000 items/kg dominated by particles. The particle size range found was about 20-100 μ m (median values in beaches and sediments of 60 and 65 μ m, respectively), while the fibre range size was about 40-2000 μ m (median values of 700-800 μ m). The seawater MPs morphology was characterized by fibres. MPs found in marine samples suggest the influence of anthropogenic activities. The most affected area was near the port of Tarragona (Miracle Beach) and La Pineda related to the discharge of WWTPs and spillages from chemical industry, fact could be favoured by sea currents and the presence of infrastructures such as the Tarragona's harbour. Regarding the composition of the MPs, the densest ones (PET, PVC, polyester, but also PE) predominate in the sediments, while the lightest ones (PE, PP, PS) predominate on the intertidal zone of the beaches since they are transported by seawater.



PLASTIC'2020

Suspected screening of Micro(nano)plastics in the Ebro Delta (Mediterranean Sea).

M. Llorca, A. Vega, G. Schirinzi, K. Savva, E. Aba, M. Farré

This is the first work reporting the use of a double suspect-screening to assess most common polymers and additives in micro(nano)plastics (NPLs/MPLs) found in environmental waters. The method consisted of water filtration followed by ultrasonic-assisted extraction with toluene and analysis employing size exclusion chromatography using an advanced polymer chromatography column coupled to high-resolution mass spectrometry with an atmospheric pressure photoionisation source by negative ionisation conditions (LC(APC)-APPI(-)-HRMS). The identification of NPL/MPLs polymers has been based on increasing confirmation level, including the monomers characterisation by the Kendrick Mass Defect and confirmation and quantification when standards were available.

In parallel, the identification of main additives in NPL/MPLs composition, as well organic contaminants adsorbed onto the plastic particles were carried out by analysis of the extracts by LC(C18)-APPI (+/-)-HRMS. To assess the impact of plastic pollution it is necessary to assess the composition in terms of polymers but also the additives. This screening approach has been employed to study composition of NPL/MPLs in the Ebro Delta. Two sampling campaigns including freshwater and seawater samples have been investigated to assess plastic composition in the top 5 cm. Polystyrene (PS), polyethylene (PE), polyisoprene (PI), polybutadiene (PBD), polypropylene (PP) and polysiloxanes were the most detected polymers and PP and PE, sizing between <1000 and 2000 Da, were found at concentrations reaching up to 7000 ng/L in some areas.

The pentadecanoic acid, 1,2,3-benzotriazoles, 2-ethylhexanoic acid (2-EHA), and phthalates such as dimethyl phthalate, mono(2-ethylhexyl) phthalate (MEHP) and the phthalimide were more frequently detected plastic additives. Finally, series of organic contaminants were as well detected in the particulate fraction. These organic contaminants cannot be associated to plastic compositions but can be associated to their adsorption to the particulate matter, in particular to NPL/MPLs, due to their non-polar character. Among these organic contaminants, the more frequently detected were pharmaceutical compounds, food additives and pesticides.



PLASTIC'2020

The use of precision cut tissue slices (PCTS) to evaluate the effects of Triclosan exposure in *Mytilus galloprovincialis*

A. Gilabert, A. Murillo, C. Porte.

The extensive use of plastics has become a massive environmental problem. Plastics and additives end up in environmental compartments, such as water or sediments, presenting a risk for aquatic organisms. Triclosan (5-chloro-2-(2,4-dichlorophenoxy) phenol) is a broadspectrum antimicrobial and disinfectant agent that has been used for almost 30 years in a vast array of personal care and consumer products. When used as a plastic additive, it enhances mechanical properties of polymer toughness and strength. Triclosan has been identified as an endocrine disruptor (EDC) interfering with the normal function of the endocrine system.

More recently, evidences emerged regarding its ability to interfere with lipid homeostasis. We evaluate here the effects of triclosan in the lipidome of the digestive gland of the mussel *Mytilus galloprovincialis*, a sentinel species widely used in environmental biomonitoring programs. To this aim, a novel methodology based in the use of precision cut tissue slices (PCTS) is proposed. PCTS are small sections of viable tissue with a reproducible and uniform thickness (400 μm) that maintain the architecture and the cell-cell and cell-matrix interactions of the organ. This ex vivo approach presents the main advantages of an in vivo experiment.

PCTS were exposed to three environmentally relevant concentrations - 10, 100 and 500 nM of triclosan for 24h. Lipids were extracted from tissue and culture medium and evaluated under targeted and untargeted approaches. At these concentration levels, a tendency to an increase in the amount of triacylglycerols (TG) and a decrease in phospholipids, including phosphatidylcholines (PC), phosphatidylethanolamines (PE), phosphatidylinositols (PI) and phosphatidylglycerols (PG), were observed in the tissue in a targeted analysis. On the contrary, and due to the lack of discrimination of the media of the exposed samples compared to controls, an untargeted strategy was performed. After tentative annotation of the features found statistically different, mainly cholesteryl esters (CE) and other sterols, sphingomyelins (SM), PCs and PEs, showed a statistically significant decrease in the medium after exposure to triclosan, suggesting a decrease of their excretion from cells to medium.

We conclude that triclosan is a lipid disruptor that, even at environmental concentrations, is able to alter the lipid composition of the digestive gland of mussels, downregulate the excretion of extracellular vesicles and modify its lipid composition. These alterations can affect lipid dynamics in mussels, including lipid synthesis



PLASTIC'2020

Effects of biomicroplastics in water systems.

K. Savva, A. Vega, M. Farré, M. Llorca

The presence of plastic litter in the aquatic environment is an emerging global threat. Among plastic litter, microplastics (MPLs) are those particles of less than 5 mm that are emitted to the environment by different processes. Such MPLs have a different impact on aquatic organisms than larger pieces of plastic due to their small size. Due to the excellent mechanical properties of plastic materials, the versatility of their applications, as well as their raising market perspectives in emerging economies (i.e. in the BRICs and MINTs countries), plastics are being massively produced, particularly in single-use items. The extensive use of plastics together with their inappropriate disposal, the poor residue management carried out during decades, and the poor removal efficiency of some polymers, have conducted to the status of global environmental problem. Once enter the rivers and oceans, plastics may undergo various physical, chemical and biological mechanisms that lead to their fragmentation, sedimentation and migration. In addition, the buoyancy of small plastic fragments facilitates their ingestion by the aquatic biota entering in the aquatic food chain.

At the European context, research initiatives have been as well promoted such as the development of biodegradable plastics, named bioplastics, to be used as a substitute. To disconnect plastic production from the oil industry and to find sustainable materials under the frame of the circular economy during the last years new bioplastics have been developed. In this regard, there is a need to monitor the fate and the effects of microbioplastics (bioMPLs) under relevant environmental conditions to assess their impact in water systems as well as their potential to biaccumulate in biota.

In this context, the main objectives of this work have been i) the characterization of weathering effects on two types of bioMPLs (PLA and PHB) in water systems under realistic environmental conditions in microcosm experiments, and ii) to assess their adsorption capacity for selected surrounding co-contaminants after 1 day, 1 week and 2 months.

The main results showed that selected bioMPLs are partially degraded after the 2-months exposition in water systems. In addition, these two bioMPLs can adsorb different pesticides including fenitrothion, malathion and diuron while pharmaceuticals (carbapenemes) were partially degraded during the experimental time. Finally, the results for pesticides were approximately to Freundlich isotherm model as it has been observed for other co-contaminants. These results highlight the potential effect of bioMPLs as transfer vectors for other contaminants to biota.



PLASTIC'2020

Organophosphate esters in edible fish from the Mediterranean Sea.

B. Sala, J. Giménez, J. Fernández-Arribas, E. Lloret-Lloret, M. Coll, E. Eljarrat

European anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) are two of the most important small pelagic fish species for the commercial fisheries of the Northwestern Mediterranean Sea. In the last decades, there has been an important decline in sardines and anchovies' populations in all the Western Mediterranean Sea. Amongst several hypotheses to explain these trends, the increase in pollution may be playing an important role.

In this sense, plastic pollution is an increasing issue for the marine ecosystem with the Mediterranean Sea being a remarkably impacted area. Marine organisms are able of ingesting plastics and microplastics with potential perturbations at different physiological levels. Beyond the ingestion of plastic itself, the accumulation of plastics additives and pollutants and the capacity of some of those to bioaccumulate and/or biomagnify, is an increasing concern. In this study, we included anchovy and sardine together with one of its potential predators, European hake (*Merluccius merluccius*), to compare its concentration of plasticizers across different areas along a latitudinal gradient of the Western Mediterranean Sea ("Cap de Creus", "Delta de l'Ebre", "Golf de València" and "Cartagena") and investigate potential bioaccumulation and/or biomagnification of the organophosphate esters (OPEs). OPEs were detected in all the samples, with levels ranging from 2.02 to 74.8 ng/g wet weight (ww) in sardines, 4.02 to 35.9 ng/g ww in anchovies and 0.29 to 7.90 ng/g ww in hakes.

Ten out of fifteen OPEs analyzed were detected in sardine and anchovy samples and seven out of fifteen in hake. The distribution of OPEs was fairly similar for both small pelagic fish but contrasted with hake. Furthermore, comparison between the levels found in hake versus those found in sardine and anchovy seem to indicate that no OPE biomagnification occurred.



PLASTIC'2020

Air and dust indoor concentrations of flame retardants in Spanish environments.

R. Esplugas, J. Rovira, M. Mari, J. Fernández-Arribas, E. Eljarrat, J.L. Domingo, M. Schuhmacher

Flame retardants (FRs) are widely used in consumer products including furniture foam and electronic equipment (i.e.: computers, monitors, and TVs). They can easily migrate from consumer products into the surrounding environments over time. Some of the most extensively used FRs, brominated flame retardants (BFRs), are of high concern due to their persistent, bioaccumulative and toxic properties. Therefore, restrictions on these compounds have paved the way for increased use of emerging flame retardants (EFRs). The aim of this study was to identify and quantify the indoor presence of 4 BFR (Polybrominated diphenyl ethers (PBDEs), 2 Ethylhexyl 2,3,4,5 tetrabromobenzoate (EH TBB), Bis (2 ethylhexyl)tetrabromophthalate (BEH TBBP) and Hexabromocyclododecanes (HBCDD)) as well as of 4 emergent flame retardants (EFRs) (Tris(chloroethyl) phosphate (TCEP), Triphenyl phosphate (TPHP), Tris(1,3 dichloro 2 propyl)phosphate (TDCPP) and Isopropyl phenyl phosphate (IPPP).

We measured concentrations in both air and settled dust in 20 indoor Spanish environments (5 schools, 5 offices and 10 houses). For indoor air sampling, 2 low volume pumps (Leland Legacy, SKC Inc., Valley View Rd, PA, (USA)) were used during 24 hours. In order to collect OPFRs and BFRs, the pumps were attached to 2 adsorbent cartridges (ISOLUTE[®] ENV+ 200 mg/6 mL Biotage, Uppsala (Sweden)) at 5L/min and to 2 cartridges containing polyurethane foam (PUF) and a glass fiber filter (SKC Inc., Valley View Rd, PA, (USA)) at 5L/min, respectively. Settled dust was collected from elevated surfaces (i.e.: tables and shelves) in the same living room. All samples were stored at 20 °C before FRs extraction employing dichloromethane (DCM) combined with a SPE column system. Finally, PBDEs, EH TBB and BEH TBBP were analyzed by GC MS MS, with electron ionization, whereas HBCDDs were analyzed by LC MS MS and TCEP, TPHP, TDCPP and IPPP were analyzed by turbulent flow chromatography (TFC) in combination with MS MS. Differences in the total levels and profiles of the BFRs and EFRs were noted among schools, offices and houses.



PLASTIC'2020

Estimación de la exposición a OPEs y HFRs de trabajadores de reciclaje de residuos electrónicos mediante pulseras de silicona y camisetas

A. Peris, Y. Wang, M.R. Rifat, S.I. Ahmed, N. Aiche, L.V. Nguyen, J. Urík, E. Eljarrat, B. Vrana, L.M. Jantunen, M.L. Diamond

En este estudio, se utilizaron pulseras de polidimetilsiloxano (PDMS) y camisetas de algodón para evaluar la exposición de trabajadores de plantas de residuos electrónicos en Dhaka (Bangladesh) a diferentes plastificantes y retardantes de llama: PBDEs, NBFRs, DP y OPEs. Las medias de las tasas de absorción, normalizadas por superficie, para PBDEs, NBFRs, DP y OPEs fueron de 170, 8.5, 4.8 y 270 ng/dm²/h para pulseras y de 5.4, 2.0, 0.94 y 23 ng/dm²/h para camisetas, respectivamente. Las concentraciones de TCEP, TD CIPP, TmCP, BEH, TEBP y DP halladas en las pulseras presentan una correlación directa significativa con las halladas en las camisetas. En las pulseras se han acumulado 7 veces más que en las camisetas, especialmente aquellos compuestos que se esperan principalmente en la fase gas. Además, se ha introducido el método del “sándwich” de PDMS para estimar la fracción de compuestos fácilmente liberables (ERF) de las camisetas que se ha asumido estar relacionada con la exposición dérmica. Los ERFs de las camisetas oscilan entre el 6 y el 75% del total de los compuestos acumulados en dichas camisetas y presentan una correlación inversa significativa con el coeficiente de partición octanol aire de los compuestos.

La media de exposición diaria mediante transferencia dérmica camiseta piel es de 0.32, 0.13, 0.11 y 9.1 ng/kg de peso corporal /día para PBDEs, NBFRs, DP y OPEs, respectivamente. La evidencia de la exposición a plastificantes y retardantes de llama de los trabajadores de reciclaje de residuos electrónicos en este país de recursos limitados, con carencia de equipos de protección personal, alienta a la toma de medidas para minimizar su exposición y a la regulación de la gestión de productos químicos considerando la exposición a dichos compuestos mediante productos de desecho.



PLASTIC'2020

Estimating phthalate exposure at the population level by the analysis of wastewater: case-study within thirteen Spanish cities

I. González-Mariño, L. Ares, R. Montes, R. Rodil, R. Cela, E. López-García, C. Postigo, M. López de Alda, E. Pocurull, R.M. Marcé, L. Bijlsma, F. Hernández, Y. Picó, V. Andreu, A. Rico, Y. Valcárcel, M. Miró, N Etxebarria, J.B. Quintana.

Estimating exposure to phthalate plasticizers is crucial to perform appropriate risk assessment and develop control measures. In this study, we analyze wastewater to estimate the exposure to six phthalates within thirteen Spanish cities. Composite daily samples were collected over four consecutive days in Spring 2018 at seventeen wastewater treatment plants serving ca. 6 million people. Concentrations of phthalate metabolites were converted into population-normalized loads and used to estimate (i) metabolite levels in urine, and (ii) values of daily exposure to the parent phthalates. Population-weighted means of the estimated concentrations in urine varied between 0.7 ng/mL and 520 ng/mL. Compared to human biomonitoring data, very high levels were obtained for monomethyl phthalate, metabolite of dimethyl phthalate. This fact, together with literature data pointing to other sources of this metabolite in sewage led to its exclusion for exposure assessment. As for the remaining metabolites, results obtained on a local scale revealed the butylated phthalates as the ones posing the highest concern, particularly for toddlers. On a national scale, including all the sampled sites, di-(2-ethylhexyl) phthalate accounted for the highest percentage of total risk, followed closely by diethyl phthalate and di-iso-butyl phthalate.



PLASTIC'2020

SESIÓN DE PÓSTERS



PLASTIC'2020

Optimization of methodology for microplastics analysis in Mediterranean seafood samples

N. Exposito, J. Sierra, J. Rovira, D. Kalaronis, A.M. Duarte, M. Schuhmacher

The higher microplastics (MPs) abundance combined with its potential toxicity (physical blockage and abrasion, additives leakages, pollutant carriers) might affect the good ecology state of important regions of seafood cultivation at Mediterranean coast. It is important to collect environmental data with accurate MPs measures to assess environmental risk and to obtain deeply knowledge about the negative impact on the aquatic biota and possible risks to human health by bioaccumulation through food web. Until now, there is a not standardized protocols instead considerable effort showed by scientific community for developing analytical techniques for MPs identification, quantification and composition analysis. The methodologies developed have drawbacks and advantages and it is necessary to adapt them to the different environmental samples requirements because these presents limited application. The aim of this study was to develop an accurate and practical methodology for MPs extraction (20 μ m to 5 mm) from seafood samples of Catalonia Coast (Spain) improving existent methodologies as a contribution for international and standardized protocols for analysis of MPs.

It was suggested a methodology, which combines different reactions or steps: enzymatic hydrolysis (hydrolases, proteases, cellulases, and chitinases), alkaline treatments (KOH 10%), Fenton processes with sonication, ZnCl₂ extraction. This method was developed for the analysis of 30-50 g of seafood samples, which includes oysters, mussels, razor clams, marine snails and small marine clams, reducing almost totally the sample matrix >95 %. After density separation extraction, a centrifugation step, followed by the supernatant extraction and filtration on PTFE filter was carry out. The filters were analysed with Raman and micro FTIR Spectroscopy techniques focusing in MPs >20 μ m. In addition, some samples were recovered with Polycarbonate filters, instead of PTFE filters, in order to identify plastic particles and fibres quickly by Fluorescence Microscopy. Control (blanks) treatments were applied due not closed and isolated laboratory environment may contain significant levels of fibres. The recovery rate is being calculated with virgin plastic spherical particles of PE spanning from 53 to 500 μ m.



PLASTIC'2020

Deep sea litter and its interactions with the megafauna in the Gulf of Cadiz (North Eastern Atlantic, Spain)

J. Aguzzi, M. Francescangeli, G. Ercilla, F. Estrada, J. Valencia, I. Sobrino, J.B. Company, A. Mecho

A recent study about the marine deep sea litter in the continental slope of the Gulf of Cadiz reveals relatively high percentages of plastic debris (up to 33%), which appear along other litter remains, as ceramic, glass, metal, abandoned longlines and fishing nets (Mecho et al., 2020). Plastic is observed in all morpho sedimentary domains such as canyons, open slopes and contourite furrows and channels, which were surveyed by Remotely Operated Vehicle (ROV), between depths of 220 and 1000 m. Several species (e.g., the fish *Phycis blennoides*) and decapod crustaceans (e.g., shrimp *Plesionika martia*) were observed to interact with plastic artefacts. Megabenthos could use plastic debris as a substitution for burrows for hiding, indicating that these artefacts effectively enhance camouflage opportunities.

Plastics apparently enter into the Gulf of Cadiz as litter coming from continent (rivers, coastal currents) and dumping from the maritime and fishing vessels. When plastic debris arrives to the sea, the buoyancy properties would favour their piracy by the important Atlantic inflow moving south westwards. This inflow may favour its transport and funnelling when this inflow interacts with the canyon head. This means that plastic could come not only from nearby sources but also from far away sources. When we overlapped our georeferenced data with bottom current flows of the Mediterranean Outflow Water, we also observed that plastic is concentrated in the sites affected by relatively weaker bottom currents. This would suggest that bottom current deceleration triggers or promote the deposition of this type of litter. In fact, in videos where bottom currents are relatively strong, the presence of floating plastics passing the ROV is common.



PLASTIC'2020

Lipidomic evaluation of the single and combined effects of polyethylene microplastics and two PCB congeners on human hepatoma cells.

A. Menéndez, C. Bedia, J. Jaumot

Microplastics have become one of the leading environmental threats due to their persistence, ubiquity and intrinsic toxicity. This potential harm that microplastics cause on ecosystems varies from direct effects (i.e., entanglement and ingestion) to their ability to sorb a diversity of environmental pollutants (e.g., heavy metals, persistent organic compounds or pharmaceuticals). Recent studies have underlined the important enrichment of persistent organic compounds on microplastics, often exceeding 106 times relative to their concentration in solution. Therefore, the toxicological assessment of this “Trojan horse” effect (i.e., hiding of the actual toxic potential of microplastics due to their ability of sorbing multiple harmful pollutants) is one of the hottest topics in the environmental toxicology field.

Omics technologies are widely used to better understand the response of an organism to pollutants exposure. The main goal of these techniques is enabling rapid screening of large quantities of small molecules of organisms under certain environmental conditions. These approaches provide information about the molecular mechanisms involved in the toxicological processes. Up to date, any previous study has evaluated the combined effect of PCBs and MPs using omic approaches.

Herein, the single and combined ecotoxicological effects of two polychlorinated biphenyl (PCB) congeners (PCB 101, a non-dioxin-like congener, and PCB 126, the most toxic dioxin-like congener) and polyethylene microplastics (PE-MPs) were analysed on the HepG2 hepatoma cell line using an untargeted lipidomic approach. A previous study to assess the sorption and desorption rates of PCBs at different concentrations in PE-MPs was performed. Moreover, a cell viability assay to evaluate the cell lethality of both pollutants was also carried out. The results obtained showed significant sorption of PCBs by MPs, especially for PCB 126. For the cell viability assay, MPs did not produce significant cell mortality on the concentration range studied (from 49 to 25,000 mg/L). Besides, the results suggested an hormetic behavior for both PCB congeners. Preliminary results of the lipidomic study showed clear changes in lipid levels by either single or combined exposure treatments.

Overall, this study provides an ecotoxicological insight into the “Trojan horse” effect that MPs may have with sorbed PCBs, evaluating their sorption rates and potential synergistic effect on human hepatoma cells..



PLASTIC'2020

Effects of conventional and biodegradable microplastics on marine microbial communities.

U. Lora, L. Schenone, M. Sebastián, I. Forn, F. Peters, H. Kaartokallio, M. Lehtiniemi, Sala M.M

Microplastics are ubiquitous in marine ecosystems and are suitable matrices for bacterial attachment and growth. Studies on the microbes growing on plastics are mainly done using flow cytometry and massive sequencing. Additionally, microscopical techniques provide also the possibility to quantify specific groups (CARD FISH) and to distinguish between free living or bacteria attached to the microplastic particles. We show here the results of an international mesocosm experiment done to see the effects of conventional and biodegradable microplastic on the planktonic communities of the Baltic Sea.

Mesocosms were filled with Baltic seawater filtered through 100 μ m, and nutrients (N+P) and zooplankton were also added. Mesocosms were amended with microplastics at in situ concentrations in triplicates: None (control), conventional, biodegradable, conventional+biodegradable microplastics. Our specific aim was to assess the differences in the number, activity and identity of bacteria associated with the microplastics during the experiment. Our results show a low impact of the presence and quality of microplastics on marine bacterial communities.



PLASTIC'2020

La huella dactilar inicial de ftalatos y la firma hidroquímica como factores clave que controlan las tendencias de concentración de ftalatos en aguas embotelladas con PET durante largos tiempos de almacenamiento

M. Becerra-Herrera, D. Arismendi, A. Molina-Balmaceda, J. Uslar, V. Manzo, P. Richter, M.A. Caraballo

La concentración de ésteres del ácido ftálico (PAEs) en el agua embotellada y los diferentes factores (pH del agua, tiempo de almacenamiento, exposición a la luz solar y temperatura) que los afectan/controlan se han convertido en temas candentes durante los últimos años. Sin embargo, se han publicado resultados bastante contradictorios sobre los efectos que estos factores pueden tener en la concentración de PAEs. En un intento por encontrar un consenso sobre este tema, se realizó un estudio exhaustivo que consideró el efecto combinado de largos tiempos de almacenamiento (más de un año) y la signatura hidroquímica del agua (incluido el pH del agua, la composición elemental y la presencia/ ausencia de CO₂ disuelto) utilizando las cuatro marcas de agua embotellada más consumidas en el mercado chileno.

Primero, se compiló una base de datos exhaustiva que incluye la concentración de TotalPAEs en agua embotellada en todo el mundo. Esta información nos permitió establecer la imagen global actual del rango de concentración de TotalPAEs en aguas embotelladas, así como la posición de las muestras chilenas dentro de este rango. Segundo, y siguiendo el concepto de la signatura hidroquímica típicamente utilizada en hidrogeología para clasificar los tipos de aguas, se propuso la noción de una huella dactilar de ftalatos en agua. Como resultado, las muestras estudiadas se clasificaron utilizando su concentración de TotalPAEs y su ftalato individual más abundante. Tercero, por medio del análisis estadístico multivariado, fue posible confirmar, por primera vez, que la composición elemental de las muestras (individualizadas por su conductividad eléctrica), y no el pH, es el factor clave para generar la huella dactilar inicial de ftalatos (por ejemplo, las muestras con más elementos disueltos totales tenían mayores concentraciones de TotalPAEs, y viceversa).

Finalmente, con respecto al efecto de los largos tiempos de almacenamiento, este estudio demuestra que todas las tendencias (aumento, disminución o constante) de la concentración de TotalPAEs son posibles, siendo lo más importante de estas tendencias el hecho de que están controladas por la signatura hidroquímica específica y la huella dactilar de ftalato del agua embotellada.



PLASTIC'2020

Organophosphate plasticizers in air particles from subway stations

J. Fernández-Arribas, R. Olivero-Verbel, T. Moreno, C. Reche, M.C. Minguillón, V. Martins, B. Johnson-Restrepo, E. Eljarrat

Organophosphate esters (OPEs) are high-production-volume chemicals widely used in a variety of industries, including plastics, foams, paints, furniture, building materials, electronics and construction. They are used as plasticizers, as flame retardants, as stabilizers for antifoaming and as additives to floor polishes, lubricants, lacquers and hydraulic fluids. Moreover, OPEs are also used as extreme pressure additives and antiwear agents in hydraulic fluids, lubricants, transmission fluids and motor oils.

With the spread of OPEs, these groups of emerging pollutants have been raising increasing concern due to their reported toxic effects, including endocrine disruption, neurotoxicity and suspected carcinogenicity. Some epidemiological studies have also reported decline of semen quality, and asthma and allergies.

Indoor environments are considered a hotspot for human exposure to OPEs. Humans spend their lives in a variety of microenvironments, such as houses, offices, and cars. OPEs have been found in all these indoor environments at concentration levels ranging between ng/m³ up to µg/m³. However, no information is available about the occurrence of these pollutants in air from other microenvironments such as subway stations. The main objectives of the present study are to evaluate the presence of different OPEs in air particle samples from subway stations in Barcelona and to assess the non-dietary human exposure to these compounds through air inhalation. To the best of our knowledge, this is the first study to show the occurrence of these plastic additives in particulate matter from subway.

A total of 30 samples of fine respirable dust (PM_{2.5}) collected on the platforms of subway stations were selected. OPEs were detected in all the analysed samples, indicating widespread contamination by these emerging pollutants, with levels ranging between 1.59 and 202 ng/m³ (mean value of 39.9 ng/m³). Seventeen out of nineteen tested analytes were detected. Compounds with higher concentration levels were tris(1,3-dichloro-2-propyl) phosphate (TDCIPP) with a mean value of 14.6 ng/m³, followed by tris(chloroisopropyl) phosphate (TCIPP) with a mean value of 11.0 ng/m³.



PLASTIC'2020

Caracterización de residuos sólidos urbanos domiciliarios del Distrito Metropolitano de Quito en abril del 2020, durante la pandemia provocada por el SARS CoV2

D.E. García Tumipamba, A.P. Bolaños Villarreal, F.V. Cuarán Sarzosa

El presente trabajo se realizó en la ciudad de Quito, sector de Santa Rita, provincia de Pichincha, parroquia Chillogallo, durante la emergencia sanitaria por el brote de la enfermedad por coronavirus (COVID-19) declarada a nivel mundial. Para la caracterización de los residuos sólidos domiciliarios generados se realizó una separación desde el origen, se pesó semanalmente los residuos orgánicos durante 4 semanas en el mes de abril, usando una balanza y el uso estricto de los equipos de protección personal como: mandil, guantes de nitrilo y mascarilla. Se procedió a contabilizar durante esos meses, los desechos inorgánicos reciclables como cartón, papel, madera, plástico, entre otros y desechos peligrosos como medicamentos vencidos, baterías y pilas. La materia orgánica registró 12.81 kg en un promedio semanal. La composición de los residuos fueron: desechos peligrosos 13.26%, desechos no reciclables 0.23% y desechos reciclables 86.51%, de este último: 59.14% corresponde a plásticos, 34.41% a papel, 0.27% a madera, cartón a 4.3%, vidrio a 1,34%, el aluminio a 0.54%. Dichos datos, dejan ver los hábitos de consumo del hogar. Se realizó además, el cálculo de la tasa per cápita (PPC) con un valor promedio de 0.46 kg/hab.día.

Se observó en este estudio que el plástico fue el material que mayor generación se produjo: 220 productos entre botellas, fundas, empaques, recipientes y otros materiales. En otras ciudades del Ecuador, es mucho más débil el servicio de recolección, por lo que, esas ciudades son más susceptibles a la contaminación ambiental y las afecciones en su salud. Muchos modelos empleados en otros países han resultado exitosos, sobre todo ahora, que existe un incremento de residuos sólidos infecciosos. Sin embargo, para Ecuador aún sigue siendo un gran desafío emplear técnicas y procedimientos mucho más sustentables y productivos. Tanto para los países desarrollados como para los países en desarrollo, continuar apostado a los rellenos sanitarios o a la incineración como únicos caminos para el manejo y gestión de los residuos, es una manera de no asumir su responsabilidad. Comparando esta investigación con estudios afines, Moya, Jaramillo, Játiva, Aldás, & Kaparaju, (2017), presentan en su investigación: Waste-To-Energy Technologies: an opportunity of energy recovery from Municipal Solid Waste, using Quito - Ecuador as case study, el potencial de generación de energía a partir de residuos sólidos municipales (RSU) en Quito, Ecuador, para procesos bioquímicos y los termoquímicos utilizando modelos genéricos. Los resultados de estos investigadores mostraron que los RSU de Quito contenían 69.3% de residuos biodegradables y 30.7% de residuos no biodegradables..



PLASTIC'2020

Plásticos en Brasil: Cómo un país políticamente inestable contribuye para comprender la amenaza mundial de los plásticos en los peces marinos.

M. Santos de Moura, M. Vianna

Brasil es el país con la población, territorio y la economía más grande de América del Sur. Desde el inicio de la década, el país sufre recortes en las inversiones destinadas a ciencia, y el desmoronamiento de las políticas de seguridad ambiental. Los momentos más complicados han sido después de las recientes retiradas de las protecciones de áreas de mangue y el petróleo en las playas del nordeste, que por más de un año no se pudo encontrar su origen. Con todas las dificultades, Brasil es el más grande responsable de los reportes de plástico, logrando que el área de fao 41, tenga un número de reportes comparables al de los mares europeos del atlántico nordeste 21 y de los mares Mediterráneo y Negro 27 [1] 1]. Ese estudio tuvo como objetivo compilar las publicaciones ocurrientes en Brasil por una perspectiva cientométrica en bases de datos científicos, Web of Science, Scopus y Scielo, revisando las publicaciones disponibles. Fueron encontradas 68 especies de peces teleósteos en 24 estudios y 5 especies de peces elasmobranchios en 5 estudios. Gran parte de esos peces tienen un status de amenaza poco preocupante y la ingesta es la interacción más reportada. Los elasmobranchios tienen un esfuerzo de muestreo menos grande en comparación a los teleósteos, siendo así los más descuidados. La mayoría de los estudios están publicados después de 2011 con la gran mayoría concentrada en la costa nordeste del país (área FAO 41.1.2). Así mismo, los estudios comprenden el litoral brasileño de norte a sur ampliamente distribuidas.

Sin embargo, todavía hay mucho esfuerzo que hacer para comprender los impactos de ese tipo de amenazas en los peces de los diferentes ecosistemas marinos brasileños al largo de su extenso litoral. Los datos muestran como un país con problemas notables de inestabilidad política y desigualdad social, sin grandes inversiones en ciencia y con la ausencia de un programa como el MSFD de la Unión Europea, contribuye positivamente para el entendimiento del asunto. El papel de los científicos y de las personas capacitadas hace que el tema sea un visible para ser estudiado. Esta situación puede construir una referencia regional en el tema de la amenaza por plástico en los peces marinos y aumentar los reportes en el continente Suramericano en el ámbito del Mercosur y de Prosur, para así finalmente contribuir al aumento de los reportes mundiales.



PLASTIC'2020

**Evento online, retransmitido
en streaming**

Estas Jornadas han sido cofinanciadas por la
Agencia Estatal de Investigación con el Proyecto
EXPOPLAS (PID2019-110576RB-I00) y la
Acreditación de Excelencia Severo Ochoa
(CEX2018-000794-S)





PLASTIC'2020
#PLASTIC2020_IDAEA