



PLASTIC'2022

2^{as} Jornadas sobre CONTAMINACIÓN POR PLÁSTICOS
(PLASTIC'2022)

Martes 22 de Noviembre de 2022

LIBRO DE ABSTRACTS

PRESENTACIONES ORALES

- 9h-9h10 Bienvenida
Ethel Eljarrat (Organizadora de PLASTIC'2022)
- 9h10-9h45 CONFERENCIA PLENARIA: Plásticos y otros tóxicos en la salud de la mujer.
Nicolás Olea (Universidad de Granada)
- Chairman:* *Marta Llorca*
- 9h45-10h **Análisis rápido de microplásticos en filtros por microscopía infrarroja LDIR.**
Fernando Tobalina (Agilent Technologies)
- 10h-10h15 **Identificación y cuantificación de microplásticos en aguas de depuradoras de la comunidad valenciana y su evolución en el tiempo.**
Santiago Sánchez Alberola (IATA-CSIC)
- 10h15-10h30 **Impact of marine plastic photodegradation in the biogeochemistry of the ocean.**
Cristina Romera Castillo (ICM-CSIC)
- 10h30-10h45 **Cytotoxicity assessment of micro and nano bioplastics and plastic additives in single use household items.**
Katerina Savva (IDAEA-CSIC)
- 10h45-11h **Bioaccumulation of plastic additives and organic pollutants in zebrafish through microplastics.**
Arianna Bautista (IDAEA-CSIC)
- 11h-12h Pausa café – **Sesión de Pósters**
- Sesión Especial: Exposición humana a la Contaminación por Plásticos*
Chairman: *Teresa Moreno*
- 12h-12h15 **Plastic additives in beverages and foodstuffs: exposure assessment through diet.**
Julio Fernández Arribas (IDAEA-CSIC)
- 12h15-12h30 **Nontargeted screening of chemicals migration from plastic food contact materials by high resolution mass spectrometry.**
Eva Herrera (IDAEA-CSIC)
- 12h30-12h45 **Factores que condicionan la toxicidad de los microplásticos ingeridos a través de la dieta.**

Alicia Sánchez (IATA-CSIC)

12h45-13h **Daily exposure to organophosphate ester plasticizers in indoor environments.**
Aleix Balasch (IDAEA-CSIC)

13h-13h15 **The presence of chemical additives associated with plastic in facemasks and their impact on human health.**
Sandra Callejas (IDAEA-CSIC)

13h15-13h30 **Children's exposure to phthalates, non-phthalate plasticizers and bisphenols and associations with neurodevelopmental outcomes.**
Mercè Garí (IDAEA-CSIC)

13h30-13h45 **Sub-lethal in vitro effects of polystyrene nanoplastics in primary human nasal epithelial cells – Focus on autophagic effects.**
Balasubramanyam Annangi (Universitat Autònoma de Barcelona)

PLÁSTICOS Y OTROS TÓXICOS EN LA SALUD DE LA MUJER

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La exposición humana a los polímeros plásticos derivados del petróleo y sus componentes es un fenómeno preocupante no suficientemente estudiado. Los plásticos son compuestos orgánicos complejos formados por polímeros monómeros, aditivos y elementos adheridos tanto químicos como biológicos. Las consecuencias de la interacción de los microplásticos y nanoplásticos con el organismo dependen de factores físicos, como el tamaño, y también de su composición química y de la carga biológica que porten.

La exposición de la mujer a contaminantes ambientales, como por ejemplo los plásticos y sus componentes, es un asunto mal gestionado cuyo conocimiento y consecuencias tan solo ahora empiezan a desvelarse. Tanto la simplicidad de haber considerado al varón como modelo exclusivo para los estudios de exposición humana, ignorando la especial susceptibilidad de la mujer (discriminación por cuestión de sexo), junto a la posición de desventaja que la mujer ha sufrido en tareas y ocupaciones con mayor exposición ambiental (discriminación de género), han motivado que ahora recibamos con asombro la información que generamos sobre la exposición de la mujer y las consecuencias sobre la salud. A esto se une la posibilidad de que la mujer sea, a su vez, transmisora de la exposición durante la maternidad (embarazo, lactancia y crianza), aspecto muy mal estudiado cuyas evidencias enervan muchas sensibilidades.

Es urgente y necesaria la aplicación del principio de precaución mientras se genera más conocimiento sobre la inocuidad y los efectos adversos de la exposición humana a plásticos.

ANÁLISIS RÁPIDO DE MICROPLÁSTICOS EN FILTROS POR MICROSCOPIA INFRARROJA LDIR

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La caracterización de microplásticos y el desarrollo de métodos de análisis adecuados enfrenta actualmente numerosos retos. Una muestra medioambiental, como el agua, puede contener miles de partículas de microplásticos mezcladas con otras partículas de otros tipos, como arenas, residuos orgánicos u otros [1], lo que impone serias limitaciones a su análisis mediante las técnicas habituales de microscopía visible [2]. Otras técnicas con mayor selectividad, como la microscopía FTIR o Raman están siendo cada vez más empleadas [3], aunque también sufren de limitaciones y resultan excesivamente lentas [4].

La reciente introducción de la microscopía infrarroja basada en láser de cascada cuántica (LDIR) ha permitido disponer de una herramienta de análisis adecuada para el análisis rápido de partículas de tamaño microscópico capaz de cuantificar, identificar y clasificar los fragmentos y fibras encontrados, incluso de forma automatizada. No obstante, hasta ahora, los procedimientos de análisis requerían transvasar las partículas previamente filtradas sobre una superficie plana y reflectiva para obtener los espectros individuales de cada partícula que permitan su identificación, lo que añade un paso más de complejidad a la preparativa de la muestra.

Como alternativa a este modo de trabajo, en esta comunicación presentamos los primeros ejemplos de análisis de microplásticos en aguas por LDIR obtenidos directamente sobre filtros, simplificando de esta manera la preparativa de la muestra y facilitando un poco más el análisis en rutina de los microplásticos.

[1] Primpke, S., Cross, R. K., Mintenig, S. M., Simon, M., Vianello, A., Gerdt, G., & Vollertsen, J. (2020). *Applied Spectroscopy*, 74(9), 1127-1138.

[2] Schymanski, D., Oßmann, B. E., Benismail, N., Boukerma, K., Dallmann, G., Von Der Esch, E., Fischer, D., Fischer, F., Gilliland, D., Glas, K., Hofmann, T., K  ppler, A., Lacorte, S., Marco, J., Rakwe, M. E., Weisser, J., Witzig, C., Zumb  lte, N., & Ivleva, N. P. (2021). *Analytical and Bioanalytical Chemistry*, 413(24), 5969-5994.

[3] K  ppler, A., Fischer, D., Oberbeckmann, S., Schernewski, G., Labrenz, M., Eichhorn, K.-J., & Voit, B. (2016). *Analytical and Bioanalytical Chemistry*, 408(29), 8377-8391

[4] Primpke, S., Christiansen, S. H., Cowger, W., De Frond, H., Deshpande, A., Fischer, M., Holland, E. B., Meyns, M., O'Donnell, B. A., Ossmann, B. E., Pittroff, M., Sarau, G., Scholz-B  ttcher, B. M., & Wiggin, K. J. (2020). *Applied Spectroscopy*, 74(9), 1012-1047.

IDENTIFICACIÓN Y CUANTIFICACIÓN DE MICROPLÁSTICOS EN AGUAS DE DEPURADORAS DE LA COMUNIDAD VALENCIANA Y SU EVOLUCIÓN EN EL TIEMPO

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La elevada presencia de microplásticos (MPs) de diferentes tamaños, materiales y concentraciones en el medio acuático es una preocupación mundial debido a su potencial daño físico y químico a los organismos acuáticos y terrestres. Además, la bioacumulación de estos compuestos está llevando a su ingestión por parte del ser humano a través del consumo de mariscos, miel e incluso agua embotellada.

El objetivo principal de este trabajo fue conocer la eficiencia de diferentes depuradoras (EDAR) de la Comunidad Valenciana a la hora de reducir la presencia de MPs. Para ello, se estableció un protocolo de identificación, caracterización y cuantificación de los MPs mediante la utilización de diferentes técnicas tales como la microscopía óptica, espectrometría Raman e infrarroja (ATR-FTIR).

Se identificaron mayoritariamente materiales comunes como el polietileno (PE) y polipropileno (PP) en forma de fragmentos, y fibras de poliéster y acrílico que son utilizadas en la industria textil por su resistencia. En general, los resultados indicaron una alta eficiencia de las depuradoras, con casi un 90% de reducción, aunque algunas depuradoras solo redujeron un 55% la cantidad de partículas presentes. Además, la cantidad de micropartículas y, en particular, de microplásticos fue significativamente mayor a la entrada y salida de las depuradoras en los meses más lluviosos.

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IMPACT OF MARINE PLASTIC PHOTODEGRADATION IN THE BIOGEOCHEMISTRY OF THE OCEAN

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More than 250,000 metric tons of plastic are currently floating on the sea surface threatening marine fauna from small copepods to big mammals including human beings. That floating plastic is exposed to sunlight which is its main degradation factor producing scratches and embrittlement. Commercial plastic is never pure and it contains additives and plasticizers to improve the properties required for its purpose and to make it more resistant to degradation. When in contact with water and, specially, under sunlight radiation, these additives and the products from plastic degradation can leach out to the aquatic medium becoming part of the dissolved organic matter (DOM) pool naturally present in the ocean. The chemical compounds leached from plastic can alter the biogeochemistry of the seawater with consequence for the marine organisms. Here, it will be shown the results of several studies in which different types of plastic (including biodegradable and aged polymers) were exposed to sunlight degradation in seawater during 1-6 days. The chemical composition of the seawater was analyzed at the beginning and the end of the experiment for dissolved organic carbon (DOC), fluorescence, absorbance and pH. We found that plastic releases compounds in seawater which present a characteristic fluorescence signal. Aged plastic released a higher amount of material than virgin plastic and biodegradable plastic did not show differences regarding the petrol-based plastic. Finally, we found that the DOM and CO₂ released during plastic photodegradation can alter the chemistry of seawater. These results will contribute to better understand the impact of plastic in marine ecosystems and the marine carbon cycle.

CYTOTOXICITY ASSESSMENT OF MICRO AND NANO BIOPLASTICS AND PLASTIC ADDITIVES IN SINGLE-USE HOUSEHOLD ITEMS

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Bioplastics made of renewable sources provide an excellent alternative to fossil-based materials. However, similar or higher quantities of plastic additives than fossil-based plastics are used in the formulations of bioplastic to improve their performance and barrier properties¹. Nowadays, there is an increasing concern about sources of chemical exposure. However, there is an important knowledge gap regarding complex additive mixtures, particularly in bio-based materials. In this study, we have characterised the presence of plastic additives in single-use materials, that were collected from retail shops in Spain, which are made of the most common bio-based biodegradable materials, Poly(lactic acid) (PLA) and poly(hydroxybutyrate) (PHB), in contrast with a fossil-based plastic material that is made of extensive-usage high-density polyethylene (HDPE). The approach consisted of the pulverization of material in the nano-micro range (100 nm-10 µm), and the materials were extracted using different solvents and ultrasonic-assisted solvent extraction (UASE). The combined extracts were analyzed by high-performance liquid chromatography coupled with high-resolution mass spectrometry equipped with a heated electrospray ionisation source operated in positive and negative ionization conditions (HPLC-HESI(+/-)-HRMS), using a suspect screening approach². A total number of 203 additives were tentatively identified (confidence level 2) in the bioplastics items of this study. An average of 123 plastic additives were found in PLA items and 121 in PHB items. Plasticizers were the most abundant additives; the phthalates group was the most commonly found, while 63 plastic additives were confirmed by standards and quantified. In parallel, the cytotoxicity of plastic particles in terms of cell viability and oxidative stress was studied using A549 alveolar basal epithelial cells, and the toxicity of the different extracts was also established using HepG2 adenocarcinoma cells. The main results of this study demonstrated that the plastic particles did not show a significant reduction in cell viability, but oxidative stress was significant, with PLA being the material that showed the highest effect. On the other hand, extracts of plastic particles did not show inhibition of cell viability except for HDPE extract, but the different extracts produced oxidative stress, with PLA showing the highest effect. Although the item showing the highest concentrations of additives was the extract of PLA material while also showing the most elevated oxidative stress, the low migration of toxicants from plastic materials ensures their safe use. However, this also supports the idea that bioplastics can contain many toxic substances in their formulations, some of which are unknown and should be studied in more depth.

[1] Zimmermann, L., et al., Environmental Science and Technology, 2019. 53(19).

[2] Llorca, M., et al., Journal of Hazardous Materials, 2021. 404.

BIOACCUMULATION OF PLASTIC ADDITIVES AND ORGANIC POLLUTANTS IN ZEBRAFISH THROUGH MICROPLASTICS

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Plastic pollution is an emerging threat with serious consequences for animal health and the environment. Among them, microplastics (MPs) with a size below 5mm are the ones that could cause harmful effects to biota since they can be ingested by a wide variety of species. The risks associated with these small fragments come from the material itself and the chemical contaminants that are absorbed into it from the surrounding water. To assess bioaccumulation in tissues, a feeding study of 4 treatments was conducted with zebrafish for 60 days. Exposure experiments were carried out through the diet (10% of total) and two more experiments, one using clean pellets from a factory and a blank control experiment without MPs in the fish diet. The analysis of chemical pollutants was by liquid chromatography coupled to a high-resolution mass spectrometry (LC- HRMS).

Our results verify the bioaccumulation of chemical pollutants in zebrafish tissues, also over the time. In addition, in some cases, pollutants have more tendency to adsorb to microplastics instead of being desorbed. The family of plasticizers show most of the compounds in level 2 of identification, while plastic synthesizers were quantified as the highest concentration in zebrafish tissues, followed by plasticizers.

Our main findings support the hypothesis that, in this real scenario, plastic additives and chemical contaminants adsorbed on environmental microplastics (EMPs) bioaccumulate in the fish tissues due to long-term ingestion of MPs.

Key words: Microplastics additives, Bioconcentration, Zebra Fish experiment, HRMS

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PLASTIC ADDITIVES IN BEVERAGES AND FOODSTUFFS: EXPOSURE ASSESSMENT THROUGH DIET

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Among plastic applications, food and beverages packaging is one of the main ones. Additives are added to plastics in order to enhance their mechanical and chemical properties. Flame retardants and plasticizers, such as organophosphate esters (OPEs) or phthalates, represent the 47% of additives in plastics [1]. Furthermore, alternatives like acetyl tributyl citrate (ATBC) or di(2-ethylhexyl) adipate (DEHA) have increased their use, even though their lack of toxicity cannot be assured.

The main objective of this study is to evaluate the estimated daily intakes (EDIs) of plastic additives such as OPEs, phthalates and alternative plasticizers through diet. With this purpose, different beverages (water, cola drinks, juice, wine, hot drinks) and foodstuffs (meat, fish, dairy products, fruit and vegetables, cereals, infant products) were selected for extraction and subsequent analysis by LC-MS/MS. EDIs were determined taking into account the Spanish per capita consumption and the Spanish National dietary survey on children and adolescents (ENALIA). Body weight was established in 5 kg for infants (aged 0-12 months), 12 kg for toddlers (aged 1-3 years) and 70 kg for adults (aged over 18 years), according to EFSA recommendations [2].

As remarkable results for beverages, 2-ethylhexyl diphenyl phosphate (EHDPP) was found in cola drinks with a mean value of 2.74 µg/L, which led to EDIs for adults and toddlers of 1.20 and 0.04 ng/kg body weight (bw)/day, respectively. Referring to foodstuffs, higher levels of DEHA were obtained from serrano ham, with a concentration of 10.5 µg/g. Thus, EDI in adults resulted in a value of 702 ng/kg bw/day, which raised to 2409 ng/kg bw/day for toddlers. Focusing on infant foods, a meat based ready-to-eat meal showed 3.35 µg/g of ATBC, with EDIs of 801 ng/kg bw/day for toddlers and 5099 ng/kg bw/day in the case of infants. These results showed up the high exposure degree to plasticizers through diet, and the importance of highlight the presence of these chemicals in food as an outcome of plastic pollution, in order to contribute to a restrictive legislation in plastic applications.

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[1] Cheng, H., Luo, H., Hu, Y., Tao, S. 2020. Water Research 185, 116253.

[2] EFSA Scientific Committee. 2012. EFSA Journal 10(3), 2579.

NONTARGETED SCREENING OF CHEMICALS MIGRATION FROM PLASTIC FOOD CONTACT MATERIALS BY HIGH RESOLUTION MASS SPECTROMETRY

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Food packaging has become essential to preserve the nutritional properties and sensory characteristics of food. Despite the advantages that packaging provides to the consumer, nowadays there is concern in environmental and health topics since food packaging could represent a potential source of contamination because of the possible transfer of components from packaging to food.

The aim of this study is to investigate migration of chemicals from plastic food contact materials (FCMs) used for microwave and conventional oven heating (roasting bags, microwavable plastic trays and microwave oven bags). The study focuses on foods that are marketed in packaging to be cooked with (vegetables, purée, omelette and meat), in order to evaluate if any chemical migrates from FCMs only by contact or when the food has been cooked.

Due to the variety of foods studied, several extraction processes have been carried out [1]. Gas and liquid chromatography separation systems coupled with Orbitrap mass analyzers were used for comprehensive nontargeted screening. This approach expands the chemical space covered to include semivolatile, nonvolatile, nonpolar and polar compounds. Compound Discoverer 3.3 software was used for nontargeted analysis of the data. Critical parameters in GC and LC workflows were established: accurate mass data (<5ppm), isotope pattern matching, intensity thresholds, markbackground, score databases, etc [2]. This approach allowed to identify intentionally added substances (IAS), i.e, components and additives used in the production of polymeric materials and plastics, and non-intentionally added substances (NIAS) such as degradation of IAS.

Finally, the long-term goals of this work are to assess the human exposure and safety risk to these migrates and to contribute to safer packaged foods.

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[1] Hajeb, P et al. 2022. Chemosphere 287,132306

[2] Taylor, R.B., Sapozhnikova, Y. 2022. J.Agric.Food.Chem, 70, 4805-16

FACTORES QUE CONDICIONAN LA TOXICIDAD DE LOS MICROPLÁSTICOS INGERIDOS A TRAVÉS DE LA DIETA

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En los últimos años, organismos como la Autoridad Europea de Seguridad Alimentaria (EFSA, 2016) y la Organización Mundial de la Salud (OMS, 2019) han mostrado una creciente preocupación por la presencia de microplásticos (MPs) en nuestra dieta. Debido a su tamaño, la absorción intestinal de los MPs puede verse limitada. Sin embargo, los aditivos empleados en su fabricación pueden atravesar la barrera intestinal y llegar a la circulación sistémica.

En este estudio se ha evaluado la liberación de aditivos plásticos en dos etapas previas a la absorción intestinal: el cocinado del alimento y su digestión gastrointestinal. Para tal fin se ha empleado agua adicionada con MPs (<500 µm), la cual se ha sometido a un proceso de cocción y a una digestión in vitro. En el líquido de cocción y en la fracción digerida se han analizado varios aditivos plásticos mediante cromatografía de gases acoplada a espectrometría de masas (GC-MS). Además, se ha estudiado la influencia de diferentes factores en esta liberación: la presencia de grasa en la matriz y el efecto del envejecimiento del plástico, empleando radiación UV. Los resultados muestran que tanto en el cocinado como en la digestión se liberan aditivos con carácter tóxico: derivados del ácido ftálico (DEP, DBP y DEHP), bisfenol A (BPA), N-butil benceno sulfonamida (NBBS) y benzofenona, entre otros. También se pone de manifiesto que la presencia de aceite durante el cocinado y la digestión favorece esta liberación. Asimismo, el envejecimiento del plástico es otro factor relevante en este proceso.

El presente estudio muestra que el cocinado previo de alimentos con MPs y la digestión a la que se ven sometidos tras su ingesta pueden favorecer la absorción y llegada a la circulación sistémica de aditivos plásticos, algunos de los cuales han sido clasificados como probable/posible cancerígenos en humanos (IARC, 2011).

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[1] EFSA, 2016. EFSA J. 14, e04501.

[2] IARC, 2011. Group Eval. Carcinogen. Risk. Hum. 97, 311-344.

[3] WHO, 2019. World Health Organization, Geneva. ISBN: 978-92-4-151619-8

DAILY EXPOSURE TO ORGANOPHOSPHATE ESTER PLASTICIZERS IN INDOOR ENVIRONMENTS

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Humans are daily exposed to chemical additives in plastics, being the main routes food ingestion and air inhalation. Exposure through inhalation is not well understood, despite the fact that these chemicals occur in inhalable particles, especially in indoor environments where plastic materials are so common. Organophosphate ester plasticizers (OPEs) have been shown to reach concentrations of $\mu\text{g/g}$ in indoor environments [1].

To assess OPEs concentration levels in indoor environments, a sampling campaign was conducted in different microenvironments from everyday life. Four rooms from 10 houses were sampled, which were bathroom, bedroom, kitchen and living room, also public transport and private cars and four work places. Particulate matter below 2.5 microns in size was collected in 37 mm quartz microfiber filter using a personal environmental monitor with a pump at 10L/min. Particles in filters were extracted by ultrasonic, filtered with glass wool and evaporated to reconstitute with methanol. Extracts were analysed with turbulent flow chromatography coupled to liquid chromatography and tandem mass spectrometry.

Concentration levels were between 4.37 and 75.4 ng/m³ in houses, with a mean of 14.2 ng/m³. These levels were lower than those from transports and workplaces with mean concentrations of 58.0 and 47.2 ng/m³, respectively. In almost all cases the most abundant OPEs were tris(2-chloroisopropyl) phosphate (TCIPP) and triethyl phosphate (TEP), but in some workplaces tri n-butyl phosphate (TNBP) had also a relevant contribution to ΣOPEs , and in cars tris(1,3-dichloro-2-propyl) phosphate (TDCIPP) was also elevated.

A human health risk assessment study was performed, considering the time spent in each microenvironment. Only indoor environments were considered, and a total of 23 hours was considered as the time spends daily in indoor environments. Estimated daily intakes (EDIs) were calculated and obtained results showed that the dose of OPEs does not suppose a non-carcinogenic or carcinogenic risk for human health: levels were 1756 times below the risk threshold for non-carcinogenic risk and 69 times lower for carcinogenic risk. The environment contributing the highest to the total EDI was the workplace, being the 61% of total daily intake, which was superior to the global house EDI (31%) even if a higher amount of time is spent in houses. The microenvironment from the house with the highest EDI was the living room with a 12% of indoor EDI, and transport represented a 7%, which is relevant considering than less than an hour is invested in this activity. As a conclusion it was found that the daily inhalation of OPE does not suppose a risk for human health by itself, but other sources of intake can increase these values to the threshold, as ingestion or dermal contact.

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[1] Van den Eede, N., Dirtu, A.C., Neels, H., Covaci, A., 2011. Analytical developments and preliminary assessment of human exposure to organophosphate flame retardants from indoor dust. *Environ. Int.* 37, 454–461.

THE PRESENCE OF CHEMICAL ADDITIVES ASSOCIATED WITH PLASTIC IN FACEMASKS AND THEIR IMPACT ON HUMAN HEALTH

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From the COVID-19 pandemic, the consumption of single-use or reusable facemasks has widely increased by the general public, since they have been recommended or even enforced as personal protection against the SARS-COV-2. A great number of these facemasks are produced from synthetic polymers, to which certain chemical additives are added during their production, such as plasticizers, flame retardants, and some heavy metals, among others. Even though, very few studies have evaluated the potential risk to humans that would result from the prolonged use of facemasks.

In this study, organophosphate esters (OPEs), an emerging group of pollutants with reported toxic effects, as well as heavy metals were determined in 38 different facemasks corresponding to four different types: surgical, KN-95, FFP2, and reusable facemasks. Subsequently, an inhalation study was carried out to evaluate human exposure to these toxic chemicals. For this experiment, dummy heads equipped with Personal Environmental Monitors (PEM) were used, simulating 8h of human breath. The inhalation experiments were performed under three different conditions (initial conditions (22°C and 60% humidity); high temperature (35°C and 60% humidity) and high humidity (22°C and 80% humidity)). Both, the facemask and the quartz filters were analysed by an ultrasonic solvent extraction with hexane: acetone (1:1). Sample purification and analysis were performed online with liquid chromatography coupled to a tandem mass spectrometer (LC-MS/MS) Thermo Scientific TurboFlow™ system.

OPEs were detected in all analyzed masks, with levels ranging between 24,7 to 20.427 ng/mask, KN-95 being the most contaminated ones. Regarding heavy metals, the highest levels (up to 150 µg/mask) were for Zn and Cu, since these metals are applied as viricides. Results obtained from inhalation experiments showed that temperature positively affects the release of OPEs from the facemask, being 6% the mean release percentage. On the other hand, the release percentage for metals is lower, being in most cases << 1%. Once the degree of inhalation has been calculated, the daily intake of OPEs and heavy metals due to the use of facemasks has been evaluated, showing always safe values for human health. Finally, an environmental impact assessment was carried out, calculating the waste generated globally by the use of facemasks, as well as the number of OPEs released into the environment, being the reusable masks the most sustainable option.

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CHILDREN'S EXPOSURE TO PHTHALATES, NON-PHTHALATE PLASTICIZERS AND BISPHENOLS AND ASSOCIATIONS WITH NEURODEVELOPMENTAL OUTCOMES

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Introduction and Aim: Exposures to phthalates, non-phthalate plasticizers and bisphenols may play a role in the development of child behavioral and psychomotor problems. The aim of the study was to evaluate the associations between childhood exposures to these compounds and neurodevelopmental outcomes in the REPRO_PL birth cohort (Poland).

Methods: Urine samples were collected at the time of children's neurodevelopmental assessment (age 7 years). Online-SPE-LC-MS/MS was used for the determination of BPA and 21 phthalate metabolites (n=400) and their replacement alternatives BPF, BPS, three metabolites of diethylhexil-terephthalate (DEHTP) and three metabolites of DINCH (n=150). Child's neurodevelopment was assessed by the Strengths and Difficulties Questionnaire (SDQ) and the Intelligence and Development Scales (IDS). Multivariate regression models accounting for sex-specific effects were applied, including the use of stratification and interactive approaches.

Results: BPA, BPF and Σ DEHTP were found to be positively associated with several SDQ scores in boys, including emotional symptoms, peer-relationship and conduct problems, as well as the pro-social behavior. Conversely, among girls, the compounds which were associated with poorer behavioral scores were MMP, Σ DnBP and Σ DiBP. For IDS, higher exposures to BPF were associated to lower scores in Fluid IQ and Cognition in boys, while among girls, we found a negative association between DINCH and MMP and mathematical scores.

Conclusions: This study indicates that children's exposure to several replacement compounds of BPA and phthalates, such as BPF and DEHTP, are associated with adverse effects on behavioural and cognitive development of school age children, with a divergent sex-specific effects.

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SUB-LETHAL IN VITRO EFFECTS OF POLYSTYRENE NANOPLASTICS IN PRIMARY HUMAN NASAL EPITHELIAL CELLS – FOCUS ON AUTOPHAGIC EFFECTS

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The potential effects of released micro-nanoplastics (MNPLs) into the environment from various sources, as emerging pollutants, arouse considerable interest in the scientific community. It is now established from various studies that they do pose a possible human health risk when we come into contact with them. One of the potential routes of exposure to humans could come from inhalation, due to their widespread presence in the air. We aimed to understand the toxic effects polystyrene nanoplastics (PSNPLs with 50 and 500 nm), in human primary nasal epithelial cells (HNEpCs), the first line of cells acting as a barrier to MNPLs in the respiratory system. For this, we chose several endpoints such as estimation of cell viability, generation of iROS, loss of mitochondrial membrane potential (MMP) and intracellular localization of them. Besides, we evaluated the role of the autophagy pathway which is a normal cellular process involved in the recycling of damaged organelles, aged proteins, and oligosaccharides into simpler forms for cell survival, as a potential toxic mechanism of the selected MNPLs. Our data revealed there was no significant decrease in cell viability due to different concentrations of PSNPLs (from 0.5 to 100 µg/mL) over untreated control after 24 h. Nevertheless, we observed an increase in cellular internalization of PSNPLs versus untreated control in confocal microscopy. Furthermore, there were significant increases in the induction of ROS, and significant loss of MMP when cells were treated with PSNPLs (100 µg/mL) as compared to the control after 24h. With regard to autophagy, there were significant increases in the autophagy markers LC3-II and P62 after the treatment of the cells with PSNPLs at exposures lasting for 24 h, suggesting the possible induction and blockage of the autophagy pathway by PSNPLs.

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[1] Huang, J., Dong, G., Liang, M., Wu, X., Xian, M., An, Y., Zhan, J., Xu, L., Xu, J., Sun, W., Chen, S., Chen, C., Liu, T. 2022. Chemosphere 307, 136093. [2] Tan, Y., Zhu, X., Wu, D., Song, E., Song, Y. 2020. Environ. Sci. Technol 54, 11485-11493.

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Póster 1 - TÉCNICAS ACOPLADAS: LA MEJOR HERRAMIENTA PARA LA IDENTIFICACIÓN DE LOS MICRO Y NANOPLÁSTICOS

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Con el crecimiento de la producción mundial de plásticos (de 359 millones de toneladas en 2018 a 368 millones de toneladas en 2019 según Plastics Europe) aumenta también la cantidad de residuos plásticos. Se estima que aproximadamente un 5% de la producción termina en el medio ambiente y una parte de esta lo hace en forma de micro- y nanoplásticos (MNP).

El principal problema en la lucha contra los MNP radica en que no existe todavía una legislación al respecto. Esto se debe en gran parte a la dificultad en la estandarización de una metodología para su análisis e identificación.

En AIMPLAS disponemos de metodologías adecuadas para el análisis de MNPS en función del tipo de sustrato, lodos, suelos, biota, agua de consumo etc.

Las técnicas acopladas son la mejor herramienta para la identificación de MNP y cada vez más utilizadas¹. Mediante el uso de μ -FTIR, SEM-EDX, Pyr-GC/MS, podemos abarcar la identificación de MNPs en función de la información que se desea obtener.

Como ejemplos de casos prácticos, en la figura 1 se muestran el resultado del análisis de MNP con estas técnicas acopladas.

- μ -FTIR: permite visualizar la morfología, tamaño, color e identificación de MNP > 10 μ m.
- SEM-EDX: permite visualizar la morfología, tamaño e identificación elemental de partículas > 10 μ m
- Pyr-GC/MS: identificación cuantitativa y cualitativa de MNP > 1 μ m

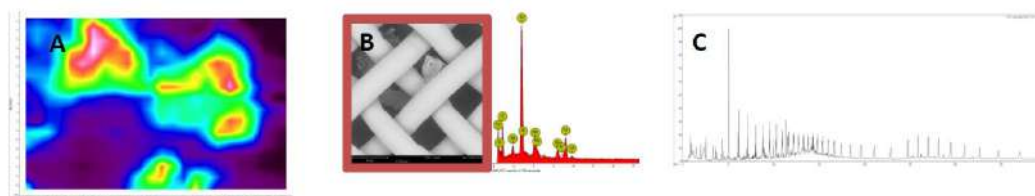


Figura 1. Imagen química de partículas analizadas mediante μ -FTIR (panel A), partícula analizada con SEM-EDX (panel B) y cromatograma obtenido por Pyr-GC-MS (panel C)

[1] Müller, Y. K.; Wernicke, T.; Pittroff, M.; Witzig, C. S.; Storck, F. R.; Klinger, J.; Zumbülte, N. 2019. Anal. Bioanal. Chem. 412 (3), 555–560.

Póster 2 - DEVELOPMENT OF A FLUORESCENT STAINING PROTOCOL OF NANOPLASTICS FOR CELL INTERNALIZATION STUDIES

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One of the most characteristic properties of nanoplastics (NPLs, 1 nm to 1 µm) is their ability to trespass the biological barriers. Moreover, they have been reported as toxic at cellular level and to show adsorption properties towards organic and inorganic pollutants, acting as pollutant carriers into the organism. Nevertheless, NPLs are difficult to detect and characterize at cellular level due to their nano-size and mostly carbon-based composition. Therefore, indirect detection is needed to identify the intra-cellular position of these pollutants in internalization experiments, which can be performed by fluorescent labelled particles. However, there is a lack of harmonized and established protocols for NPLs staining which leads to a significant deficiency of coherence and comparability between research results.

In the present work, a protocol to prepare fluorescent NPLs has been developed. Nanospheres of polystyrene (PS) latex of 170 nm were used as nanoparticle model being stained with different fluorescent dyes or optical brighteners, at temperatures below 100°C. After, the dyed nanoparticles were internalized in the cell, showing that the dye or brightener was not released into the cell medium and being successfully observed inside the cell structure under confocal microscopy.

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[1] Prüst M, Meijer J, Westerink RHS. 2020. Particle and Fibre Toxicology 17(1), 1–16.

[2] Katsumiti A, Losada-Carrillo MP, Barros M, Cajaraville MP. 2021. Scientific Reports 11(1), 1–17.

Póster 3 - POLYMERS OF MICRO(NANO)PLASTICS IN HOUSEHOLD TAP WATER OF THE BARCELONA METROPOLITAN AREA

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Microplastics (MPLs) are emerging persistent pollutants affecting drinking water systems, and different studies have reported their presence in tap water. However, most of the work has a focus on particles in the 100-5 µm range. Here, a workflow to identify and quantify polymers of micro and nanoplastics (MNPLs), with sizes from 0.7 to 20 µm in tap water, is presented. The analytical method consisted of water fractionated filtration followed by toluene ultrasonic-assisted extraction and size-exclusion chromatography, using an advanced polymer chromatography column coupled to high-resolution mass spectrometry with atmospheric pressure photoionization source with negative and positive ionization conditions (HPLC(APC)-APPI(±)-HRMS) and normal phase chromatography HILIC LUNA® column and electrospray ionisation source in positive and negative mode (HPLC(HILIC)-ESI(±)-HRMS). The acquisition was performed in full scan mode, and the subsequent tentative identification of MNPLs polymers has been based on increasing the confirmation level, including the characterisation of monomers by using Kendrick Mass Defect (KMD) analysis, and confirmation and quantification using standards. This approach was applied to assess MNPLs in tap water samples of the Barcelona Metropolitan Area (BMA), that were collected from August to October 2020 from home taps of volunteers distributed in the 42 postal codes of the BMA. Polyethylene (PE), polypropylene (PP), polyisoprene (PI), polybutadiene (PBD), polystyrene (PS), polyamide (PA), and polydimethylsiloxanes (PDMS) were identified. PE, PP, and PA were the most highly detected polymers, and PI and PBD were found at the highest concentrations (9,143 and 1,897 ng/L, respectively).

Póster 4 - CONTAMINACIÓN POR MICROPLÁSTICOS EN AGUA, SEDIMENTOS Y ESPECIES COMERCIALES DE LA CIÉNAGA GRANDE DE SANTA MARTA, CARIBE COLOMBIANO

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Los microplásticos son contaminantes emergentes que se han encontrado en todas las matrices ambientales de los ecosistemas marinos y costeros, donde pueden generar impactos ecológicos y socioeconómicos. Este estudio evalúa la contaminación por microplásticos en aguas superficiales y sedimentos, así como la ingestión por parte de especies de peces de importancia comercial en la Ciénaga Grande de Santa Marta (CGSM), una frágil laguna tropical de menos de 2 m de profundidad en la costa del Caribe colombiano. Los muestreos se efectuaron en marzo y mayo de 2021, recolectando muestras de agua superficial con un balde y muestras de sedimentos con una draga manual en 33 estaciones. Además, se compraron 474 ejemplares de las nueve especies de peces comerciales más capturadas y consumidas localmente, analizando posteriormente sus tractos digestivos. La abundancia de microplásticos varió de 0,0 a 0,3 ítems L⁻¹ en aguas y de 0,0 a 3,1 ítems kg⁻¹ en sedimentos. Además, el 21,1 % de las especies de peces analizadas contenían microplásticos en sus tractos digestivos, con una abundancia promedio entre 1 y 1,5 ítems por individuo. Los microplásticos en agua y sedimentos y en el tracto digestivo de los peces presentaban características similares, mostrando también una asociación moderada y estadísticamente significativa. Los tipos de microplásticos más comunes en las tres matrices analizadas fueron fibras, fragmentos y películas transparentes, blancas y azules, compuestas predominantemente por polietileno y polipropileno. La abundancia de microplásticos fue mayor en las estaciones cercanas a las desembocaduras de los ríos que vierten en la CGSM y a las áreas urbanas, donde además se concentra una alta densidad de actividades pesqueras e infraestructuras de acuicultura, fuentes importantes de microplásticos y otros contaminantes. En la CGSM se produce lo que hemos denominado el “circulo vicioso de la contaminación por plásticos”, en el cual la misma comunidad que contamina la ciénaga podría estar recibiendo estos contaminantes a través del consumo de alimentos contaminados. En conclusión, la contaminación por microplásticos en la CGSM podría representar una amenaza para el ecosistema de la laguna costera y para la población local que depende de la pesca artesanal para su sustento. En consecuencia, se requiere estar vigilante y contemplar cuanto antes acciones efectivas para reducir la contaminación y sus impactos socioambientales en la CGSM.

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Póster 5 - SEARCHING HOTSPOTS OF NEUSTONIC MICROPLASTICS CONTAMINATION IN THE CANARY ISLANDS

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The Canary Islands are in the North Atlantic subtropical gyre and influenced by the African coastal upwelling and the Canary Current, which is fed by the Azores Current that transports high concentrations of plastics that end up reaching the Canary Islands archipelago [1]. In the study by Herrera et al. 2020 [2] on neustonic microplastic in the Macaronesia region, they found a high variability in the concentration of microplastics, with values ranging from 15283 items/km² in Los Gigantes (Tenerife) to 1007872 items/km² in Las Canteras (Gran Canaria). The results showed a microplastics to zooplankton dry weight ratio of 2 ± 1.3 , so that in some areas were found double the microplastics as zooplankton. These values reveal the potential negative impact of microplastics and associated chemical pollutants on the marine environment and biota, especially on filter-feeding animals. To study the current state and impact of sea surface microplastics the IMPLAMAC expedition was carried out in October 2021 from Lanzarote to La Gomera, and 14 surface water samples were collected from the Canary Islands with a manta net. The objectives of this study were found hotspots of microplastic pollution in surface waters, to quantify and characterise microplastics and neustonic zooplankton. With this study it will be observe the evolution of microplastic pollution in surface waters respect to the study previously carried out by Herrera et al. 2020 [2].

[1] Eriksen, M., Lattin, G.L., Monteleone, B., Cummins, A., Penn, E., 2010. Spatial and Temporal Distribution of Plastic Pollution in the North Atlantic Subtropical Gyre: Results from Two Expeditions in 2010 Marcus.

[2] Herrera A, Raymond E, Martínez I, Álvarez S, Canning-clode J, Gestoso I. 2020. First evaluation of neustonic microplastics in the Macaronesian region, NE Atlantic. Marine Pollution Bulletin 153: 110999.

Póster 6 - MONITOREO DE MESO Y MICROPLÁSTICOS EN UNA ZONA ESPECIAL DE CONSERVACIÓN (ZEC) EN TENERIFE, ISLAS CANARIAS

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Los residuos plásticos se han convertido en uno de los mayores contaminantes de los ecosistemas marinos debido a su persistencia, amplia distribución y constante acumulación, especialmente en las playas [1]. En este trabajo, se evaluó la presencia y composición de mesoplásticos (5 – 25 mm) y microplásticos (1 – 5 mm) en seis playas (Playa de los Guíos, Playa de la Arena, Playa de la Jaquita, Playa San Juan, Playa de Ajabo y Playa de Montaña Roja) de una Zona Especial de Conservación (ZEC) situada en el litoral sursuroeste de la isla de Tenerife (Islas Canarias, España). En cada playa se tomaron 5 muestras sobre la línea de marea alta con una separación de 25 m entre cada punto. Las muestras se recolectaron semanalmente durante 12 semanas consecutivas en el periodo comprendido entre el 18 octubre de 2021 y 05 de enero de 2022. Para ello, se utilizó un marco de 50 x 50 cm (0,25 m²) y 5 cm de profundidad para delimitar la fracción de arena muestreada. En total, se recolectaron 2.240 mesoplásticos y 10.074 microplásticos, lo que equivale a 25 mesoplásticos/m² y 112 microplásticos/m². En términos de peso, se recolectaron 146,48 g de mesoplásticos y 87,48 g de microplásticos. Sus composiciones químicas se determinaron mediante espectroscopía infrarroja por transformada de Fourier, encontrando que el 77 % fueron de polietileno, el 19 % de polipropileno y el 4 % de poliestireno, lo que está de acuerdo con la producción mundial de plástico. De entre todas las playas, la playa de la Reserva Natural Especial Montaña Roja, que es la única con orientación nordeste, mostró los contenidos más altos con 960 mesoplásticos (64 mesoplásticos/m² y 61,87 g) y 7.593 microplásticos (506 microplásticos/m² y 67,97 g). Esta contaminación tan relativamente alta amerita estudios posteriores en el ecosistema de Montaña Roja.

Agradecimientos – Al grupo de investigación Applied Analytical Chemistry Research Group (AChem) de la Universidad de La Laguna.

[1] Harris, PT. 2020. Marine Pollution Bulletin 158, 111398

Póster 7 - PRESENCIA DE MICROPLÁSTICOS EN LAGOS DE ALTA MONTAÑA EN SIERRA NEVADA, ANDALUCÍA, ESPAÑA

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La presencia de microplásticos (MPs) se ha estudiado hasta ahora en casi todos los ecosistemas acuáticos de la Tierra, prestando cada vez más atención a los ríos y lagos, incluyendo algunos lugares remotos. Sin embargo, rara vez se han examinado las diferencias en la concentración y caracterización de los MP entre lagos cercanos. Este trabajo se llevó a cabo en el marco de la iniciativa de ciencia ciudadana "74 oasis glaciares-lagos de alta montaña". El objetivo principal fue analizar la abundancia de MPs en la superficie de 35 lagos glaciares del Parque Nacional de Sierra Nevada en Andalucía. Tras el muestreo, se extrajeron los MP y se determinaron parámetros cualitativos como la forma, el tamaño, el color y la naturaleza de los MP mediante el uso de un estereomicroscopio. Además, se cuantificó el número y la concentración de estas partículas y se relacionó estadísticamente con algunas características de los lagos y variables ambientales. Los principales resultados mostraron que los MP estaban presentes en todos los lagos, con una abundancia máxima de 21,3 partículas/L. Los fragmentos fueron la forma predominante (59,7%), seguidos de las fibras (38,8%) y de las esferas, muy escasas. Los MP <45 µm de tamaño fueron las más abundantes, y las partículas de color azul representaron más del 50% del total. Tras el análisis estadístico, no se encontraron diferencias significativas en la abundancia media de MPs entre cuencas (valor $p > 0,05$), pero las concentraciones estaban relacionadas con la presencia de praderas que rodean los lagos (valor $p = 0,035$). Este resultado indica un origen principalmente antrópico de los MP en estos lagos causado por las actividades de ocio y al aire libre de los montañeros, aunque otras variables como el transporte atmosférico hacen posible que los MP lleguen a todos los lagos, convirtiéndose en una fuente relevante de contaminación. La gran abundancia de MPs en estos lagos remotos es preocupante, merece una mayor investigación y puede servir como base para mejorar las regulaciones sobre la gestión de residuos y para establecer objetivos más estrictos para evitar la contaminación por MPs en las zonas de reserva natural.

[1] Godoy V, Calero M, González-Olalla JM, Martín-Lara MA, Olea N, Ruiz-Gutierrez A, Villar-Argaiz M. The human connection: First evidence of microplastics in remote high mountain lakes of Sierra Nevada, Spain. Environ Pollut. 2022 Oct 15;311:119922. doi: 10.1016/j.envpol.2022.119922. Epub 2022 Aug 10. PMID: 35961567.

Póster 8 - UNA REVISIÓN DE LA CONTAMINACIÓN POR MICROPLÁSTICOS EN LAGUNAS COSTERAS

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Las lagunas costeras son ambientes de transición entre los sistemas acuáticos continentales y marinos, y ocupan aproximadamente el 13% de la línea costera del mundo. Tienen, además, una gran importancia ecológica y socioeconómica como proveedoras de valiosos servicios ecosistémicos. Sin embargo, estas lagunas están sujetas a numerosas presiones humanas, incluida la contaminación por microplásticos. El objetivo de esta revisión es identificar y resumir los avances en la investigación de la contaminación por microplásticos en las lagunas costeras de todo el mundo. Consideramos artículos científicos sobre este tema publicados mayoritariamente en inglés entre el año 2000 y el 21 de abril de 2022, disponibles en Scopus y Google Scholar. Se encontraron 57 artículos con datos sobre la abundancia de microplásticos y sus características en 50 lagunas costeras. El número de publicaciones sobre este tipo de contaminación en lagunas ha aumentado significativamente desde 2019. Las diferencias metodológicas entre los estudios de microplásticos en lagunas costeras son un factor limitante para comparaciones de amplio alcance. La mayoría de los estudios (77%) se realizaron por separado en distintos compartimentos ambientales (agua, sedimentos u organismos), siendo la integración limitada, lo que dificulta la comprensión actual de la dinámica de los microplásticos en dichas lagunas. Se ha constatado que los microplásticos son más abundantes en lagunas con costas y cuencas altamente pobladas y que soportan actividades humanas intensivas. Por el contrario, las lagunas en áreas naturales protegidas presentan menor abundancia de microplásticos. Predominan los microplásticos de tipo fibra/filamento y fragmentos, y los polímeros de polietileno, poliéster y polipropileno. La dinámica de acumulación o exportación de los microplásticos en las lagunas costeras está influida por la meteorología estacional, la hidrodinámica, las presiones antropogénicas y la tipología de los microplásticos. La investigación futura sobre contaminación por microplásticos en lagunas costeras debería prestar especial atención a las cuestiones metodológicas, la evaluación y seguimiento de la contaminación, la dinámica y los impactos de los microplásticos, y las medidas de prevención como parte de una gestión ambiental integrada.

Agradecimientos – Agradecemos el apoyo institucional de INVEMAR y de la Universidad de Barcelona (GRC Geociencias marinas – Doctorado en Ciencias del Mar) y el apoyo financiero del Ministerio de Ciencias y Tecnología de Colombia (proyecto 2105-852-71858, financiado por el fondo Francisco José de Caldas, Colombia).

Póster 9 - DYNAMICS OF MICROPLASTIC FIBRES IN BLANES BAY (NW MEDITERRANEAN) FROM 2014 TO 2021

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Microplastics (generally defined as plastics < 5 mm) represent a significant fraction of the plastic waste in marine environments worldwide. When ingested, they can be hazardous for many organisms and their contaminants can be transferred to upper levels of the food chain, even becoming a potential risk to human health. The quantification of this fraction in the water column depends largely on the methodology used (different net types and mesh size or different volumes of bulk samples) and most of them do not detect sizes smaller than 100 µm (usually smaller than 300 µm), underestimating the abundances of microplastics in the water. In this study, monthly data (from 2014 to 2021) from the Blanes Bay Observatory (NW Mediterranean) were analyzed with the aim of determining the seasonal and medium-term temporal dynamics of surface microplastic fibres in an oligotrophic zone slightly affected by river discharges and human activity. Fibres were observed and counted using the Utermöhl method (sedimentation of an aliquot of water sample and observation under an inverted microscope) which allows the quantification of smaller sizes (up to 50 µm) than those detected by the usual methods. Microplastic fibres were present in practically all the samples in a range between 10 and 720 fibres per liter, and no clear seasonal or medium-term temporal pattern was observed. The relationship of microplastic fibre abundances with environmental variables such as freshwater inputs (i.e. river discharges, urban runoff, sewage outflow) or those derived from anthropogenic activities (such as fishing or tourism) will be discussed.

Póster 10 - ADSORCIÓN EN MICROPLÁSTICOS DE CONTAMINANTES ORGÁNICOS PRESENTES EN AGUAS DULCES Y RESIDUALES

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El análisis y la prevención de microplásticos (MPs) en agua es una temática reciente de gran interés mundial debido a la gran problemática medioambiental y toxicológica que conforman. Estas partículas pueden liberarse al agua directamente o formarse por la degradación de plásticos más grandes. Una vez liberados, los MPs pueden interactuar mediante diferentes mecanismos de sorción con sustancias químicas, mayoritariamente contaminantes orgánicos presentes en las aguas, por lo que se convierten en vectores de sustancias químicas peligrosas. Este estudio se centra en comprender la interacción de polímeros con diferente polaridad y que han sido encontrados en grandes cantidades como son la poliamida (PA), polietileno (PE) y polipropileno (PP) de diferentes orígenes y morfologías, con dos de los contaminantes orgánicos más abundantes en las aguas dulces de la Comunidad Valenciana, como son, un herbicida, la terbutilazina (TBA, N2-tert-Butil-6-cloro-N4-etil-1,3,5-triazina-2,4-diamina) y un hidrocarburo aromático policíclico, el pireno (PYR). Las cinéticas de adsorción demuestran que la interacción entre los MPs y los contaminantes varía según la composición química, la estructura cristalina y la morfología de las partículas en la que se encuentran en la naturaleza dichos polímeros, siendo mayor esta interacción en el caso de la PA de origen textil. Finalmente, los resultados indican que las micropartículas en general, y especialmente las fibras de PA, pueden comportarse como concentradores de contaminantes y ser portadoras de los mismos en el ambiente acuático de la Comunidad Valenciana, o utilizarse como sistemas de extracción de contaminantes del agua.

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Póster 11 - SUSPECT SCREENING OF MICRO-NANOPLASTICS IN THE GASTROINTESTINAL TRACTS OF EBRO RIVER FISHES BY LC-HRMS

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In this work, the presence of MNPLs in the gastrointestinal tracts of fish from the Ebro River has been investigated using a double suspected screening approach to assess and quantify polymers and additives.

The sample treatment consisted on a double digestion step with KOH, and HNO₃. Followed by extraction by ultrasonic-assisted extraction (USAE) with toluene (for polymers), and methanol (for additives). The suspected screening of polymers, was carried on by size exclusion chromatography (SEC) using and advanced polymer chromatography (APC) column followed by high resolution mass spectrometry using an atmospheric pressure photoionization (APPI) source, in positive and negative ionization modes (APC-(±)APPI-HRMS). The analysis of the main groups of plastic additives was carried out using liquid chromatography with a C18 analytical column coupled to HRMS equipped with an electrospray ionisation source (ESI) operating under positive and negative conditions (LC-(±ESI)-HRMS). The acquisition was performed in parallel with full-scan (FS) and data-dependant scan (ddMS2) modes, working under positive and negative ionization modes. For the tentative identification, different on-line databases and an in-house library were used. Exact mass with an error within ±2.5 ppm and MS2 spectra were used for the tentative identification.

Confirmation level was reached for polymers, which were quantified. For plastic additives a prioritization list was made and the compounds with higher impacts were quantified.

The one of the most frequently detected polymers found was polyethylene, detected in 84% of the samples with a maximum concentration of 3500 µg/g. Intermediates in polymer synthesis were the additives group most frequently found, being present in 93% of the samples.

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(1) Llorca, M., Vega-Herrera, A., Schirinzì, G., Savva, K., Abad, E., & Farré, M. *Journal of Hazardous Materials*, 404 (2020).

(2). Schirinzì, G. F., Pedà, C., Battaglia, P., Laface, F., Galli, M., Bani, M., Consoli, P., Scotti, G., Esposito, V., Faggio, C., Farré, M., Barceló, D., Fossi, M. C., Andaloro, F., & Romeo, T. *Journal of Hazardous Materials*, 397 (2020).

Póster 12 - ATMOSPHERIC CONTAMINATION FROM NANOPLASTICS AND RELATED PRODUCTS COMING FROM PLAYGROUND

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Nowadays the industry devoted to recycling materials coming from the end-of-life tiers (ELTs) has been widespread to generate, for example, the commonly known as “crumb rubber”. This rubber is versatile with many uses, especially in environmentally sensitive areas such as playgrounds. For example, in Barcelona city alone there are 250 school playgrounds lined with granulated rubber products. Once present outdoors, these artificial surfaces will be subject to abrasion and weathering. The main objective of this work has been to evaluate different microelastomer materials potentially released into the environment when crumb rubber is exposed to natural weathering effects. The different materials were exposed to aging effects under natural conditions for two months and the released inhalable fractions (PM_{2.5} and PM₁₀) were sampled every day [1]. Finally, the ectotoxicological effects on microcrustaceans *Daphnia magna* was also evaluated.

The analysis of nanoplastics (NPLs) [2] showed the presence of polyethylene (PE), polypropylene (PP), polybutadiene (PBD), polysiloxanes and polybutylene (PB-1), at concentrations up to 114 ng/L in PM_{2.5} fractions. In the same fraction we also identified till 56 plastic additives from different families (antioxidants, pigments, copolymers, flame retardants, fungicides, lubricants, plasticizers, polymeric preserving, compounds used during the synthesis of polymers and/or plastic additives, and UV filters). Finally, the eco-toxicological experiments showed that the acute toxicity of leached compounds, either virgin material or aged material, are toxic for the organisms although at concentrations much higher than the ones released to the media.

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[1] T. Moreno, P. Trechera, X. Querol, R. Lah, D. Johnson, A. Wrana, and B. Williamson. (2019) International Journal of Coal Geology, 203: p. 52-59.

[2] M. Llorca, A. Vega-Herrera, G. Schirinzi, K. Savva, E. Abad, and M. Farré. (2021) Journal of hazardous materials, 404: p. 124022.

Póster 13 - TRUE TO LIFE REPRESENTATIVE SECONDARY NANOPLASTICS. OBTENTION, CHARACTERIZATION, AND HAZARD EVALUATION

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Micro and nanoplastics (MNPLs) are emergent environmental pollutants requiring urgent information on their potential risks to human health most of them yet to come or be described. One of the problems associated with the evaluation of their undesirable effects is the lack of real samples, matching with those resulting from the environmental degradation of plastic wastes. To such end, we propose an easy method to obtain polyethylene terephthalate nanoplastics from water plastic bottles (PET-NPLs) but, in principle, applicable to any other plastic goods sources as we demonstrate. An extensive characterization indicates that the proposed process produces uniform samples of PET-NPLs of around 100 nm, as determined by using a multi-angle and dynamic light scattering methodology. An important point to be highlighted is that to avoid the metal contamination resulting from methods using metal blades/burrs for milling, trituration, or sanding, we propose to use diamond burrs to produce metal-free samples. To visualize the toxicological profile of the produced PET-NPLs we have evaluated their ability to be internalized by cells, their cytotoxicity, their ability to induce oxidative stress, and to induce DNA damage. We have demonstrated, that despite the remarkable cellular uptake, no significant induction of biological effects was detected by the methodologies studied on this work at short time exposure, opening the field for further long-term experiments and alternative approaches. Thus, no relevant increases in toxicity, reactive oxygen species (ROS) induction, or DNA damage -as detected with the comet assay- have been observed. The use of real samples, as produced in this study, will generate relevant data in the discussion about the potential health risks associated with MNPLs exposures.

With further experiments we have represented more accurately contaminants found in the environment, resulting from the fragmentation on nanocomposites from daily use goods such as opaque PET ending up with PET-Ti nanoparticles. This approach provides us a material with the remarkable characteristic of being able to colocalize the signals for both the polymer and the metal. Hence, we provide an alternative to nanoparticle tracking in in vitro and new alternative and more complex models.

Keywords: Nanoplastics, polyethylene terephthalate, physicochemical characterization, cell uptake, cytotoxicity.

Póster 14 - HAZARD ASSESSMENT OF INGESTED POLYSTYRENE NANOPLASTICS IN DROSOPHILA LARVAE

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Micro- and nanoplastics (MNPLs) are intentionally produced for commercial uses (primary MNPLs) or are formed from environmentally aged plastics (secondary MNPLs). Independent of their origin, all of them will finally end up in the environment constituting some of the known emergent pollutants. Despite the inert nature of plastics, questions about their potential biological effects on human health need to find sound answers. In addition, the association between the potentially induced effects and the MNPL size is also required to be known. In this context, we have used our in vivo model of *Drosophila* larvae and three nanopolystyrene plastics (PSNPLs) sized 50, 200, and 500 nm (PS-50, PS-200, and PS-500) to add new data to better understand the potential health risks of MNPLs. Our model has permitted us to visualize (via transmission electron microscopy, TEM) the journey of the PSNPLs administered via ingestion, their interaction with gut lumen components (including symbiotic microbiota), their uptake by gut enterocytes, their translocation through the intestinal barrier to the hemolymph, and their uptake by hemocytes. This behavior was observed for the three analyzed sizes and, for the largest sizes, changes in size/shape were observed in ingested PSNPLs. Although no relevant toxicity, as measured by the egg-to-adult viability, was observed, exposure induced a wide molecular response altering the expression of genes involved in the general stress response, in the antioxidant response and even in the genotoxicity response, as well as in genes related to the intestinal damage response. Furthermore, a general induction of ROS production and DNA damage was also detected. Interestingly, these types of responses were size-dependent with the small PSNPL size inducing a higher response.

Póster 15 - DECIPHERING THE EFFECTS INDUCED BY NPLS IN PERIPHERAL BLOOD IMMUNE CELLS

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The increasing presence of nanoplastics (NPLs) in the environment, predominantly derived from the degradation of plastics wastes, has focused attention on the effects of these compounds on human health. There is evidence that humans can internalize NPLs through inhalation and ingestion and that the small size of the plastic particles may allow for their absorption, reaching the bloodstream, permitting their systemic biodistribution. Indeed, Leslie et al. (2021) have been able to detect plastics ≥ 700 nm in human whole blood samples representative of the general population. Although several studies in invertebrates have linked NPLs exposure to disruption of the immune system and some have assessed the in vivo immunotoxicity of NPLs in small mammals, information on the effects of NPLs on the human immune system is still lacking.

In the present study, we exposed ex vivo human peripheral blood from healthy donors to several representative NPLs, not only to the most used (polystyrene. PS) but also to polyethylene terephthalate (PET) and to polylactic acid (PLA). To explore the influence of the NPLs physicochemical characteristics on the analyzed effects, different sizes were chosen: 50 nm PS with different surface characteristics (pristine PS, carboxyl (-COOH), and amino (-NH₂)), 100 nm PET, and 150 nm PLA. After 24 h of blood exposure to NPLs, white blood cells (WBC) were isolated and processed for flow cytometry analysis and single-cell RNA sequencing (scRNA seq).

Our results suggest that the internalization dynamics of the NPs depend on the WBC sub-population, that it is modulated according to the type and functionalization of the particle. Interestingly, our flow cytometry data shows that all PET nanoparticles are capable to internalize in lymphocytes, monocytes, and polymorphonucleated cells (PMN) at a similar level. In contrast, PS nanoparticles were highly internalized by monocytes, but not in the other WBC types. Our findings also emphasized the effects of the NP surface characteristics, showing that PS-COOH are able to internalize in the three WBC populations at higher levels than PS-NH₂. The analysis of the scRNA seq data is ongoing. These data will permit us to identify differentially expressed genes between each WBC population for the different NPL exposures. Also, the proportion of each cell subtype population will be defined for each one of the exposure conditions.

Overall, these findings will show us for the first time the NPLs effects on the human immune blood cells.

Póster 16 - SIZE-DEPENDENT EFFECTS OF PSNPLS ON HUMAN B-LYMPHOCYTE CELL LINE

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Plastics are a serious ecological problem since their wastes pollute any corner of our environment. In the environment, plastic wastes are degraded to microplastics (MPLs, < 5000 nm), and further to nanoplastics (NPLs, < 1000 nm) possibly can affect human health. In consumer packaging and construction purposes, polystyrene (PS) plastics is widely used. Due to this, PS nanoplastics (PSNPLs) can enter the human body translocating epithelial barriers and to organs and tissues by systemic circulation. Therefore, blood cells can be a direct target of PSNPLs. The hazardous effects of micro-nanoplastics may be modulated by various factors, including size and it can be a relevant factor affecting cellular uptake, consequently their potential hazards. Although few studies focused on the effect of size, most of them involved only the micrometer range. Thus, studying the in-vitro toxicological effects due to PSNPLs is appropriate. For this, we assessed the toxic effects of PSNPLs with three different sizes of, 50, 200 and 500 nm using human hematopoietic cell line, Raji-B (B lymphocytes) as target cells. Prior, we performed the characterization of PSNPLs of all sizes by transmission electron microscopy (TEM) and nano zeta-sizer. Following, the cells were exposed to different concentrations of all sizes of PSNPLs with various exposure times (3, 24 and 48 h) to determine cell viability, intracellular reactive oxygen species (iROS), cellular internalization (using TEM, confocal microscopy and flow cytometry) and other toxicological endpoints. Preliminary results indicated no significant changes in cell viability in exposures lasting for 24 h, while time dependent iROS production occurred in 3 and 24 h of exposition with all sizes of PSNPLs estimated by using flow cytometry. These results were relevant considering that cellular internalization was significant for all the sizes. Interestingly, after intracellular localization, PSNPLs with lower size 50 nm were able to reach the mitochondria in the cells. Hence, we further evaluated the loss of mitochondrial membrane potential (MMP) and found a significant decrease in MMP after 24h of exposure to PSNPLs 50nm. Overall, the results suggested the size dependent effect of PSNPLs in Raji-Bs considering iROS and mitochondrial membrane damage. The study would be further evaluating the gene expression profile of general stress related genes after exposures to different doses and sizes of PSNPLs.

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[1] Lu YY, Li H, Ren H, Zhang X, Huang F, Zhang D, Huang Q, Zhang X. Size-dependent effects of polystyrene nanoplastics on autophagy response in human umbilical vein endothelial cells. J Hazard Mater. 2022 Jan 5;421:126770. doi: 10.1016/j.jhazmat.2021.126770. Epub 2021 Jul 31. PMID: 34358975.

[2] Fröhlich, E., Meindl, C., Roblegg, E. et al. Action of polystyrene nanoparticles of different sizes on lysosomal function and integrity. Part Fibre Toxicol 9, 26 (2012). <https://doi.org/10.1186/1743-8977-9-26>

Póster 17 - POLYSTYRENE NANOPLASTICS: SURFACE- AND SIZE-DEPENDENT EFFECTS ON HUMAN PRIMARY ENDOTHELIAL CELLS

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As of 2015, humans had produced 8.3 billion metric tons of plastics, 6.3 billion tons of which had already become waste. Although plastic wastes are considered long-lasting and stable in the environment, under the influence of different physical and chemical factors plastics undergo fragmentation into micro- and nanometer-level particles, named micro- (100 nm – 5 mm) and nanoplastics (≤ 100 nm) (MNPLs), respectively. During this weathering process, plastics suffer from changes in their physicochemical surface properties that can influence its toxicological potential. Nowadays, there is increasing evidence suggesting that environmental MNPLs can reach the human body through different pathways: ingestion, inhalation and dermal contact. Indeed, Leslie et al., (2021) have been able to detect plastics ≥ 700 nm, including polystyrene, in whole blood samples representative of the general population. However, the potential effects of MNPLs on the health of exposed individuals are still unknown and require further research.

In the present study, polystyrene nanoparticles (nPS) and Human Umbilical Vein Endothelial Cells (HUVECs) were used to better understand what are the toxicokinetic and toxicodynamic interactions of MNPLs with the vascular system.

To explore the influence of physicochemical properties on the observed effects, representative nPS of different sizes (PS-COOH 30 nm, 50 nm, and 100 nm) and surface characteristics (Pristine PS, carboxyl (-COOH) and amino (-NH₂)) were included in the study.

Our results suggest that although all nPS are internalized by HUVECs, the internalization dynamics are modulated based on the functionalization and the size of the particle. Interestingly, our flow cytometry data also shows that both PS-COOH 50 nm and PS-COOH 100 nm are able to modify the morphology of the cell and increase its inner complexity/granularity. When analyzing possible toxic effects by treating the cells with a concentration of 100 $\mu\text{g/mL}$ we observe that only PS-NH₂ 50 nm is able to reduce cell viability (- 40% vs control; 12 h treatment). Finally, our first approach to study ROS generation when treating the cells with 100 $\mu\text{g/mL}$ of PS-COOH 50 and PS-COOH 100 nm for 24 h shows an increase in ROS production with both types of nPS particle (+ 70% in both cases vs control).

Overall, our results indicate a surface- and size- dependent effect of nPS on HUVEC cells. Further experiments are needed to fully understand the impact of MNPLs on the vascular system, and how the particle's properties influence the effects.

**Póster 18 - STEMNESS IMBALANCE AND ONCOGENIC EFFECTS INDUCED
BY IN VITRO CHRONIC EXPOSURE TO PS AND PET NANOPLASTICS IN
BREAST PROGENITOR CELLS**

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The widespread presence of micro- and nanoplastics (MNPLs) in the environment is rising concerns regarding their potentially harmful effects on human health. They easily enter the human body and have the ability to translocate through physiological barriers. Indeed, MNPLs have already been detected in blood and lung tissue. The number of studies focused on their effects on health is progressively increasing, generally linking MNPLs exposure with mild but relevant effects in terms of cytotoxicity, ROS generation, DNA damage, and pro-inflammatory response alterations. These endpoints have been mainly explored at the short term, however, plastic particles are well-known for their persistence in the environment and this feature is expected to also occur in tissues. MNPLs' bioaccumulation extended in time could lead to molecular adverse effects such as mutagenesis and carcinogenesis, an aspect insufficiently explored until now.

Stem cells are among the most persistent cell types, with lifespans ranging from months to several years. This makes them likely targets of persistent pollutants as is the case of MNPLs. Therefore, this study aims to evaluate the long-term effects of polystyrene- (PS-NPLs) and polyethylene terephthalate (PET-NPLs) nanoplastics on MCF10A, a model of breast progenitor cells with known potential to go through malignant transformation. We have developed an in vitro approach in which we continuously exposed the cells for 12 weeks to PS- or PET-NPLs in combination with BMP2 and IL-6, which mimic an inflammatory microenvironment. At several time points during the chronic exposure, we have monitored the cell's differentiation and transformation status. The colony-forming-cell (CFC) assay and the mammosphere formation assay have shown a differential effect of PS- and PET-NPLs on MCF10A differentiation, while no significant indications of cell transformation have yet been observed with the soft agar assay. Ongoing work is focused on the in-depth characterization of the exposed cells, analyzing several differentiation markers which will contribute with relevant data regarding the impact of MNPLs in cell fate deregulation.

Póster 19 - LONG-TERM EXPOSURE TO NANOPLASTICS ALTERS MOLECULAR AND FUNCTIONAL TRAITS RELATED TO THE CARCINOGENIC PROCESS

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Micro/nanoplastics (MNPLs) are considered emergent pollutants widely spread over all environmental compartments. Although their potential biological effects are being intensively evaluated, many doubts remain about their potential health effects in humans. One of the most underdeveloped fields is the determination of the potential tumorigenic risk of MNPLs exposure. To shed light on this topic, we have designed a wide battery of different hallmarks of cancer applied to prone-to-transformed progress MEF cells exposed to polystyrene nanoplastics (PSNPLs) in the long term (6 months). Interestingly, most of the evaluated hallmarks of cancer are exacerbated after exposure, independently if they are associated with an early tumoral phenotype (changes in stress-related genes, or microRNA deregulation), advanced tumoral phenotype (growing independently of anchorage ability, and migration capacity), or an aggressive tumoral phenotype (invasion potential, changes in pluripotency markers, and ability to grow to form tumorspheres). This set of obtained data constitutes a relevant warning on the potential carcinogenic risk associated with long-term exposures to MNPLs, specifically that induced by the PSNPLs evaluated in this study.

Póster 20 - THE POTENTIAL EFFECTS OF THE IN VITRO DIGESTION ON THE PHYSICOCHEMICAL AND BIOLOGICAL CHARACTERISTICS OF POLYSTYRENE NANOPLASTICS

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Plastic wastes released into the environment are degraded to micro/nano plastics (MNPLs) by the effects of different physicochemical/biological processes. The main exposure route to MNPLs is via ingestion. Thus, once MNPLs enter the human body they must pass through different compartments of the gastrointestinal tract that may affect their physicochemical properties and surface features. To effectively determine the toxicological profile of MNPLs, the role of digestion must be considered. Accordingly, this study aims to determine the influence of the in vitro digestive process on the toxicity of polystyrene nanoplastics (PSNPLs) in three different human leukocytic cell lines: Raji-B (B-lymphocytes), TK6 (lymphoblasts), and THP-1 (monocytes). The in vitro digestion process was performed on pristine polystyrene (PSNPLs) and on its fluorescent counterpart (fPSNPLs) resulting in their digested products (dPSNPLs and dfPSNPLs). Using transmission electron microscopy (TEM) and scanning electron microscopy (SEM) we have determined that all particles are spherically shaped, with similar appearance and sizes. Nevertheless, the digested particles show a relevant tendency to agglomerate. The hydrodynamic radius (measured by Dynamic Light Scattering, DLS), shows that digested particles have a larger hydrodynamic size, and the polydispersity index (PDI) indicates that the non-digested particles are more monodisperse. These results agree with the results of the Z-potential showing that the digested particles have less Z-potential. Also, the particles were analyzed by Nano tracking analysis (NTA) to measure the hydrodynamic radius supporting the previously obtained data.

Cell uptake was evaluated with the fluorescent polystyrene counterparts (fPSNPLs and dfPSNPLs) by flow cytometry and confocal microscopy. Results show that the three selected cell lines internalize more dfPSNPLs than fPSNPLs, at the same concentration. When cell viability was assessed, only moderate effects were observed at the highest concentration of dPSNPLs in TK6 at exposures lasting for 24/48 h. No intracellular ROS production was observed in any of the cell lines at 24/48 h and, finally, genotoxic damage induction was detected only at 24 h exposure in THP1 cells, and at the highest concentrations. No oxidative DNA damage was detected at any time and in any cell line.

Finally, the visualization and characterization of proteins on the surface of PS particles was done by Raman spectrum showing the association of proteins on the particle surface and information about the secondary protein structure on particle surface.

Póster 21 - STUDYING THE EFFECTS OF NANO PLASTICS DERIVED FROM TEABAGS IN AN IN VITRO MODEL OF THE INTESTINAL EPITHELIUM

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The increasing presence of micro- and nano-sized plastics in the environment, and in the food chain, is of growing concern. Plastics from consumer goods can break down into micro and nano plastics (MNPLs), migrate into the food and facilitate their human ingestion. A good example is the teabags, which become a new source of MNPLs since the traditional paper bags were substituted with plastic bags.

Among the different studies on the potential hazard effects of MNPLs, those related to the MNPLs released from teabags are practically inexistent. To cover this gap, we have designed a new method to first obtain, identify and characterize the plastic particles released from teabags, and then determine their harmful effects. Since humans are exposed to teabags-MNPLs via ingestion, we have used a well-established model of in vitro intestinal barrier to perform toxicological studies. The model consists of a triple coculture containing enterocytes-like cells (Caco-2 cells), goblets-like cells (HT-29 cells), and lymphocytes B (Raji-B cells).

To obtain the released MNPLs, we have used tea bags available from the supermarket. Then, particles were isolated and fully characterized by Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), energy dispersive X-ray (EDX), Nano Z-sizer, and Fourier Transform Infrared Spectroscopy (FTIR).

The results from SEM-EDX and FTIR confirmed that the particles derived from teabags were mostly polylactic acid (PLA). Moreover, using the Nano Z-sizer we could detect a hydrodynamic size of approximately 120 nm. Finally, TEM and SEM images showed the spheric shape and confirmed the size from both PLA in suspension and in the teabag tissue.

Once the presence and release of PLA-NPLs from teabags was demonstrated, we aimed to study the interaction between PLA and human-derived cell lines. Using TEM and confocal microscopy, we confirmed that PLA-NPLs could internalize into all three human-derived cells after 24 hours. Moreover, NPLs were seen reaching the cell nucleus compartment. Using flow cytometry, we could quantify that PLA-NPLs had a 100% of internalization when exposing HT-29 and Raji-B, but only 60 % of internalization when exposing Caco-2 cells, suggesting that NPLs internalization may vary depending on the cell type or in vitro model.

Therefore, this study opens new insights regarding the cytotoxic and genotoxic effects of MNPLs, reinforces the urgent need for multidisciplinary studies that further investigate the MNPLs as emergent contaminants, and could serve as an example for regulatory agencies to pay close attention to the regulation of MNPLs production and management.

Póster 22 - COMPARATIVE TOXICITY OF BEACH MESOPLASTICS FROM SOUTH SPAIN: AN IN-VITRO APPROACH

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Plastics are the most abundant debris accumulated on beaches. Mesoplastics which can be found in a vast variety of shapes and sizes, act as major vectors for hazardous chemicals, either initially present in the plastics or absorbed from the environment. In this study, mesoplastics were collected from five different beaches located on the Atlantic coast of Cádiz (Spain). The polymer composition of the collected mesoplastics was dominated by polyethylene (PE) and polypropylene (PP). The plastic debris collected on each beach was divided into two parts. One of them underwent a simulated exposure to sunlight to test potential photodegradation, while the other remained intact. Both plastic sub-samples were extracted with methanol, and the presence of organophosphate ester plasticizers (OPEs) was determined by LC-MS/MS, identifying nine OPEs with high variability in the total OPE concentrations between beaches (from 32.6 to 1821 ng/g). To investigate the potential toxicity of mesoplastics before and after photodegradation, the PLHC-1 cell line (Poeciliopsis lucida hepatocellular carcinoma) was exposed to the methanolic plastic extracts. Regarding the hazardous potential of the samples, generally, extracts from photodegraded plastics showed higher cytotoxicity, ROS generation, and genotoxicity (micronuclei formation) than those from intact mesoplastics. However, EROD activity was higher in most of the non-photodegraded samples, indicating the presence of CYP1A inducers in beach mesoplastics; although for 2 out of 6 samples the presence of CYP-inducers increased after photodegradation. The obtained results suggest that plastic extracts contain chemicals able to induce cytotoxicity and genotoxicity in organisms and that further photodegradation of those mesoplastics may facilitate the release of more chemicals that might contribute to the overall toxicity of the samples. The results of this work confirm the potential of these in-vitro tools to assess the risks of plastic pollution and highlight the need to pay more attention to plastic waste management.

Póster 23 - THE CHEMICAL EXPOSOME IN MATERNAL BLOOD AND PLACENTA AND THE POTENTIAL USE OF SEWAGE SLUDGE TO PRIORITIZE HAZARDOUS SUBSTANCES

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Chemicals are part of our daily lives and we are exposed to numerous chemicals through multiple pathways, including plastic derivatives. Relevant scientific evidence contributing to the regulation of hazardous chemicals require a holistic approach to assess simultaneous exposure to multiple compounds. Currently, the main way to obtain data on the exposure to organic chemicals is through human biomonitoring, that requires very complex and costly sampling campaigns. Finding efficient proxies to predict the risk of chemical exposure in humans is an urgent need to cover large areas and populations at a reasonable cost. We conducted a study to characterize the human chemical exposome in maternal blood and placenta samples of a population-based birth cohort in Barcelona (2018-2021, n>300). Ultimate HRMSbased approaches were applied including wide-scope target, suspect (for >2300 and >10000 chemicals, respectively) and non-target screening. More than sixty chemicals were identified including plastic additives as well as pesticides, personal care products or industrial compounds, in the range of ng/mL and ng/g. In parallel, sewage sludge from the wastewater treatment plants serving the residence areas of the studied population were also screened, showing correlations with the type and concentrations of chemicals found in humans. Our findings were suggestive for the potential use of sewage sludge as a proxy of the human exposure and its application in early-warning systems to prevent chemical threats.

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Póster 24 - A RELIABLE AND RAPID APPROACH FOR THE ANALYSIS OF THE PLASTICIZER DI(2-ETHYLHEXYL) PHTHALATE (DEHP) IN LAUNDRY WASTEWATER USING ON-LINE HS-SPME-GC-MS/MS

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Laundry wastewater is a very heterogeneous matrix that contains a complex mixture of several compounds (e.g., detergents, surfactants, dyes), including priority pollutants of the Water Framework Directive (Directive 2013/39/EU) such as the di(2-ethylhexyl) phthalate (DEHP) [1], an endocrine disruptor that may negatively impact aquatic ecosystems. DEHP is one of the most common phthalates and it is widely used as plasticizer in the textile industry [2]. Thus, it can reach the environment during manufacture, use, washing, and disposal of textiles. Therefore, the development of simple and sensitive methods for its determination is crucial in order to monitor its levels and better characterize laundry wastewater as an emission source of DEHP into the environment.

A simple, reliable, and solvent-free method based on on-line headspace solid-phase microextraction coupled to gas chromatography tandem mass spectrometry (HS-SPME-GC-MS/MS) was developed to determine DEHP in laundry wastewater. The use of on-line HS-SPME allowed to simplify the sample preparation, reducing the risk of contamination. The method showed good sensitivity, accuracy, and precision. The applicability of the developed methodology was shown by analyzing laundry wastewater samples collected in different days.

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[1] Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy. 2013. Official Journal of the European Union L226, 1-17.

[2] Yakamercan, E., Aygün, A. 2021. Journal of Environmental Chemical Engineering 9, 105436.

Póster 25 - REUSE OF GREYWATER IN THE LAUNDRY SECTOR: THE LIFE RECYCLO PROJECT

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Several factors such as high population density, low rainfall (e.g. south of Europe), as well as the effect of the climate change, are leading to the need of a change in water management. In Europe, the reuse of wastewater is not a common practice, but it is becoming increasingly attractive in the context of the circular economy. Thus, 42 million m³ of water each year are used in the laundry sector in Europe, being a water resource and a reuse opportunity. Accordingly, the LIFE RECYCLO project proposes to treat this greywater, saving between 50% and 80% of water and eliminating 90% of chemical micropollutants. Consequently, the resulting water can be reused in the same laundries. Several treatment prototypes will be installed at different laundry facilities in Luxemburg, Spain, and France and their performance will be assessed through the evaluation of their efficiency in the removal of micropollutants. Several analytical methods based on gas and liquid chromatography coupled to mass spectrometry, will be used for the determination of the contaminants of interest: i.e. pharmaceuticals, antimicrobials, preservatives, flame retardants, plasticizers, and other plastic additives. Furthermore, the phthalate DEHP and nonylphenol, which are considered as priority substances under the Water Framework Directive, will also be measured.

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Póster 26 - ESTUDIO PILOTO SOBRE LA COMPOSICIÓN DEL POLVO DE CASA: ABUNDANTE PRESENCIA DE COMPONENTES DEL PLÁSTICO Y CONTAMINANTES DIRUPTORES ENDOCRINOS

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La exposición a contaminantes ambientales que ocurre en el domicilio (“indoor”) está subestimada en los estudios de biomonitorización humana. Los contaminantes derivan tanto del aire exterior, los materiales de construcción y el mobiliario, como del empleo de productos químicos componentes de textiles, artículos de limpieza, ambientadores y cosméticos, el tipo de hornilla y calefacción. A pesar de ello poco se conoce sobre la composición del polvo recogido del interior de la vivienda familiar, cuya naturaleza parece haber cambiado de composición en los últimos años. Este trabajo se planteó como un estudio piloto con objeto de investigar los contaminantes químicos presentes en el polvo recogido en un domicilio familiar. Las muestras se obtuvieron mediante aspiración, en un muestreo mensual, durante un año natural. Una vez pesadas las 12 muestras (8,245-12,429 g), se seleccionaron tres alícuotas de 100 mg que se sometieron a extracción con acetonitrilo y análisis cromatográfico de bisfenoles (BPA, BPF, BPS) parabenos (MPB, EPB, PPB y BPB), bezofenonas (BP-1, BP-3, BP-6, BP-8; 4-OH-BP) y perfluorados (PFHxA, PFHpA, PFOA, PFNA, PFDeA, PFOS, PFUnA, PFDoA, PFTrA, PFHxS), elegidos por su actividad de disrupción endocrina y metabólica. Los análisis morfológico y químico presentan las muestras como una maraña de fibras de origen artificial (plásticos y textiles) y natural (cabello), con partículas de tamaño comprendidas entre unos pocos milímetros hasta 0,3 μm , límite impuesto por el tamaño de poro del filtro de la aspiradora. Entre los compuestos químicos investigados, el filtro UV BP-3 fue el compuesto químico mas abundante con una concentración media de 1.360,34 ng/g (rango 512-3.891), seguido muy de cerca por el monómero del policarbonato y las resinas exposi BPA concentración media 1.253,44 ng/g (rango 544-2.481); también se encontró BPS, sustituto del BPA, valor medio 203,16 ng/ml (rango 133-204); entre los parabenos destacó MPB, media 580,29 ng/g (rango 339.1007). Los perfluorados estuvieron representados por varios isómeros como PFOA (media 6,71 ng/g, rango 1,53-29,6) y PFOS (media 3,02, rango 1,38-9,03). Dada la exposición al polvo de casa y los hábitos de los niños de corta edad, la presencia de estos contaminantes es preocupante y colocan a la contaminación “indoor” en una posición muy relevante como fuente de exposición infantil. Nuevos trabajos se desarrollan para la caracterización biológica del efecto de estos disruptores endocrinos, mientras, medidas precautorias deberían ser tomadas en consideración como la adecuada aspiración y la ventilación de los domicilios.

Póster 27 - ORGANOPHOSPHATE ESTER PLASTICIZERS IN RUBBER RECYCLING AND RECREATIONAL SURFACES

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We revisit understanding of the chemical complexity of different kinds of particulate vulcanised elastomers widely used in playgrounds and sport fields, adding new data on organophosphate esters (OPEs) content of used tyre and ethylene propylene diene monomer (EPDM) crumb rubber microplastics. A total of 10 different particulate vulcanised elastomers were analysed, three of them made from used tyres and the rest of EPDM, 3 bonded with polyurethane and 4 unbonded. The application varies depending on the type of crumb rubber, thus recycled tyres are used as turf infill or base layer of playgrounds, while EPDM is used as wear layer in playgrounds. Samples were supplied by the Barcelona Ajuntament and the Genan company. All samples were analysed as given and cryogenically ground to particle size between 200 and 300 µm. Crumb rubber extraction was performed using accelerated solvent extraction with hexane acetone (1:1) at 50°C and 1500 psi. Samples were subjected to an online sample purification and analysis using turbulent flow chromatography-liquid chromatography-tandem mass spectrometry.

Highest ΣOPE concentration levels were detected in the used tyre for turf infill crumb rubbers, with levels between 8,889 and 118,183 ng/g. The compounds that were found with higher concentrations in these samples were tris(2-ethylhexyl) phosphate (TEHP), triethyl phosphate (TEP), tris(2-butoxyethyl) phosphate (TBOEP) and 2-ethylhexyl diphenyl phosphate (EHDPP). For EPDM samples, ΣOPE concentration levels were lower, between 71.6 and 2,001 ng/g with a mean of 756 ng/g. The concentration was higher in crushed samples, probably as a result of improving extraction efficiency when crushing the sample. Apart from the different concentration levels when comparing with used tyres, the compounds with higher contribution to ΣOPEs were also different, being TEP, tris(2-chloroethyl) phosphate (TCEP), triphenyl phosphate (TPHP) and tri-n-butyl phosphate (TNBP) the ones with higher contributions.

Several of these OPEs, such as TCEP, TEHP and TNBP, suppose a potential carcinogenic and non-carcinogenic risk to human health through inhalation, ingestion or dermal contact [1]. Other compounds as TEP, TPHP and EHDPP are being studied for a potential non-carcinogenic risk to human health [2-3].

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[1] USEPA, 2022. Regional screening levels (RSLs). <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>

[2] Chen, Y., Liu, Q., Ma, J., Yang, S., Wu, Y., An, Y., 2020. A review on organophosphate flame retardants in indoor dust from China: Implications for human exposure. *Chemosphere* 260, 127633.

[3] He, C., Wang, X., Thai, P., Baduel, C., Gallen, C., Banks, A., Bainton, P., English, K., Mueller, J.F., 2018. Organophosphate and brominated flame retardants in Australian indoor environments: Levels, sources, and preliminary assessment of human exposure. *Environ. Pollut.* 235, 670–679.

Póster 28 - PRECAUTIONARY MEASURES TO THE EXPOSURE OF ORGANOPHOSPHATE ESTER PLASTICIZERS BY E-WASTE DISMANTLERS

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Electronic waste (e-waste) recycling, which includes electronics products such as computers, televisions, and mobile phones, has raised its importance. This is basically because these devices are made mainly of metals which are valuable and reusable materials. The recycling facilities can be considered hot spots of air pollution as a lot of particulate materials (PM) are emitted during the recycling. The emitted PM can contain hazardous substances associated with plastic materials, such as plasticizers and flame retardants, which presents a potential risk for the dismantlers.

A previous study [1] has reported the presence of these hazardous substances in the air of a recycling facility, and how their workers are exposed, specifically the presence of organophosphate ester plasticizers (OPEs). As a continuation of this study, some precautionary measures are evaluated, in particular the use of personal protective equipment (PPE). Two different facemasks (surgical and FFP3) were compared for their efficiency in reducing the inhalation exposure suffered by the dismantlers.

For that purpose, a sampling campaign has been performed in two working areas of a recycling facility located in Catalonia: an area for cathodic ray-tube (CRT) TV dismantling and a grinding area. A group of selected dismantlers wore, during the working hours and for four different sampling days, one of the compared facemasks, and a silicone necklace. This type of necklace was employed to evaluate and compare the exposure of each dismantler at each working place. For both facemasks and silicone necklaces, ultrasonic solvent extraction was performed. Sample purification and analysis were performed online with LC-MS/MS Thermo Scientific TurboFlow™ system. Finally, to complement the exposure information, and ensure which PPE is more effective, dismantlers' urine samples were collected each sampling morning. In urine samples, metabolites of potential hazardous substances associated with plastics were studied, such as OPEs and phthalates among others.

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[1] X A. Balasch, M. López, C. Reche, M. Viana, T. Moreno, E. Eljarrat, Exposure of e-waste dismantlers from a formal recycling facility in Spain to inhalable organophosphate and halogenated flame retardants, *Chemosphere*, Volume 294, 2022.

Póster 29 - PROYECTO LIFE4FILM: RECICLADO MECÁNICO DE FILM DE POLIETILENO POST-CONSUMO. ESTUDIO DE IMPACTO AMBIENTAL

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1. Introducción – LIFE4FILM es un proyecto cuyo principal objetivo es evitar la incineración y vertido de los residuos de film de polietileno (PE) contenidos en los Residuos Sólidos Urbanos (RSU) a través de tecnologías de reciclaje innovadoras en una planta de reciclaje preindustrial de 1,40 ton/h (10.000 ton/año). La nueva tecnología aumentará la eficiencia de los recursos, valorizando el film de PE de los RSU en materia prima industrial utilizable al tiempo que garantiza su aceptación en el mercado. La planta piloto ubicada en Alhendín (Granada – España) producirá 0,55 ton/h de material reciclado. En este trabajo se analiza el estudio del impacto ambiental del proceso de reciclaje mecánico del PE mediante la metodología de Análisis de Ciclo de Vida (ACV). El proceso industrial se divide en cuatro grandes áreas de operación: clasificación, lavado, extrusión y tratamiento de aguas residuales.

2. Experimental - ACV es una metodología para analizar el impacto ambiental de un producto, proceso o actividad, teniendo en cuenta su ciclo de vida completo, desde la extracción de materias primas, hasta la producción, distribución, mantenimiento, reutilización, reciclaje y eliminación (ISO 14040, 2006; ISO 14044, 2006). Completar un ACV implica: i) un inventario de todas las 'entradas' y emisiones de energía y materiales al medio ambiente; ii) evaluar el impacto ambiental potencial asociado con estos insumos y emisiones; iii) calcular el valor de los indicadores de desempeño para tomar decisiones. Se eligió como unidad funcional la producción de 1 kg de granza de LDPE reciclada a partir de film post-consumo presente en residuos sólidos municipales mixtos. Se utilizó el software SimaPro para el estudio.

3. Resultados y Discusión - Los resultados mostraron que el área de lavado tiene los mayores impactos ambientales, principalmente por el consumo de energía eléctrica, seguida por la clasificación. Además, el impacto sobre la emisión de CO₂ en kg equivalentes fue de 0,416 por kg de unidad funcional.

4. Conclusiones -. El reciclaje mecánico de residuos plásticos puede considerarse una práctica de gestión sostenible. Este tratamiento también genera un impacto ambiental que hay que tener en cuenta, aunque los impactos son muy inferiores a los generados por el proceso de fabricación de granza virgen.

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Póster 30 - DISTRIBUTION OF PRODUCTS ON THERMAL AND CATALYTIC PYROLYSIS OF DISCARDED SURGICAL MASKS

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The disposable masks generated during the COVID-19 pandemic have attracted wide attention in the world. Unfortunately, some of these masks are currently contaminating the Spanish ecosystems. This research aims to develop a new strategy to valorise wasted COVID-19 masks based on pyrolysis to convert them into useful products. This type of mask is composed of a non-woven polypropylene fabric, nylon ear strips and a polyethylene nose bridge strip with a metal rod inside [1]. In a first stage, surgical masks were thermally pyrolyzed at a temperature of 500 °C with the purpose of obtaining valuable solid (char), liquid (oil) and gas products. The pyrolysis was carried out in a horizontal tubular furnace in an inert N₂ atmosphere. When no oxygen was left in the oven, the sample was heated with a heating rate of 10 °C/min until 500 °C were reached. Once the temperature was arrived at, a residence time in the furnace of 60 minutes was programmed. To collect the liquids generated, two glass traps submerged in a bath of water, ice and salt were placed at the outlet of the tubular reactor. The volatiles that do not condense pass through the pipe and ended in gases bags to constitute the gaseous fraction. The surgical masks reached an oil yield of 59.08%, a gas yield of 39.52% and a 1.40% of solid yield. In a second stage of research, the volatiles generated during thermal pyrolysis were cracked with sepiolite as catalyst at 500 °C. The cracking with catalyst was more effective obtaining by-products with low molecular mass increasing the final yield of gas product (43.89% against 39.52%) and reducing the viscosity of the oil product. In addition, methane was the major component of the gas, along with ethane and carbon dioxide. However, the use of sepiolite as a catalyst enhanced the methane and carbon dioxide content of the gas at the expense of ethane.

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[1] X. Sun, Z. Liu, L. Shi, and Q. Liu, "Pyrolysis of COVID-19 disposable masks and catalytic cracking of the volatiles," *J Anal Appl Pyrolysis*, vol. 163, p. 105481, 2022, doi: 10.1016/j.jaap.2022.105481.

Póster 31 - TRANSPLACENTAL TRANSFER OF PLASTICIZERS AND FLAME RETARDANTS IN FIN WHALES (BALAENOPTERA PHYSALUS) FROM THE NORTH ATLANTIC OCEAN

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Marine mammals are one of the groups of animals most affected by marine pollution including that by organic compounds which, besides bearing recognised harmful effects to adults, they may also affect fetuses through placental transfer. In this study we analysed samples of fin whale (*Balaenoptera physalus*) females and their fetuses collected in the western Iceland summer feeding grounds in 2018. Three different families of organic pollutants: organophosphate esters (OPEs); halogenated flame retardants (HFRs); and short chain chlorinated paraffins (SCCPs), were analysed and their placental transfer investigated. HFRs were detected in 87.5% of females and 100% of fetus samples with concentrations that ranged between nd-15.4 and 6.37–101 ng/g lipid weight (lw), respectively. OPEs were detected in all samples, both from females (85.8–567 ng/g lw) and fetuses (nq-1130 ng/g lw). SCCPs were detected in 87.5% of female samples and 100% of foetal samples with concentrations that ranged between nd-30.9 and nq-574 ng/g lw, respectively. For OPE compounds, a significant negative correlation was observed between the logarithm maternal transfer ratio and their log Kow, indicating that a high lipophilicity reduced placental transfer rate. Interestingly, the decabromodiphenyl ethane (DBDPE) was the compound with the highest log Kow but also the one that was transferred the most from mothers to fetuses, calling for in-depth research on this pollutant. These results constitute the first evidence of mother-calf transfer of plasticizers and flame retardants in fin whales. Further investigations are needed to determine their potential effects on this species and other groups of animals.

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