

# **Title: Microplastics in sediments of transition environments: origins, fate and interaction with contaminants. Mitigation strategies**

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## **Research program**

Plastic has become popular for its versatility and convenient usability. The physical-chemical properties of plastic, mainly strength, lightweight and durability, combined with low production costs, make this material almost irreplaceable in the production of household goods, construction and industry. Plastics have been identified as primary pollution components of marine environments for several decades; however, the risks associated with their presence have only been recognized and understood. Plastics, once exposed to UV radiation and abrasion from sea waves, fragments into microplastics, especially along the coasts due to the energy released in these environments, with final deposition on beaches.

The result is that these plastic microspheres meet on beaches and in ocean waters around the world and a major concern with PMMA is that once introduced into the environment, it is very difficult to remove them, and they are likely to persist for centuries.

MPs can accumulate and exert toxicity by interfering with the immune response, which can be due to monomers, additives (plasticizers, flame retardants) and pollutants adsorbed during environmental exposure.

Apart from the chemical additives that are already present at the time of their syntheses such as phthalates, bisphenol A and polybrominated diphenyl ethers, MP can adsorb organic contaminants, metals and pathogens from the environment and transmit them to the organisms that ingest them. This aggravates their toxicological profile since with this additional toxic load they could induce greater toxic effects (Alimba et Faggio, 2019). Moreover, the very small size of these materials means that the total exposed surface area per unit volume is very high, promoting their ability to aggregate and transport toxic substances (Cesa et al., 2017). The adsorption and the interaction mechanism between aged microplastics and hydrophilic organic pollutants represent a new and interesting area of study. Useful in this regard is the use of infrared spectroscopy (IR) and scanning electron microscopy (SEM), techniques able to detect significant surface oxidations and localized microcracks on aged microplastics.

## **Proposal for a PhD position**

In Campania, to our knowledge, there are no studies on the presence of MP in the sands of beaches of anthropized environments. The project aims to study and minimize the impact of MP contamination on the biosphere. This objective, which can only be achieved gradually, passes through intermediate stages on which this project is based. It will be studied the geomorphological, structural and granulometric characteristics of critical beaches for anthropic pressure. It will be evaluated the effects of tidal dynamics, wave motion, sea currents, the presence of watercourses as well as human intervention through the construction of works along the coast or the reprofiling of the same coastline. This will help to understand what are the critical factors

that favour the accumulation of MP on some beaches rather than others. Furthermore, it will be studied the interaction of MP with contaminants and their sources. The project includes sampling, quantification and physical and chemical characterization of MP, the particle size analysis, quantification and physical and chemical characterization of MPs, determination of contaminants in the sand as well as those adsorbed, study of the effects of aging of MP on the capacity of accumulation of contaminants. Finally, the laboratory procedures will be transferred in the field, to reduce the presence of microplastics present in the sand of the beaches. These procedures should be low cost, not invasive from a physical point of view and be able to create no new contaminants.