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Occurrence and Characterization of Small Microplastics (<100 µm), and Microlitter in Seawater: the Venice Lagoon as a Case Study

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Extended Abstract

How small can microplastics be? Plastics particles and fibers [1,2], emerging pollutants, are classified according to their sizes, but the classification has been subject to lengthy debates. In 2019 the European Chemical Agency [3] has clearly defined microplastics and their sizes: "a material composed of solid polymer-containing particles, to which additives or other substances may have been added, with particle dimensions ranging from 1 nm to 5 mm and with fiber lengths ranging from 3 nm to 15 mm and length to diameter ratio of >3. ECHA has also firmly stated the need of polymer identification when analyzing microplastics.

In many studies microplastics were analyzed using optical microscopy in epifluorescence (with Nile red staining) or scanning electron microscopy, but these techniques did not allow the polymer identification; hence, in these studies only a few selected particles were chosen and analyzed using FTIR. In this study, a new method for the extraction, purification, quantification, and the simultaneous polymer identification of small microplastics, additives and plasticizers using Micro-FTIR was developed. The study is focused on small microplastics (<100 µm), because particles and fibers in this size range can be mistaken as food particles, be ingested by several macro- and micro-invertebrates, according to the size of their mouthparts, and then enter the food web, becoming a threat for the environment and for biota (human beings included). To evaluate pathways of distribution and possible sources of small microplastics, additives and plasticizers, surface water was collected in six different sites of the Venice Lagoon. Particular care was devoted to minimize/avoid any contamination during pretreatment and analysis of samples [4]. The developed method was validated and is robust, repeatable, and reliable. A total of 21 polymers was identified. Fluorinated polymers, Polyethylene (PE HD) and Polyester (PL) are dominants in all sites studied; the abundance of small microplastics ranged from 4335 ± 91 to 16759 ± 179. Micro litter includes additives, plasticizers, plastic monomers, synthetic and natural fibers, Cellulose, rayon and silk were identified in the water of the sites studied; the monomer of polyvinyl chloride (PVC), vinyl ester, and two PVC plasticizers (i.e. Calcium-Zinc PVC plasticizer and N-(2-ethoxyphenyl)-N-(2-ethylphenyl)-ethanediamide (NNE) were observed. Plasticizers and additives can be employed as a proxy of the presence of plastic polymers in the environment.

References

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