Evidence of small microplastics in waters and sediments of the Venice Lagoon: quantitative analysis and polymer identification using Micro-FTIR

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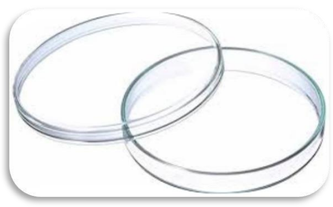
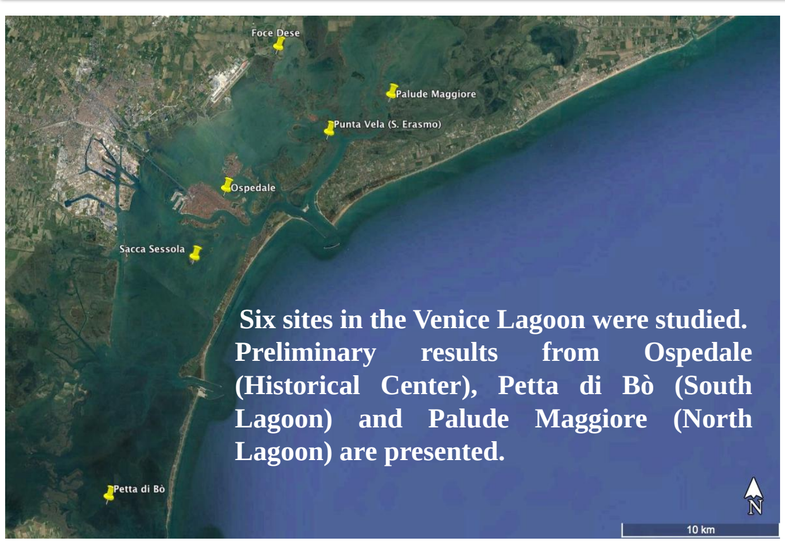
In this study small microplastics (SMPs 1-100 µm) were studied in sediments and waters of the Venice Lagoon using micro-FTIR.
A method of purification, quantification and polymer identification was developed.

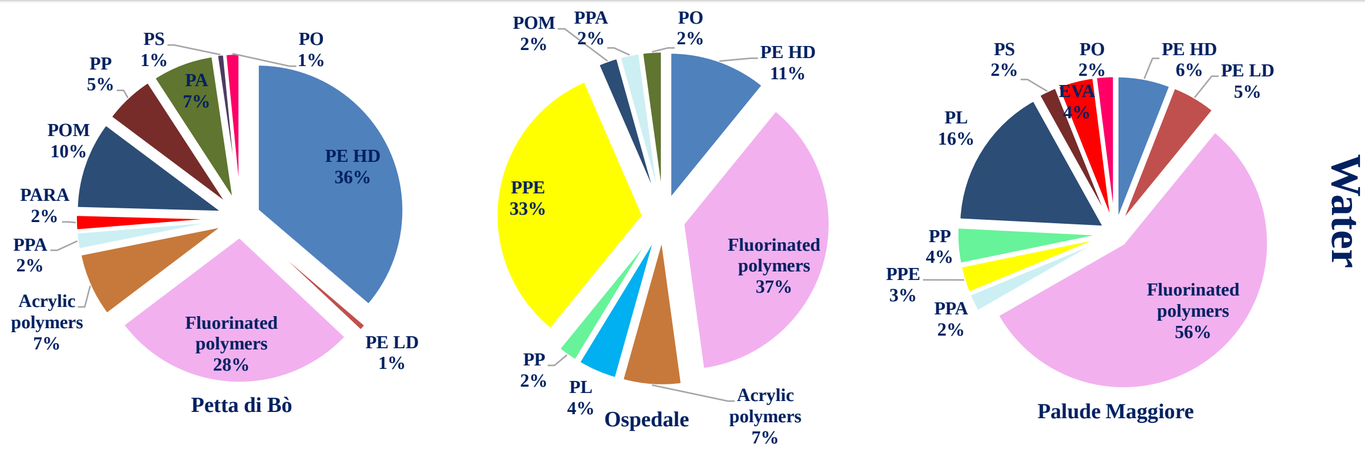


Materials and Method

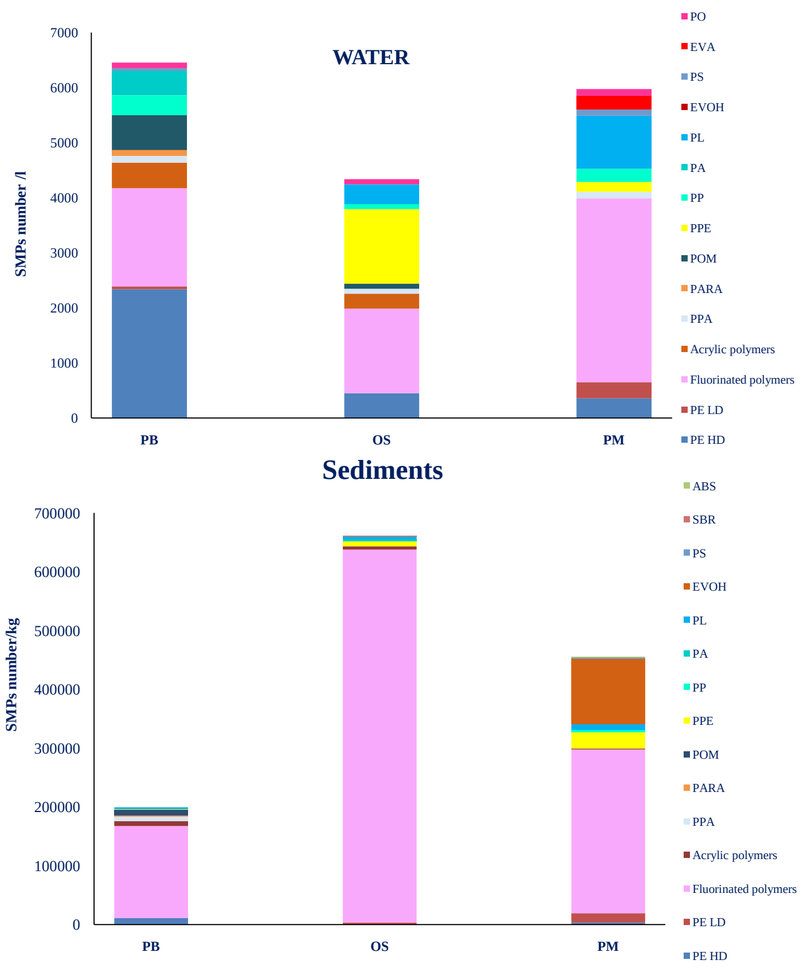
- Sediment samples were kept in aluminium boxes and covered with aluminium foil and stored at 4 °C until the pre-treatment for the analysis. Water were collected in amber glass bottles, hydrogen peroxide was added to digest organic matter and stored at 4 °C until the pre-treatment for the analysis.
- The sample pre-treatment and all the decontamination steps were performed in a plastic free clean room ISO 7.
- Glassware and steel tweezers, cotton lab coat and nitrile gloves were employed in order to minimize any plastic contamination.
- Samples and blanks were tested at least in triplicate.
- Microplastic particles were extracted from sediments and waters, taking advantage of the oleophilic properties of plastic polymers.
- Before the extractions sediments were quartered and waters were shaken thoroughly. Separating funnels were employed for the microplastics extraction. On the same aliquot of water or sediments the extraction was repeated twice.
- Following the phases settling, the oil layer was recovered with hexane and ethanol in a cleaned Erlenmeyer flask and then filtered on Whatman® Anodisc inorganic filter membrane 0.2 µm (47 mm diam.). Filters were purified with ethanol.
- Filters were then stored in cleaned glass Petri dishes and they were dried at room temperature in clean room for 72 h, until the analysis with Micro-FTIR.

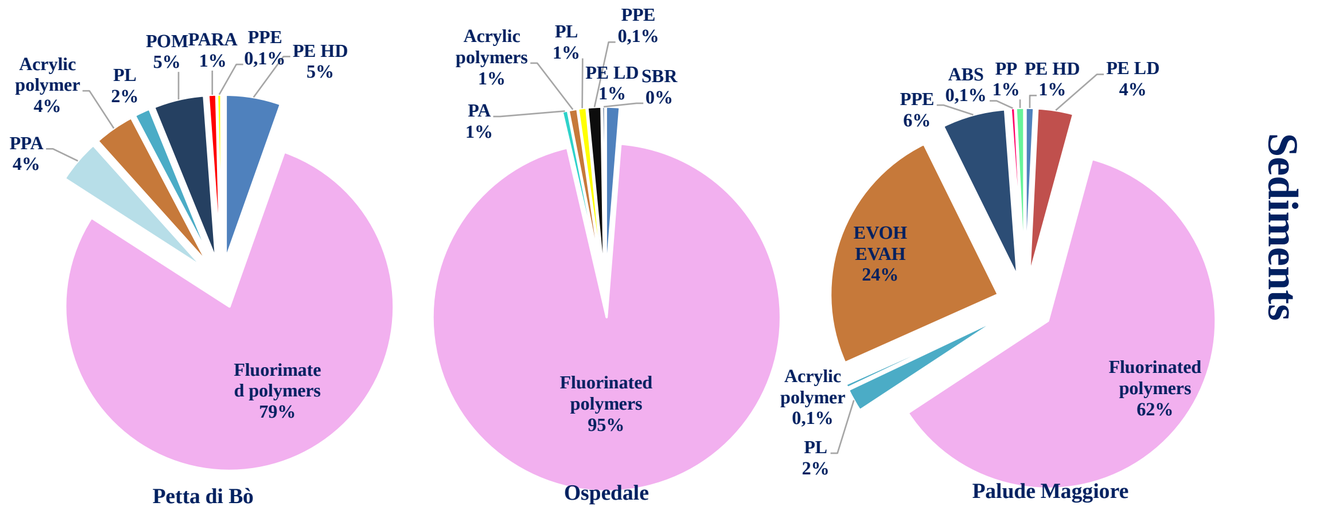
The **European Chemical Agency** (ECHA, 2019) has proposed the definition of microplastic as "a material composed of solid polymer-containing particles, to which additives or other substances may have been added, with particle dimensions ranging from 1 nm to 5 mm and with fiber lengths ranging from 3 nm to 15 mm and length to diameter ratio of >3. Furthermore, **ECHA has firmly stated the need of polymer identification when analyzing microplastics**. According to the literature, analyses of microplastics in water and sediments were mainly performed via a microscope (e.g. optical or stereo microscope, SEM, etc.) and then followed by the polymer identification via FTIR. **Microplastic analyses performed via Micro-FTIR allows the quantification of particles and fibers and the simultaneous identification of polymers**.





Preliminary results are shown; data are being processed for a forthcoming publication (Corami et al. *in preparation*).
Microplastic particles are randomly distributed on the surface of the filter according the Poisson distribution. Standard deviation (σ), relative standard deviation % (CV %) and upper and lower confidence levels (IF) were calculated for each sample.
SMPs were detected in all samples analyzed. A total of **21 polymers was identified**. SMPs percentage (in different color) in surface waters and sediments of each sample site are shown.
In water samples fluorinated polymers, PE HD and PL are dominants in all sites.
In sediments samples, the most abundant polymers are fluorinated polymers and PE HD.
SMPs concentration (number of particles/ kg) in sediments is about ten times higher of that observed in water (number of particles/l). **Differences among the sites are observed**.





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