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First results on microfibers in marine sediments from the Gulf of Naples, Italy

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Microplastics (MPs) are emerging pollutants exhibiting a wide range of morphologies, sizes, and visual properties (Lusher et al., 2020). They are found in the environment in different forms such as pellets, i.e., spherical beads, films, foams, fragments, fibres, etc. Microfibres are the most frequently reported in literature (Arienzo et al., 2021). Microplastics can vehicle xenobiotics on their surface including persistent inorganic and organic pollutants. Contaminants and pathogens are collected and transmitted to biota aggravating their toxicological profile (Arienzo et al., 2021). Once generated, MPs may travel along oceans and finally be trapped in marine sediments, the ultimate sink (Harris 2020). Microplastics are present in the environment as result of disruption of primary sources like microbeads, secondary sources like synthetic fibers or due to weathering and breakdown of larger plastic pieces. Weathering is the result of chemical transformations and/or mechanical stresses such as wind, water flow, or corrasion. These transformations are known to cause changes in the plastic's performance such as increased brittleness and discoloration (Hebner and Maurer-Jones, 2020). For these reasons, microscopical analysis of samples is largely employed in microplastic research protocols, usually starting with an initial isolation followed by morphology recognition (Lusher et al. 2020). Visual classification is essential in supporting the various methods and can assist in reducing potential shortcomings of these methods. This study focuses, for the first time, on microplastic distribution in marine sediments, specifically in four submerged and two emerged sand samples of the Posillipo coast, NE of Naples City, in the homonymous gulf. The study is focused on microplastic distribution in marine sediments comparing submerged and emerged samples, highlighting the correlation occurring between sand particles dimensions. Counting and morphological characterization was performed by an original approach, without any pre-treatment of the specimens. Three grams of sample were manually quartered in a controlled environment and homogeneously distributed in glass capsules to allow easy morphological identification and counting. Based on Lusher et al 2020, four descriptive categories were used to aid in visual descriptions of microplastics: morphology (size, shape, texture), optical properties (color, reflectivity), behavior (flexibility), and surface roughness. The procedure also helped the identification of microplastics linked to sediments, and the exploration of microplastic surface for presence of biological or chemical pollutants. Morphological data from optical microscopy assay were used for subsequent SEM analysis of the selected microfibers to confirm the presences of contamination. Morphological data evidenced the presence only of microfibers with different sizes, textures (fiber bundle, single, string), color, and reflectivity, especially in submerged sediments. Moreover, microfibers appeared to be bound to sediments particles, 3% and 13% in two samples. SEM showed alterations on the microfibers surface and local presences of microplastic beads. To fully characterize the studied sediments, mineralogical and micro-Raman analyses along with a particle size classification were also carried out. This analytical procedure represents a preliminary approach to the study of MPs in marine and continental sediments finalized to better address further investigations required to carefully characterize these emerging pollutants.

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