Exploring Microplastic Pollution in the Danube Delta

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Abstract:

The occurrence and distribution of microplastics (MPs) have been widely studied in recent years in marine and freshwater environments worldwide. However, only a few research studies have focused on MPs pollution within the Danube River–Danube Delta–Black Sea system. This study aimed to investigate the abundance, distribution, and physicochemical properties (type, size and color) of MPs in the Danube Delta via Sf. Gheorghe distributary. To obtain insights into MPs contamination, sediment samples were collected with a Van Veen grab sampler, while the MPs from water samples were obtained using a portable pump equipped with four filters (4 mm, 500 µm, 300 µm and 100 µm). After isolating MPs onto aluminium oxide filters, the particles were examined visually under a stereomicroscope, followed by chemical identification using µ-FTIR, fluorescence-based detection with Nile Red staining and morphological characterization by SEM. MPs were detected in all analysed samples, showing differences in abundance, type, size, shape, color, and chemical composition among sampled stations. The dominant particle shape found was fibres, followed by fragments, predominantly coloured (black and blue) and transparent. In terms of chemical composition, the

most abundant polymers were polypropylene, polyester and polyamide. The analysed samples contained not only synthetic MPs, but also natural and semi-synthetic fibres. Additionally, the MPs showed smooth surface morphology, with few structural changes on some particles. This research fills critical gaps in understanding freshwater MP pollution by providing valuable baseline data and offering a framework for continued monitoring, identification of pollution sources, and development of specific mitigation strategies.

Keywords:

Microplastics, sediment, water, characterization, chemical composition.

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