Quantifying micro- and nanoplastics

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Sheet 11: Quantifying micro- & nanoplastics

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Why quantifying micro- & nanoplastics?

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Macroplastics are the most visible and mass-wise significant part of plastic pollution. Derived largely from the breakdown of macroplastics, microplastics (1µm-5mm) and nanoplastics (< 1 µm) are more abundant and present greater risks to the health of humans and the environment[44] (see Microplastics and ocean biogeochemical cycles and Is plastic toxic?). **Micro- and nanoplastics are released throughout the entire lifecycle of plastics, not solely when they become waste[45].**

Quantification approaches

Scientists are studying plastics by assessing their size, morphology, quantity, mass, as well as the chemical composition of their polymers and additives. The collection of micro- and nanoplastics necessitates distinct methodologies for water (using Manta nets or sampling of water), air (passive or active collection), and soil (plastic particle separation in sampled soils based on density). Particle sorting is partially conducted manually for larger microplastics (>500 µm to 5 mm), while modern chemical techniques (such as analytical pyrolysis and infrared spectroscopy) are employed for direct analysis of smaller microplastics (ranging from 1 to 25 µm) and nanoplastics (< 1 µm).

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Current limitations

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- The distribution of plastics in the environment is highly heterogeneous. **Research often focuses on accumulation sites rather than on diffuse pollution, even though the latter has considerable impacts.**
- While analytical techniques are available to characterize polymers in environmental samples, **the identification of additives—comprising thousands of potentially hazardous molecules** (see Diversity of chemicals in plastics)—remains challenging within complex matrices.
- The development of **analysis of micro- and nanoplastics in biological tissues**, crucial for understanding their impacts on organisms, is still in progress[46].

[44] Rai et al., 2021. Environmental fate, ecotoxicity biomarkers, and potential health effects of micro- and nano-scale plastic contamination. J. Hazard. Mater. 403, 123910

[45] Gontard et al., 2022. Recognizing the long-term impacts of plastic particles for preventing distortion in decision-making. Nature Sustainability, 5(6), pp.472-478.

[46] Albignac et al., 2022 Determination of microplastic content in Mediterranean benthic organisms by pyrolysis-gas chromatography- tandem mass spectrometry. Marine Pollution Bulletin 181, 113882.

Plastics :
Poison most handy

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