Reducing the Risk of Cross-Contamination through defining a Standard Operating Procedure (SOP) for microplastic sampling, processing and identification

Background and rationale

No Standard Operating Procedures (SOPs) for microplastic (MPs) sampling, extraction purification or identification approaches are currently available. This makes the increasing number of MPs studies hardly – if at all – comparable.

**JPi-Oceans BASEMAN project – Goals**

1. the validation and harmonization of analytical methods, which are indispensable for
2. the identification and quantification of MPs.

The results of the project will provide EU authorities with tools and operational measures that may be applied to describe the abundance and distribution of MP in the environment. Such tools will allow JPi-O evaluation of member state compliance with existing and future monitoring requirements.

Sampling & Processing

It is extremely difficult to reduce cross-contamination risks while collecting and processing environmental samples, nonetheless there are precautions that can significantly reduce contamination and increase data quality during in situ operations at sea or on land (Fig. 2):

- **Clean working areas** – reduce cross-contamination of commonly used materials in a vessel (e.g. filters, paint scraps) or in a laboratory (e.g. benches, fume hoods, etc.).
- **Daily controls** – monitor airborne particles using clean filters in labelled plastic dish;
- **Controlled environment** – reduce number of people working on each task; Avoid sudden movements; if possible, close doors and windows;
- **No synthetics** – wear 100% cotton clothing and lab coat (if possible) avoid wearing synthetic garments (e.g. fleece fabrics). Record the colors of the clothing worn underneath;
- **Clean equipment** – before and after deployment of sampling tools (e.g. corer, net) check device for any contamination. Wash and rinse tools, if possible, with filtered water;
- **Decontamination** – pre-clean all glassware with diluted acid solutions to ensure there are no microplastics in them. Wash and rinse in ultrapure water;
- **Replicates** – conduct replicates under similar conditions. Note that sampling for and against the current does not produce replicates, but different samples;
- **Sample storage** – whenever possible, store samples in labelled glass jars. Try to avoid, if possible, adding chemicals to the samples (e.g. formaldehyde). Take photos of every sample and methods used.

Identification

Identification of polymer type and its elements can be done through the following techniques:

1. micro-Fourier Transformed Infrared spectroscopy (µ-FTIR);
2. micro-Raman spectroscopy (µ-Raman);
3. Pyrolysis–gas chromatography-mass spectrometry (Py-GC-MS);
4. X-ray Fluorescence spectroscopy (XRF).

Micro-FTIR is the recommended technique, due to the large number of studies that use it worldwide.

Reporting results

These are the recommended categories below for reporting microplastics, allowing comparison among studies worldwide.

- Number of microplastics: per area (µ particles km⁻²) | per volume (µ particles m⁻³)
- per mass (µ particles kg⁻¹ dry)

References

5. Alves et al. (2017), Identification methods of microplastics and a review. Synthetic Methods, 5, 154, Royal Society of Chemistry. DOI: 10.1039/c7sm00575g

Reducing cross-contamination

In the field of microplastics research, Airborne fiber contamination can be significantly reduced by applying a forensic science approach while sampling environmental samples in research vessels and while processing and identifying microplastics in the laboratory.

The promotion of standardized methodologies in the form of SOPs for European coastal areas will ensure better data quality for both monitoring and research purposes.

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