Validation and optimization of a drum-sieve for the sampling of microplastics in natural and urban water streams

Keywords: microplastics, sampling, rivers, wastewater treatment plant, µFT-IR

Proposed: December 2024 Valid until: June 2025

Background

Microplastic (MP) contents in surface waters are mostly determined based on sampling campaigns using mantra nets with a mesh size of 330 µm. Thus, only MPs > 330 µm are collected. However, an increasing number of MPs with decreasing particle size is expected and MPs in the lower size ranges are more likely taken up by biota. Thus, alternative sampling approaches, which allow collecting smaller MPs are urgently needed. Grab sampling and pressure filtration, two alternative sampling approaches, only allow processing limited water volumes and thus, results from such studies may lack representativeness. The drum sieve technology allows processing large water volumes and thereby offers an interesting alternative for collecting MPs from surface waters.

Objectives of the suggested topic

In this study, the performance of a drum sieve, which was designed at Eawag, will be assessed. In a first step, spiking experiments using colored or fluorescently labelled MPs and tap water as a media will be conducted to determine the recoveries of the (drum sieve) sampling approach. These experiments will be followed by a series of experiments targeting urban surface waters with variable total suspended solids (TSS) contents and compositions (e.g., wastewater treatment plant effluent and River Rhein). Optimal operational parameters of the drum sieve will be determined for sample volumes ranging from a few 100 to a few 1000 liters.

Microplastic contents in the collected solids will be determined using automated µ-Fourier Transform (FT) – Infrared (IR) spectroscopy instruments complemented by automated light microscopy analyses. Processing of the samples will follow well-established procedures in our lab[1], but will be modified if needed.

The results of the study will help to decide on the most suitable sampling strategies for MPs in surface waters. Furthermore, results from the case studies will contribute to a better assessment of the current MP contents in selected surface waters.

Specific information / Requirements

The master thesis will be performed in the Process Engineering department of Eawag (Dübendorf) and office space with computer will be provided.

Having a driving license is a plus.

Advisors and Supervisors

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Supervisors: Dr. Ralf Kägi, Guillaume Crosset-Perrotin

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References

1. Philipp, Matthias, Thomas D. Bucheli, and Ralf Kaegi. "The Use of Surrogate Standards as a QA/QC Tool for Routine Analysis of Microplastics in Sewage Sludge." *Science of The Total Environment* 835 (August 2022): 155485. https://doi.org/10.1016/j.scitotenv.2022.155485.