A new filtration system for extraction and accurate quantification of microplastics

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Abstract:

The analysis of microplastics is crucial due to their widespread occurrence and significant impact as environmental pollutants. Appropriate extraction and analytical techniques are necessary to evaluate the abundance, dispersal, and effects of microplastics. In this context, the filtration step to extract microplastics from solution media is indispensable for quantifying microplastics accurately. Usually, a pretreatment procedure such as density separation or solvent extraction is employed before filtration. Nevertheless, the adsorption of microplastic particles onto the glassware surface is known to occur and careful rinsing is inevitable for a suitable recovery rate. The study presents a novel filtration device developed for easy use to increase microplastic recovery from liquid samples. Fluorescent polyethylene (PE) particles were used to examine recovery by optical microscopy and pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS). The conventional filtration system (CFS) exhibited lower microplastic recovery (45.1 ± 7.9%, n = 10) due to the adsorption of microplastics onto the inner surface and the bottom edge of the upper glass funnel. In contrast, the newly developed modified filtration system (MFS) enables fast suction of liquid samples by removing the glass frit with the upper glass funnel and filter being spatially separated. The significantly improved recovery rates using MFS for PE particles were 100% (n = 5) and 93.4 ± 3.4% (n = 10), respectively, confirming the feasibility of the newly developed filtration system to analyze microplastics using Py-GC/MS. The study highlights the importance of filtration processing in establishing analytical standards for assessing and managing microplastics by suggesting MFS as an advanced filtration system.

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