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Active sampling of atmospheric MPs and their efficient extraction from Glass/Quartz microfiber filters

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Active sampling is the main method used to collect suspended atmospheric microplastics (MPs). Sampling is accomplished by pumping air at varying flow rates through a filter that captures particles larger than the pore size of the filter being used. The choice of filter depends on the study; in recent works using active sampling to capture atmospheric MPs, Glass and Quartz microfiber filters are the most used (Luo et al., 2022). Their chaotic organization of microfibers in multiple layers provides an efficient trap for atmospheric particles. However, such complex organization of the filter microfibers does not allow for the easy extraction of particles from these filters prior to analysis. The commonly used methods like sonication, agitation, and extensive rinsing cause partial damage to the filter itself, resulting in the release of its individual fibers (Rosso et al., 2023). As a result, MPs are partially or completely hidden by glass/quartz fibres, which can lead to under- or overestimation of MPs in atmospheric samples. In addition, not all MPs are necessarily released by sonication or agitation.

The objective of this study is to find an efficient MPs extraction protocol from the glass/quartz microfiber filters avoiding the production of small filter fibers that will alter the proper identification and quantification of MPs. Thus, two basic approaches were tested: chemical and physical.

Glass / Quartz microfiber filters are silica (SiO_2) based materials that are soluble in a Hydrofluoric acid (HF). Knowing this we developed a gentle filter digestion protocol on how to dissolve the filter and liberate atmospheric particles without damaging potential MPs, using dilute HF (0.1M) and low temperature <40°C.

Alternatively, we investigated two physical approaches based on particle transfer from filter to liquid by reverse filtration and direct particle transfer from filter to filter by using a peristaltic pump and closed circuit. Both methods aimed at releasing MPs from the sample filter with a large volume of liquid at a high flow.

Qualitative and quantitative analysis and the recovery rate for each method are performed using an optical microscope (ColSpec), micro-Fourier transform infrared (μ-FTIR) and Raman spectroscopy.