# Small microplastics no longer slip through the cracks with novel method for detection

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The exceptional properties of plastics, such as their chemical, light- and temperature-resistance, in combination with the low cost and ease of manufacturing have rendered them into one of the most popular and widely used materials over the last decades. The widespread use of plastics in everyday life has triggered an increasing global production, unfortunately also accompanied by a significant accumulation of plastic litter in the environment. In 2017, it was reported that approximately 6,300 million tons of plastic waste were generated between 1950 and 2015, around 5,000 million tons of which accumulated in landfills and the natural environment.

The environmental litter undergoes weathering processes, such as fragmentation and degradation, generating smaller particles. These plastic particles have been classified based on their size, although no final harmonized definition has been issued so far. In general, microplastics (MPs) are considered to have a size range between 1 µm and 5 mm (

There is a raising concern about the ecological impact, especially that caused by the smallest variety of these plastic microparticles, as these have a larger surface-to-size ratio, potentially enhancing the adsorption of contaminants, and show an increased bioavailability due to their capability to cross biological barriers, penetrate tissues and accumulate in organs. As a result, MPs may exert severe adverse effects in different environmental compartments and on human health, aggravated by the fact that degradation of larger particles into smaller ones leads to many more particles being present—the volume of one particle with a diameter of 1 mm equals that of 1,000,000,000 particles with a diameter of 1 µm. Up to date, however, there is no "universal" straightforward technique that provides a full characterization of MPs. In fact, many monitoring programs provide data on the larger MPs only, such that most probably only the tip of the "microplastic iceberg" is seen.

A team of researchers from Ghent University (UGent) and VITO (an independent Flemish research organization in the area of cleantech and sustainable development) has now developed a method based on the use of ICP-mass spectrometry (ICP-MS), a technique normally used for the determination of metals and metalloids at (ultra)trace levels.

The approach developed relies on the ultra-fast monitoring of transient signals (with a detector dwell time of 100 µs only) when using a quadrupole-based ICP-MS unit in so-called single-event mode and registering the signal spikes produced by individual microparticles by monitoring the signal intensity at a mass-to-charge ratio (m/z) of 13 ($_{13}C^{+}$). Spherical polystyrene microspheres of 1 and 2.5 µm—to mimic MPs coming from plastic waste—have been detected using ICP-MS, thus demonstrating the potential of the technique for providing information on the mass concentration (concentration of C per volume of water), particle number density (number of particles per volume of water) and size distribution of the MPs present.

Further research is required before the newly introduced method can be used in routine, aiming at detecting and characterizing MPs of even lower sizes (hence also addressing the nanoparticles) and the development of adequate sample preparation techniques for separating plastic microparticles from fragments of animal or plant origin. Despite the need for further optimization, the introduction of this novel method is considered a breakthrough as the technique has the potential to provide crucial information needed in studies on the environmental impact of MPs and their influence on human health, while demonstrating a high sample throughput.

**More information:** Eduardo Bolea-Fernandez et al. Detection of microplastics using inductively coupled plasma-mass spectrometry (ICP-MS) operated in single-event mode, *Journal of Analytical Atomic Spectrometry* (2019). DOI: 10.1039/C9JA00379G

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