

[The quantification of the airborne plastic particles of 0.43–11 µm: Procedure development and application to atmospheric environment](#)

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Abstract:

The environmental degradation of microplastics results in ultrafine particles that may incur severe biological concerns. Despite this, the atmospheric existence of plastics of less than a few microns has barely been investigated due to the particle size limit of conventional analytical methods. This study develops a procedure to quantify and characterize plastic particles (including nanoplastics; less than 1 µm) in the air through fractional sampling, a simple pretreatment method, and pyrolysis-gas chromatography-mass spectrometry (Py-GC/MS). We targeted 11 major polymers, namely, polyethylene, polypropylene, polystyrene, acrylonitrile-butadiene-styrene resin, styrene-butadiene rubber, polymethylmethacrylate, polycarbonate, polyvinyl chloride, polyethylene terephthalate (PET), polyamide 6, and polyamide 66 (PA66). The average spike and recovery rate of each polymer in the aerosol collected on the roof of a four-story building near a major road in Kyoto, Japan, amounted to 78–130 %, with a coefficient of variation of less than 15 %. By coupling pyr-GC/MS analysis with fractional sampling of particles within the size range of >11 µm, 11–7.0 µm, 7.0–4.7 µm, 4.7–3.3 µm, 3.3–2.1 µm, 2.1–1.1 µm, 1.1–0.65 µm, 0.65–0.43 µm, it was possible to quantify airborne nano- and microplastics by particle size. Polyethylene, polystyrene, PET, and PA66 were detected in the air, and the total mass concentration of tiny plastic particles (0.43–11 µm) amounted to 1.20 µg/m³. This translates into total particle numbers of 3.05 x 10⁶ particles/m³ (assuming spheres), revealing a substantial number of particles under 1 µm. These results will contribute to future studies to understand the atmospheric behaviors of ultrafine plastic particles and their flow-on effects on the respiratory system.

* Excerpted from online journal website (Click the title)

Frontier Labs Products used:

Multi-Shot Pyrolyzer (EGA/PY-3030D), AS-1020E, Ultra ALLOY-MP, MJT-1030Ex, F-Search MPs, Microplastics Calibration Standard set, Eco-Cup LF