

Nano- and micro-plastics in the atmosphere: an analytical approach using Py-GC-MS

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In recent years, nano- and microplastics (NMPs), including tire wear particles (TWPs), have emerged as global atmospheric contaminants. Most research predominantly focuses on mass concentration of deposited particulates, while submicron-suspended particles, directly impacting human exposure, are understudied. The present study aims to provide a measurement approach that would facilitate the routine analysis of synthetic polymers in atmospheric particles using pyrolysis-gas chromatography coupled with mass spectrometry (Py-GC-MS). We conducted analysis of polystyrene (PS), polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET), polyvinyl chloride (PVC), poly- (methyl methacrylate) (PMMA), polycarbonate (PC), and TWPs of PM₁₀ and PM_{2.5} samples. The average total atmospheric NMP concentration was found to be $0.64 \pm 0.16 \mu\text{g}/\text{m}^3$ and $0.33 \pm 0.11 \mu\text{g}/\text{m}^3$ in PM₁₀ and PM_{2.5}. TWP contributes ~70% to the NMPs composition, followed by PVC and PE at ~11% each in PM₁₀ and PM_{2.5}. The current Py-GC-MS quantification method is reliable, facilitating investigations into NMPs' environmental fate, distribution, and toxicology.

Keywords: Nano- and microplastics, tire wear particles, submicron-suspended particles, pyrolysis-gas chromatography mass spectrometry.