Atmospheric Deposition of Microplastics in North Taiwan

Anggraini Widyastuti [1]*, Jheng-Jie Jiang [1]

[1] *Advanced Environmental Ultra Research Laboratory (ADVENTURE) & Department of Environmental Engineering, Chung Yuan Christian University, Taoyuan 320314, Taiwan*

Abstract

Although microplastic research is increasing, relatively few studies focus on airborne microplastics. This study investigates the deposition fluxes, characteristics, and polymer composition of outdoor atmospheric microplastics in a developing area of northwest Taiwan. Samples were collected from four locations—industrial (DJ), metropolitan (CY), suburban (LG), and rural (GY)—across all four seasons, each for 14 consecutive days, twice per season. Pre-treatment involved 24-hour oxidation with 30% hydrogen peroxide (H_2O_2), followed by supersaturated sodium chloride (NaCl) to separate microplastics from organic matter. Optical microscopy and Fourier-transform infrared spectroscopy (FTIR) were employed for quantitative and qualitative analysis. Fragments and fibers predominated, with the highest concentrations recorded during summer in metropolitan (470.85 MPs m^{-2} d^{-1}) and industrial (362.24 MPs m^{-2} d^{-1}) areas. Samples were classified into dry and wet deposition for FTIR-based polymer identification, revealing 19 and 14 polymer types, including PP, PET, PE, and EVA. Hierarchical cluster analysis and principal component analysis (PCA) indicated that polymers in Cluster 1 closely corresponded to PCA Group 1 (LDPE, EEA, PS, PAN), while PET and PVA characterized the second component. A risk assessment suggests that ubiquitous airborne microplastics pose a non-negligible health concern, with outdoor exposure potentially reaching one million MPs annually.

Keywords: Microplastic, concentration, characteristic, deposition