Spatiotemporal Occurrence and Characteristics of Atmospheric Microplastics in Southern Taiwan During Northeast Monsoon Periods

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Abstract

This study investigated atmospheric microplastic (MP) pollution across five sampling sites in the Kaoping region of southern Taiwan (Nanzi, Fengshan, Xiaogang, NPUST, and Fangshan) from February 2 to March 28, 2024. Average MP concentrations ranged from 0.63 to 1.39 items m^{-3}, with the highest levels observed at the industrialized Nanzi site, followed by Fengshan. The lowest concentrations were recorded at the background site, Fangshan, suggesting limited local anthropogenic influence. The regional average MP concentration was 0.94 ± 0.11 items m^{-3}, indicating the widespread presence of airborne MPs. Comparison with global studies showed that Kaoping's MP levels are lower than those in Korea and Indonesia but comparable to Portugal. Meteorological analysis revealed that MP concentrations aligned with $PM_{2.5}$ patterns and increased significantly during long-range transport (LRT) events, particularly from March 12–14 and 20–22. Fangshan experienced the most significant increase during LRT periods, implying higher susceptibility to regional transport due to its geographical location. In contrast, urban stations were predominantly influenced by local sources. Diurnal variation analysis at Nanzi and Fengshan showed higher MP concentrations during the daytime due to intensified human activity, boundary layer dynamics, and particle resuspension. Chemical characterization using μ-FTIR identified nine types of polymers, with polyamide (PA) being the most abundant. LRT samples had higher proportions of acrylate copolymers (ACR), suggesting potential health risks such as allergies and respiratory issues. These findings highlight both local and regional sources of MPs and their implications for air quality and public health.

Keywords: Atmospheric Microplastics, Abundance, Characteristics, Composition, Long-range Transport.