From road dust to the air we breathe: Tracing atmospheric microplastics and heavy metals across urban elevations

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ABSTRACT

Road dust is a reservoir and potential secondary source of microplastics (MPs), which can be resuspended into the atmosphere. This study investigated elevational variations in atmospheric microplastics (AMPs) and heavy metals in road dust in Iligan City, Philippines. AMPs were collected from roadside and non-roadside environments at ground and elevated levels and characterized using microscopy, ATR-FTIR, and SEM-EDX. Road dust from Tibanga was analyzed for heavy metals using ICP-MS and evaluated through pollution and ecological risk indices. AMP concentrations were 0.09 ± 0.04 MP/m³ at roadside sites and 0.08 ± 0.03 MP/m³ at non-roadside sites. The elevated roadside site recorded the highest concentration (0.11 ± 0.04 MP/m³), 57% higher than ground level (0.07 ± 0.02 MP/m³), although the overall roadside–non-roadside difference was not statistically significant ($p = 0.05772$). Fibers dominated AMPs, accounting for 62–78% of particles. ATR-FTIR identified HDPE, LDPE, PVC, PP, PVS, and PET, while SEM-EDX detected surface-associated elements, including Pb, Hg, and Ni, particularly in roadside samples. Road dust contained Mn (757.03 mg/kg), Cr (526.74 mg/kg), Cu (382.07 mg/kg), and Zn (235.58 mg/kg). The pollution load index was 1.49, and Cu had an Igeo of 1.70, indicating moderate pollution. The overall ecological risk index was 165.55, classified as moderate risk. These findings demonstrate elevational variation in AMPs and highlight the presence of heavy metals in road dust, supporting integrated environmental monitoring in urban areas.

Keywords: Urban pollution/ Road dust/ Heavy metals/ Health risk/ PCA