

ABSTRACT

Air pollution has been the major contributor in environmental pollution. The recent worldwide environmental issue is air pollution especially microplastic and toxic metal contamination. The prevalence of microplastics in the maritime and sedimental environment has been the focus of several earlier research. However, little information about airborne microplastics is available, especially in Pakistan. Database for toxic metals in particulate matter of Lahore available but it needs to be updated. The current study investigates airborne microplastics (AMPs) and toxic metal concentrations in Lahore, Pakistan, across seasonal and environmental conditions (indoor and outdoor). For counting and visual identification of microplastic stereomicroscope was used and identification of polymer type was done by ATIR-FTIR. The amount and diversity of microplastics in each sample ranged from 3 to 8 MPs/sample. The mean MP abundance was 90 ± 1.66 MPs/m³ in the winter and 80 ± 1.41 MPs/m³ in the summer. The predominant forms were fibers and fragments with transparent and blue being the dominant colors during both seasons. Polyisobutylene (PIB), Polyethylene terephthalate (PET) and polyvinyl alcohol (PVA) showed higher percentages 22%, 15% and 15% respectively during winters. In summer samples, polyvinyl alcohol (PVA), polyaramid fiber (PAF) and Polyisobutylene (PIB) were higher 21%, 15% and 15% respectively. Rubber, Polyurethane (PU), Bisphenol A (BPA) and Ethylene cellulose (EC) were present only in winter air samples. Fiber glass was also found in a few samples, which showed higher fiber during summer (n=14) than in winter (n=9). Atomic absorption spectrometry was used to evaluate toxic elements such as iron (Fe), zinc (Zn), lead (Pb), copper (Cu), and cadmium (Cd). Significant variability was seen among sites, with $Zn > Fe > Cu > Pb > Cd$. During winter, concentration of Zn, Cu, Fe, Pb, Cd were 8.61 ± 5.19 mg L⁻¹, 1.13 ± 1.23 mg L⁻¹, 1.01 ± 0.53 mg L⁻¹, 0.60 ± 0.11 mg L⁻¹, 0.14 ± 0.17 mg L⁻¹ respectively. Concentration of Zn, Cu, Fe, Pb, Cd during summer were 5.51 ± 4.36 mg L⁻¹, 0.10 ± 0.06 mg L⁻¹, 1.04 ± 0.43 mg L⁻¹, 0.11 ± 0.08 mg L⁻¹, and 0.08 ± 0.07 mg L⁻¹ respectively. Industrial zones exhibited significantly elevated levels of both AMPs and heavy metals, underscoring industrial activities as major contributors. This study's findings offer a foundation for environmental monitoring, policy development, and public health strategies aimed at mitigating airborne pollution in Lahore.