Airborne microplastics in indoor and outdoor environments of a developing country in South Asia: abundance, distribution, morphology, and possible sources

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Abstract

Airborne microplastics (AMPs) have been reported in indoor and outdoor air in high-income countries and are expected to be a significant contributor to daily MPs exposure for human beings. There are, to date, only a handful of studies in lower-middle-income countries, although pollution can be a more significant issue due to more lax environmental regulations. In this study, AMPs from 5000 – 50 μm were sampled from indoor and outdoor environments across selected areas of Sri Lanka using an active sampling technique. Suspected AMPs were further characterised using Fourier transform infrared spectroscopy (FTIR). Microplastic concentrations (mean ± SE, particles/ m3) in indoor air (0.13 ± 0.09 to 0.93 ± 0.26) was higher than outdoor air (0.00 to 0.23 ± 0.03). This translates to an average human exposure of a little over 2500 MP particles/year. The types of indoor MPs were related to indoor-generating sources, the number of occupants, and their lifestyles. Outdoor abundance in high-density areas (0.11 ± 0.03 particles/m3) was always higher than in low-density areas (0.04 ± 0.016 particles/m3), albeit not significantly so. The highest outdoor MP abundance was found near an industrial zone, followed by urban and inland locations in high-density areas. The dominant size range of MPs was 100-300 μm, and the only shapes observed indoors and outdoors were fibers (98%) and fragments. Most MP particles were transparent, followed by blue and black. Polyethylene terephthalate (PET) was the prominent MP type followed by polyester, indicating that textile fibers could be the major source of these AMPs. Acrylic, polyamide (PA), polypropylene (PP), polystyrene (PS) and nylon were also identified. This study provides the first report on AMPs in Sri Lanka. Considering the population growth and industrialisation, further research should evaluate possible trends and health risks upon inhalation.

Keywords: Microplastics, Atmosphere, Developing Country, South Asia, Sri Lanka

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