Quantification and Identification of Microplastics in Total Atmospheric Deposition in a Coastal Area

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Abstract

Microplastics (MPs), synthetic polymer particles ranging from 1 μm to 5 mm in size, have become widespread pollutants across aquatic, terrestrial, and increasingly, atmospheric environments. Despite rising global concern, atmospheric microplastic pollution remains understudied, particularly in Southeast Asian coastal regions. This study aimed to quantify and characterise airborne MPs from total atmospheric deposition in Kuala Nerus, Terengganu, Malaysia. Passive sampling was conducted at the rooftop (~12 m) and ground level (~1.5 m) in Universiti Malaysia Terengganu during the Southwest (SWM) and Northeast Monsoon (NEM) seasons. MPs were quantified based on physical characteristics using stereomicroscopy, while polymer type and surface morphology were analysed using Micro-Fourier Transform Infrared Spectroscopy (μ-FTIR) and Scanning Electron Microscopy with Energy Dispersive X-ray Spectroscopy (SEM-EDS), respectively. The highest deposition occurred during the SWM at the rooftop site (994.10 ± 116.15 n/m²/day), while the lowest was during the NEM at the same site (525.64 ± 110.25 n/m²/day). Fibres dominated (>90%), with black the most common colour (>34%) and 1.0–5.0 mm the most frequent size range (>45%). Identified polymers included polyethylene terephthalate (PET), high-density polyethene (HDPE), and polypropylene (PP), typically linked to synthetic textiles and plastic packaging. Seasonal patterns suggested that wind and rainfall influenced the MP abundance. These findings provide baseline data for atmospheric MPs in coastal environments and underscore the need for targeted policies to mitigate airborne plastic pollution.

Keywords: Microplastics; Airborne; Coastal Area; Polymer.