Dynamics of Temporal Deposition of Atmospheric Microplastics and Bio-Aerosols in Quezon City, Philippines

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ABSTRACT

Microplastics, defined as plastic particles smaller than 5 millimeters, have emerged as ubiquitous environmental pollutants documented across all major ecosystems. The atmospheric pathways in tropical megacities remain poorly understood, particularly because their meteorological dynamics differ significantly from those in temperate regions. Majority of the studies conducted in the Philippines have mainly concentrated on the issue of contamination in aquatic environments. This study provides the first baseline assessment of both wet deposition (rainwater) and dry deposition (atmospheric settling) microplastic deposition in Quezon City, Philippines. Replicable, low-cost passive collectors were deployed at the Institute of Environmental Science and Meteorology (IESM) to capture deposition fluxes under varying meteorological conditions. To address the critical challenge of misidentification in atmospheric samples, this research applies a novel Dual-Staining "Logic Gate" Protocol. By combining Nile Red, a lipophilic fluorescent dye that targets hydrophobic polymers, with Rose Bengal, a hydrophilic counter-stain that specifically tags natural organic matter, this method establishes a strict binary exclusion criterion. The combination of these two staining techniques provides a highly robust quantification of microplastics and enhances reliability of unstained optical methods. This enhanced detection is essential for investigating the temporal variability of the aerosols. By confidently identifying the particles, this study can accurately correlate aerosol concentrations with discrete meteorological events, specifically tracking the impacts of rainfall intensity (scavenging effect), wind dynamics (resuspension), and acute, transient weather events such as intense

localized thunderstorms .By establishing a robust, low-cost identification framework and providing the country's first atmospheric flux baseline, this study can inform local mitigation strategies and illuminate the dynamic interactions between urban pollution and tropical meteorology.