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ABSTRACT BOOK

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Tracing microplastic pollution in a mangrove delta: Insights from water and sediments of Sagar Island, Indian Sundarbans

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Abstract

Marine pollution refers to the introduction of anthropogenic contaminants into oceanic systems, leading to the deterioration of water quality, disruption of ecological processes, and threats to marine biodiversity. Among various pollutants, microplastics have emerged as persistent and widespread contaminants posing severe ecological risks to coastal and marine ecosystems. The Indian Sundarbans, a UNESCO-recognized mangrove delta, is particularly vulnerable to such contamination due to intense human activities and complex hydrodynamic conditions. This study focuses on the isolation and characterization of microplastics from surface waters and intertidal sediments of Sagar Island, located at the southernmost tip of the Indian Sundarbans. Samples were collected from multiple stations representing diverse levels of anthropogenic influence. Organic matter was digested using H₂O₂, followed by density separation with NaCl and filtration through glass microfiber filters. The isolated particles were categorized based on morphology (fibers, fragments, films) and size (<0.3–5 mm). Morphological analyses were performed using bright-field microscopy and Field Emission Scanning Electron Microscopy (FESEM), while polymer types were identified using Fourier Transform Infrared (FTIR) and Raman spectroscopy. Microplastics were detected at all sampling sites, with higher concentrations in sediments than in surface waters. Fibers were the dominant form, followed by fragments, suggesting unregulated fishing activities as a major source. The prevalence of polystyrene and polyethylene indicates substantial anthropogenic pressure, particularly from tourism. Surface degradation and chemical adsorption on microplastic particles were examined using SEM–EDX. High polymer hazard and potential ecological risk indices highlight the environmental degradation of the island. Spatial variations point to inputs from coastal tourism, fishing gear, and tidal transport. The study identifies Sagar Island as a hotspot for microplastic accumulation and emphasizes the role of tidal deposition in pollutant retention. These findings provide essential baseline data for long-term monitoring and management of marine pollution in fragile coastal ecosystems.