

Title: Microplastics contamination through a mighty estuarine island: Distribution, influencing factors, and risk assessment

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Abstract: The global concern over microplastic (MP) contamination in diverse ecosystems is well-established, yet Nijhum Dwip Island (NDI), known for its ecological diversity, has not undergone a comprehensive study addressing the extent of MP pollution. This research aims to evaluate the spatial distribution, influencing factors, and ecological risks of MPs in both sediment and surface water surrounding NDI, situated in the Northern Bay of Bengal. A meticulous collection of 40 sediment and 40 tidal water samples from various sites facilitated a detailed analysis. The mean abundance of MPs in sediment was 138.39 ± 34.15 pieces/kg, while in water, it was 72.83 ± 30.76 pieces/m³. Various shapes observed on NDI included films, fragments, fibers, and foams, with fragments dominating in sediment (64.05 %) and water (61.51 %). Analysis of FTIR spectra identified two primary polymer types, namely polyethylene (PE) at 57 % and polypropylene (PP) at 40 %. The results indicated elevated pollution levels on NDI, with sediment and water pollution load index measuring 1.32 and 2.01, respectively, signifying significant MP contamination in both compartments. Given the island's rare biodiversity, the vicinity of wastewater sewages, anthropogenic activities, and atmospheric deposition, could be behind MP contamination in water and sediments. No strong correlation between MP and physiochemical properties in water and PCA biplots showed their similar distribution, whereas MP abundances in sediment were significantly correlated with pH and organic matter ($p < 0.05$), signifying a pivotal role in transporting MPs in the aquatic environment. Two canonical variables were identified as important by canonical correlation analysis, demonstrating the interdependence of MP contamination at the sample sites. This research contributes to better insights into the occurrence of MP in the rare islands, which are ecosystems that have been hardly examined for this type of pollution, and it can report sustainable interventions to lessen MP inputs to the Bay of Bengal.

Keywords: Microplastic pollution, Nijhum Dwip Island (NDI), Sediment and surface water, Bay of Bengal, Polyethylene (PE), Polypropylene (PP), FTIR spectroscopy

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