Submarine groundwater discharge of microplastics in the transitional environment of southwest India

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Abstract

Microplastics are small $(1\mu$ m-5mm) particles that are ubiquitous in the environment. Recent studies have proven its ill effects on the environment and biota. The tiny pieces of plastic are transported into the marine realm by rivers, surface runoff, and winds. However, a research gap exists in the literature involving the processes that control the distribution of microplastics in a transitional environment connecting land and sea. In the present study, we explore the presence of microplastics in water samples, which include pore water (n=8), groundwater (n=4), and seawater (n=4) from tropical beaches in southwest India. The mean (\pm standard deviation) abundance of porewater samples is 0.75 \pm 0.66 pieces per litre, groundwater is 0.15 ± 0.1 pieces per litre, and seawater is 0.11 ± 0.07 pieces per litre. The recovered category of microplastics includes fibre, fragment, film, and foam, among which fibres are the most dominant. Transparent, black, blue, white, and red were the different colors observed in the study. Fourier-transformed infrared spectroscopy revealed the presence of polyester > low-density polyethylene > polystyrene. The possible sources of the observed microplastics could be attributed to fishing activities and the washing of clothes by the coastal community. Further, there is every possibility of microplastics getting washed onto the shore by the incoming waves. The presence of microplastics in the porewater samples suggests the vertical transfer of fibrous microplastics through the porous sandy sediments and into the subterranean estuary. Besides, we propose that submarine groundwater discharge acts as a pathway and plays a crucial role in the transport of microplastics from continents into the oceans.

Keywords: microplastics, vertical transfer, submarine groundwater discharge, pathways, southwest India

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