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Assessment of litter and microplastic pollution in the water and sediment of Hirikatuoya stream, within the Walawe River basin, Sri Lanka

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Rapid urbanization and mismanagement have led to a surge in plastic pollution in crucial aquatic ecosystems globally therefore accumulation of debris in aquatic ecosystems is rapidly increasing and they are becoming ultimate sinks for the contaminants. This results in a long-term and widespread threat causing a great challenge for remediation. Poor disposal practices and littering behavior of communities have resulted in considerable quantities of litter in river banks and streams affecting their aesthetic appeal and living beings. This study was conducted to understand the status of litter and microplastic contamination at selected locations in Hirikatuoya stream, a remote stream outside the urban environment in the Rathnapura district, Sri Lanka. The percentage of plastic in litter and the percentages of microplastic particles (based on colour and morphotypes) in water and sediments were estimated, and the corresponding polymer types were also identified. Three samples of water were collected from each of the nine locations along the stream from September to October 2022. In the sampling process, the samples were filtered through a 150 μm mesh. Sediment samples were collected from the shoreline of the stream at each location using a stainless-steel scoop covering 30 cm^2 of surface area and 2-3 cm depth. Low-density particles in the samples were separated by density separation and organic matter in the sample was removed by digestion. Whatman GF/C glass microfiber filter papers of a pore size of 1.2 μm were used for sample filtration. Microscopic imaging was done using a staining method. The ATR-FTIR analysis was performed to identify the polymer type of plastic particle in water samples. The most frequently observed colour for microplastic particles in water and sediments were white (26.87%) and colourless (40.20%), respectively. Based on morphotype, fragments were more abundant in both water (49.62%) and in sediments (59.79%) compared to other morphotypes. The highest microplastic abundance in water (69±22, 60±29, 61±26 items 100 m^{-3}) and highest abundance of microplastics in sediment (15±5.92 items/kg (top), 7±3.28 items/kg (bottom)) were observed in more human and tourist activity locations. According to the ATR-FTIR analysis, polypropylene was the most abundant polymer type in plastic litter (25%). In water polypropylene was the most dominant microplastics (38.10%), followed by low-density polyethylene (14.29%) and polyethylene terephthalate (9.52%). Polypropylene was the dominant microplastics in sediments (32.2%), followed by thermoplastic vulcanizates (22.5%), high-density polyethylene (19.3%). Accordingly, it can be concluded that the Hirikatuoya stream, which is in a remote area, is contaminated with microplastics. There are potential environmental and health risks to the aquatic biota in the stream and the neighboring communities. Further investigations are required to understand the effect on aquatic animals.

Keywords: Aquatic ecosystems, FTIR, Microplastics, Water and sediments

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