

Screening of Plastic Pollution Effects in Madu-ganga Estuarine Ecosystem in Southern Province, Sri Lanka: An Approach toward the Coastal Zone Management

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Plastic pollutants act as the emerging contaminant with possible threats to aquatic ecosystems. The present study attempts to assess microplastic (MP) content in surface water and sediments of Madu-Ganga estuary which is one of the ecologically and commercially important Ramsar wetlands in Sri Lanka. Manta net (380 μm) was employed to collect surface water samples by towing net horizontally along water surface for 10 m with 1.8 ms^{-1} of average flow rate, while Ekman grab was used for sampling sediments from 4 study sites during October 2019 to January 2020. Wet Peroxide Oxidation (WPO) protocol was applied after subjecting both water and sediment samples to the wet sieving process. Fourier Transform Infrared Radiation (FTIR) analysis was used to confirm polymer types of extracted MPs in samples. MPs in digested samples were enumerated and categorized microscopically according to their size, shape, and color. One Way Analysis of Variance (ANOVA) was applied to identify the differences of MPs density with sampling location ($p < 0.05$). According to the results, both surface water and sediment layers had contaminated by MPs accumulation. Sampling location had not significant ($p > 0.05$) effect on the MP content of surface water and sediment samples. Average MPs accumulation rate of surface water and sediment samples were recorded as $40.06 \pm 1.84 \text{ items/m}^3$ and $5.88 \pm 1.33 \text{ items/100g}$ respectively. White-transparent, blue, black, and red were major color categories observed in MPs, while white-transparent color was dominant MP type of water and sediment samples. Most of the accumulated MPs were at the 0.50-1.00 mm of long-range. Fiber, sheet, and fragment shape MPs were commonly found in water and sediment samples. According to FTIR analysis, polypropylene (Characteristic absorption bands: 2950 cm^{-1} , 2915 cm^{-1} , 2838 cm^{-1} , 1455 cm^{-1} , 1377 cm^{-1}) was abundant polymer type in surface water, while sediment contains polypropylene and polyvinyl chloride (Characteristic absorption bands: 1427 cm^{-1} , 1331 cm^{-1} , 1255 cm^{-1} , 1099 cm^{-1} , 966 cm^{-1}). As per the preliminary survey, two major anthropogenic activities: commercial fishery and tourism were identified as the main point and non-point pollution sources in this ecosystem. In conclusion, this study emphasizes the growing risk of plastic pollution and the urgent need for a sustainable management plan to reduce plastic pollution in the Madu-Ganga estuary ecosystem.

Keywords: Plastic contamination, Microplastics, Coastal ecosystem, Surface water, Benthic sediments, Anthropogenic factors