Assessment of Microplastic Pollution in Mangrove Areas of the Batticaloa Lagoon, Sri Lanka

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Microplastic pollution is an escalating concern in coastal and estuarine ecosystems, with mangrove forests acting as major sinks due to their dense root networks and low hydrodynamic energy. This study assessed the abundance, distribution, and morphological characteristics of microplastics in the mangrove areas of the Batticaloa Lagoon, Sri Lanka. Water samples were collected from five locations, with two replicates from each location, by filtering 50 L of water through a 100 µm mesh sieve. Organic matter was digested by hydrogen peroxide (H_2O_2), and the residues were isolated via vacuum filtration using 0.45 µm filter paper and examined under a stereomicroscope. Where microplastic particles were classified by type, color, and shape. Microplastic abundance ranged from 700 to 1,020 particles/m³ (mean: 820±52 particles/m³). The highest abundance was recorded at Location 2 (1,020±20 particles/m³), while the lowest abundance was observed at Location 5(700±60 particles/m³). Fibers were the dominant microplastic type, accounting for 80% of the total particles, followed by fragments (19%) and films (1%). This distribution was consistent with the shape classification, where filament-shaped particles (80%) predominated over irregular-shaped particles (20%). Black particles were most prevalent (44%), followed by blue (19%), green (15%), red (13%) and other colors (9%), suggesting textile fibers and degraded fishing gear as likely dominant sources. The consistently high abundance across all sites, coupled with the predominance of fibrous, dark-colored particles, points to land-based anthropogenic inputs, including domestic wastewater and fishing activity, as key contributors to contamination in this lagoon system. These findings establish critical baseline data on microplastic pollution within the Batticaloa Lagoon mangrove ecosystem, an ecologically vital habitat that supports biodiversity, coastal protection, and local fisheries. The results highlight the urgent need for sustained monitoring, source-reduction strategies, and policy interventions to mitigate plastic pollution and preserve the ecological integrity of this coastal environment.

Keywords: *Surface water, Mangrove ecosystems, Microplastic pollution, Batticaloa lagoon*