



Physicochemical Characteristics and Microplastic Contamination of Groundwater in the Gampaha-Colombo Coastal Belt, Sri Lanka

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Over recent decades, the Gampaha District in Sri Lanka has experienced rapid urbanization and industrialization, resulting in increased dependence on groundwater due to the scarcity and contamination of surface water resources. Groundwater in the Gampaha coastal belt is characterized by pronounced acidity and heightened susceptibility to contamination from agricultural and industrial sources, with documented exceedances in pH, nitrate, and sulphate levels relative to established water quality standards. Despite increasing global concern regarding microplastic (MP) pollution, investigations into groundwater contamination by MPs in Sri Lanka remain limited including the Gampaha District coastal belt. This study aimed to evaluate the physicochemical characteristics and microplastic contamination of groundwater in the Gampaha - Colombo coastal belt. Groundwater samples ($n = 27$) were collected in November 2025. In situ measurements of temperature, dissolved oxygen (DO), pH, electrical conductivity, turbidity, and salinity were conducted using standard methods in accordance with APHA guidelines. Observed pH values ranged from 6.29 to 8.19, indicating conditions from slightly acidic to slightly alkaline, with several samples deviating from Sri Lankan drinking water standards. Electrical conductivity and turbidity ranged from 105 to 2875 $\mu\text{S cm}^{-1}$ and 125.5 to 313.76 FNU, respectively. DO concentrations varied between 0.69 and 10.90 mg L^{-1} , while salinity ranged from 0.07 to 1.54 mg L^{-1} , suggesting minimal seawater intrusion. Microplastic analysis, performed using the NOAA protocol, identified 19880 particles m^{-3} and average MPs density was recorded as 736 ± 571 particles m^{-3} across all sampling sites, spanning Negombo to Mattakkuliya. The highest MP abundance was recorded in Epamulla (2720 particles m^{-3}) in Wattala DS Division. Fibers were the dominant morphological type, followed by fragments, films, and foams, with black being the predominant color. Spearman correlation analysis revealed no significant relationships between MP abundance and measured physicochemical parameters. The findings of this study provide a baseline for future investigations into the spatial and temporal dynamics of MP contamination in coastal aquifers in Sri Lanka.

Keywords: Gampaha, Groundwater, Microplastics, Sri Lanka, Water-Quality