Water Quality and Chlorophyll Extraction Efficiency in Selected Mangrove Species of the Panadura Estuarine Mangrove Ecosystem, Sri Lanka

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Mangrove chlorophyll concentration acts as a highly sensitive bioindicator of water quality and overall ecosystem health. This study evaluated water quality spatial variation in the Panadura estuarine mangrove ecosystem during the April 2026 First Inter-monsoon period. It assessed the chlorophyll content of five true mangrove species, i.e., *Rhizophora apiculata*, *Sonneratia caseolaris*, *Rhizophora mucronata*, *Acanthus ilicifolius*, *Bruguiera sexangula* and one associated species, *Acrostichum aureum*. In situ water quality parameters: temperature, dissolved oxygen (DO), pH, specific conductance, and turbidity were measured in duplicate using a YSI ProDSS portable multiparameter meter across ten sampling sites. Chlorophyll *a*, Chlorophyll *b*, and total chlorophyll were extracted from leaf tissues using three solvents: 80% acetone, 80% methanol, and distilled water. Results showed that one-way ANOVA revealed a significant effect of solvent on chlorophyll extraction efficiency ($p < 0.05$), with acetone (80%) yielding the highest mean concentration (1.07 ± 0.31 mg/mL), followed by methanol (80%) (0.70 ± 0.21 mg/mL) and distilled water (0.52 ± 0.16 mg/mL). Water quality analysis across the ten sites identified a strong stress gradient, with Sites 5, 7, 8, and 9 classified as high-stress due to critically low DO and elevated turbidity. Principal component analysis explained 80.1% of variance along PC1, with DO, pH, and specific conductance as dominant co-varying parameters, while turbidity was the primary opposing driver, indicating the impact of freshwater dilution. The results suggest that variation in chlorophyll content is closely associated with changes in physicochemical water parameters. These spatial variations suggest that poor water quality, specifically critically low DO and high turbidity, can be a negative influence on photosynthetic efficiency and pigment stability in mangrove species. However, further comprehensive experimental studies are required to establish this direct impact. These findings highlight that deteriorating estuarine water quality threatens the mangrove physiological health, underscoring the need for targeted conservation strategies to protect these vital coastal ecosystems.

Keywords: *Chlorophyll extraction efficiency, Mangrove ecosystem, Physiological stress, Spatial variation, Water quality*