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TEMPORAL ASSESSMENT OF PHYSICOCHEMICAL PARAMETERS IN THE PERAK RIVER, MALAYSIA USING MULTIVARIATE STATISTICAL TECHNIQUES

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Abstract

This study assessed the seasonal variation of physicochemical water quality parameters in the Perak River, Malaysia, through multivariate statistical analysis. Water samples were collected from five locations across four months: March, July, September, and December 2023, representing different seasonal conditions. Eleven key parameters were analyzed, including air temperature (AT), water temperature (WT), pH, dissolved oxygen (DO), biochemical oxygen demand (BOD₅), chemical oxygen demand (COD), turbidity, total suspended solids (TSS), total dissolved solids (TDS), total alkalinity (TA), and electrical conductivity (EC), using standard methods prescribed by APHA. One-way ANOVA followed by Duncan's multiple range test revealed significant seasonal differences ($p < 0.05$) in AT, WT, pH, DO, and BOD₅. Correlation and linear regression analyses indicated strong interdependencies among parameters, particularly between temperature and DO. Varimax rotation factor analysis identified latent pollution sources, while hierarchical cluster analysis grouped sampling months based on similarities in their measured physicochemical characteristics. The findings demonstrate that both natural climatic variability and anthropogenic activities contribute to seasonal fluctuations in river water quality. This study provides an updated baseline for water quality in the Perak River and supports the need for season-specific monitoring strategies in tropical freshwater ecosystems. The integrated statistical framework provides transferable insights for managing tropical river water quality under seasonal and climate-induced stress.

Key words: multivariate analysis, Perak River, seasonal variation, tropical freshwater ecosystem, water quality

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