

Examining seasonality and vertical variability of heavy metals contamination in Urban Lake Malaysia using discriminant analysis

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ABSTRACT

The aims of this study are threefold: (1) to determine the seasonal, vertical and lateral variations in heavy metals (Na, K, Al, Fe, Ba, Cu, Ni, Cd) contamination in Varsity Lake Malaysia, (2) if the significant seasonal variation were observed, derive a discriminant function metals contributed or had the greatest effect on the seasonal variation, and (3) assess the extent to which the water quality has degenerated based on three water quality guidelines. The water Sample analysis was performed by an inductively coupled plasma-mass spectrometry. Variation in heavy metal concentration was analysed using discriminant analysis method. The results of Wilks' Lambda *F*-test, canonical discriminant function showed strong significant seasonal variations for the metals with the rainy season having greater concentrations than in the dry season. While rainy season concentrations decreased in the order Na > K > Al > Fe > Ba > Cu > Ni > Cd, the dry season concentrations decreased in the order: Na > K > Fe > Al > Ba and Ni > Cu > Cd. The finding reveals a significant discriminant function and the metals with the most significant discriminant power were Na, Cu, and K, thus made the highest contribution (60%) to the seasonal variability. Though overall concentration was higher at 1.5-m depth, no significant vertical (depth) variation was observed. Overall, the summative metal concentration is highest in the inlet section of the lake, followed by the outlet sections. None of the metals exceeded the values for the Malaysian Interim National Water Quality Guidelines Class II and the United States Environmental Protection Agency criteria. Although Cd, Al and Fe, did exceed the Canadian Council of Ministers of Environment Guidelines, the water quality is still safe for macro aquatic life, no advanced treatment is required and hence good for recreational purposes.

Keywords: Heavy metals contamination; Water quality in Malaysia; Metals concentration; Discriminant analysis; Seasonal variation; Water pollution in Malaysia; Urban Lake pollution

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