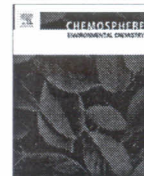




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Runoff effect on eutrophic lake water quality and heavy metal distribution in recent littoral sediment

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ABSTRACT

Multivariate statistical methods (hierarchical clustering analysis: HCA, and principal component analysis: PCA) were used to study the influence of runoff and other diffuse pollution sources on lake water chemistry of Hough Park lake in Central Missouri. In addition, heavy metal concentrations in lake littoral sediment were evaluated for enrichment and probable ecological risk. The abundance of macronutrients in the lake water column followed the order: $\text{Ca} > \text{Mg} > \text{TIC} > \text{K} > \text{Na} > \text{S} > \text{NO}_3^- > \text{N} > \text{Fe} > \text{NH}_3 > \text{N} > \text{TP}$. Heavy metal concentrations in the lake water column were below acute and chronic level ecological guidelines. TN:TP ratios (range: 4.1–6.8) revealed nitrogen limitation of algal and other photosynthetic plant growth. The HCA showed two major clusters of similarity between the sampling points suggesting different pollution levels for the clusters. PCA 1, 2 and 3 reflected the influence of natural biochemical processes, atmospheric deposition and runoff respectively on lake water chemistry. The abundance of heavy metals and the normalizing element (Li) in littoral sediment (<63 μm fraction) samples analyzed in decreasing order were: $\text{Mn} > \text{Zn} > \text{Cr} > \text{Ni} > \text{Li} > \text{Cu} > \text{Pb} > \text{Cd} > \text{Hg}$. The average concentration of Cr, Mn and Ni in littoral sediment fraction exceeded the respective lowest effects level (LEL) threshold limit. Metal bioavailability in sediment fraction was low since the most labile metal species contained between 0% and 11% of the total metal content. Using the risk assessment code (RAC) criteria, only Mn posed a medium risk to the lake system.