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## New Ecological Risk Indices for Evaluating Heavy Metals Contamination in Aquatic Sediment: A Case Study of the Gulf of Guinea

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### Abstract

New indices - modified hazard quotient (*mHQ*) and ecological contamination index (ECI) - were developed for the evaluation of heavy metals contamination of sediment. Sequential extraction method was employed to determine the levels of cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), and lead (Pb) in subtidal sediment samples from tropical ecosystems off the Gulf of Guinea. The results were used to assess the degree of contamination and estimate the extent of anthropogenic inputs from industrial activities. Results indicated that the concentrations of Cd, Cr, Cu, Ni and Pb ranged from 4.33 – 5.67, 11.12 – 28.52, 30.26 – 43.72, 2.02 – 2.60 and 162.0 – 190.37 mg/kg dw, respectively. The mean metal levels did not show significant variations among study sites during the wet and dry seasons. Spatial distribution and severity of sediment-associated contamination by heavy metals based on the newly developed indices (*mHQ* and ECI) were in good agreement with existing pollution indices and followed the descending sequence: Cd>Pb>Cu>Cr>Ni. Contamination severity index, mean hazard quotient and modified risk assessment code were also used to evaluate the sediment-heavy metal contamination, which generally indicated medium risk contamination of the investigated ecosystems. Aquatic pollution indicators (potential contamination index, ECI, hazard quotients, *mHQ*) revealed significant anthropogenic contamination by Cd and Pb, while Cr, Cu and Ni showed relatively low degree of contamination. Potential contamination index (PCI) generally followed the sequence Cd>Pb>Cu>Cr>Ni. A comparison of newly proposed indices with existing pollution indices revealed very good agreement. The contamination trends derived from the new indices were consistent and took into consideration site specificity, toxicity and a three-tier effect levels (threshold, mid-range and extreme effects guideline values) that support their reliability in evaluating contaminated aquatic ecosystems.

**Key words:** Sediment pollution indices; Heavy metals; Sediment quality; Ecological risks; New pollution indices; Contamination assessment.

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