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Assessment of the Existing Level of Pollution due to Selected Heavy Metals in Surface Sediments of Negombo Lagoon, Sri Lanka

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Abstract

This study was conducted to evaluate the existing level of pollution with respect to selected heavy metals (Fe, Mn, As, Pb, Zn and Cu) in surficial sediments of Negombo Lagoon in Sri Lanka, which is constantly exposed to diverse human induced stresses. Additionally, this study investigated the application of X-ray fluorescence spectroscopy and pollution indices in assessment of heavy metal pollution. A total of 32 surface sediment samples covering the entire lagoon were collected using a grabber sampler and the concentrations of selected heavy metals were analysed using X-ray fluorescence spectroscopy. Furthermore, the concentrations of these heavy metals were used to assess the pollution status of the Negombo Lagoon by an integrated approach using pollution indices such as Enrichment Factor, Geoaccumulation Index and Pollution Load Index. The concentrations of the heavy metals studied were compared with the Canadian sediment quality guidelines which indicate the toxic concentrations of pollutants in sediments that affect aquatic organisms. The mean concentrations of all the heavy metals analysed were higher than the Threshold Effect Level (TEL) while the mean concentration of Arsenic (As) is greater than the Probable Effect Level (PEL) stated in the sediment quality guidelines. The results of Enrichment Factor revealed that the entire Negombo Lagoon is severely enriched by As, while minor enrichment of Copper (Cu) and Zinc (Zn) was observed across the lagoon, suggesting the contribution of anthropogenic sources for metal pollution in surface sediments of the lagoon. Moreover, the calculated Geoaccumulation Indices of the metals studied confirmed that surface sediments of the entire Negombo Lagoon is contaminated with As, Zn and Cu, emphasizing the influence of anthropogenic contamination. However, the concentrations of Manganese (Mn), Iron (Fe) and Lead (Pb) in surface sediments were within their natural range, evidently showing terrigenous origin. The calculated Pollution Load Index revealed that the Negombo Lagoon is considerably polluted by the heavy metals investigated. In conclusion, Arsenic (As) has shown a greater contribution to metal pollution while Zn and Cu were identified as minor enriched contaminants in surface sediments of Negombo Lagoon. The results of this study, while being useful as a reference data base, emphasized the need of effective management strategies for conservation of the lagoon before the pollution level becomes irreversible.

Keywords: Heavy metal, Pollution, Coastal contamination, Surface sediments, X-ray fluorescence