

ID 117

An overall analysis of trace metal pollution in inland and coastal sediments of Sri Lanka

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Abstract

Trace metal contamination in sediment layer is a major issue that aquatic environments encounter. Trace metals have a higher affinity to partition to the sediment layer posing ecological and public health risk. In Sri Lanka, a number of studies have reported trace metal contamination in sediments in both inland and coastal water bodies. Since individual studies are inadequate to assess the overall status of the contamination, this study aims to evaluate the status of trace metal pollution in both inland and coastal sediments based on a meta-analytical approach. Studies reporting trace metal contamination in sediments were acquired from the literature search conducted in Google Scholar followed by a grey literature search. After screening, 21 articles reporting the sediment contamination in past 30 years were analysed. Altogether, published results of over 490 samples were considered for this analysis. Range and median values were calculated. Nonparametric Kruskal-Wallis test was performed comparing trace metal contamination between inland and coastal sediments. Geo-accumulation index was calculated to assess the status of the sediment contamination. Predominantly detected trace metals in sediments were Pb, Cd, Cu, Cr, Zn, and As. In both inland and coastal sediments reported median concentrations followed the order Zn>Cr>Pb>Cu>As>Cd and the reported concentration ranges were 28.99-2672.00, 2.51-845.33, 16.00-1197.00, 3.60-7485.00, 0-188.00, 0-105.66 for inland sediments whereas 31.00-569.52.00, 0.26-270.00, 0.03-121.66, 1.96-96.00, 0.088-10.00, 0.01-3.91 for coastal sediments in mg/kg, respectively. From the available data, significant differences were observed in the contamination level of Pb, Cu, Cr and Zn between inland and coastal sediments ($p < 0.05$) whereas there was no significant difference ($p > 0.05$) in the respective As and Cd concentrations. In coastal sediments, calculated geo-accumulation index for each studied trace metal indicated the contamination status as "Unpolluted" ($I_{geo} < 0$). In inland sediments, Pd, Cd and Zn indicated a "Heavy pollution" ($3 \leq I_{geo} \leq 4$). Contamination of Cu and Cr indicated a "Moderate to Heavy pollution" ($2 \leq I_{geo} \leq 3$), while As indicated a "No pollution" ($I_{geo} \leq 0$). Overall, there was a high level of trace metal contamination in inland sediments compared to the coastal counterparts. This could be due to high anthropogenic intervention in inland waterbodies that responsible for trace metal loading. The findings of the present study provide an overall picture of the trace metal pollution of aquatic sediments in Sri Lanka.

Keywords: Coastal; Freshwater; Geo-accumulation index; Sediment pollution; Trace metals

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