

Bioavailability of heavy metals (Zn, Cu, Pb and Fe) in surface sediments of the Malacca River, Malaysia

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Abstract

Untreated chemical wastes from industrial and domestic areas could be the point sources of the metal contamination in the surface sediments of the Malacca River. Four different sampling sites along the Malacca River were chosen due to the nearby industrial and urban activities. The aqua-regia method and the sequential extraction technique were used to extract total- and bioavailable-concentration of heavy metals in the sediments. Concentrations of heavy metals were determined by an Atomic-Absorption Spectrophotometry (AAS). Results of heavy metals in the sediments showed that the mean concentration of Cu (367.8 µg/g) exceeded the Sediment Quality Guidelines (SQGs), thus potentially being able to affect the benthic macro-fauna adversely. The concentration of Zn (152.9 µg/g) and Pb (22.52 µg/g) were lower than Interim Sediment Quality Guidelines (Low). Geofractionation of the metals in the sediments showed that the Cu in sediments from anthropogenic sources had more than 93% bioavailability ([oxidisable-organic]>[exchangeable]>[acid-reducible]). In contrast, Zn, Pb and Fe were dominantly in the form of the lithogenic fraction by 55.4%, 97.4% and 93.8%, respectively with order of extraction [residual] > [oxidisable-organic] > [acid reducible] > [exchangeable] fraction.

Keywords: Geofractionation, bioavailability, heavy metals, sediments, Malacca River.

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