

Contamination status and ecological risk of heavy metals in surface sediment of Kelantan River and its nearshore area, Malaysia

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ABSTRACT

A study on contamination status and ecological risk of heavy metals in surface sediment at selected sites on Kelantan River and its nearshore area was carried out. Ten samples along Kelantan River and 25 samples from the nearshore were analyzed using inductively coupled plasma optical emission spectrometry (ICP-OES) to determine heavy metal concentrations. Sediment samples were also analyzed for particle size compositions, total organic matter and pH content. The average concentrations for As, Cd, Cr, Cu, Mn, Ni, Pb, Zn were 7.38, 1.31, 17.71, 11.40, 507.15, 5.97, 22.61, 32.95 mg/kg for riverine and 14.14, 4.59, 29.79, 14.07, 389.96, 9.65, 62.21, 41.04 mg/kg for nearshore samples respectively. The potential ecological risk index showed stations Bekok, Manek Urai, and RH under considerable risk followed by station Pasir Mas under moderate risk. The pollution load index classified four nearshore sites (KW10, KW17, KW18, KW37) as polluted. The geo-accumulation index (I_{geo}) categorized moderate contamination for Cd and Pb. The enrichment factor (EF) along the river categorized extremely high enrichment for Cd, and significant enrichment for As, Pb and Mn while Pb and As were under very high and significant enrichment in nearshore areas. Pb, Cu, Zn, As, Ni and Cr showed significant correlations with each other.

Key words | ecological risk assessment, heavy metal pollution, Kelantan River, nearshore, surface sediment

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INTRODUCTION

Environmental pollution associated with human activities along rivers, estuaries, and coastal waters is emerging as a global dilemma as these areas are vital for human survival. The global sediment flux from river to sea has increased significantly due to intense human activities and has resulted in material transport pattern variation in estuaries and adjacent sea areas. Over the years, anthropogenic activities in the river basin have caused the tropical rainforests to deteriorate. However, due to heavy precipitation sediment

flux increases from rivers to sea in tropical areas, complicated biogeochemical cycling processes have resulted in tropical estuaries and adjacent shelf areas (Syvitski *et al.* 2005).

Sediment, as a carrier of heavy metals and pollution indicator of the aquatic environment, plays an important role in the assessment of metal contamination in natural waters. Heavy metal pollution that is largely caused by rapid industrialization, urbanization and most anthropogenic actions eventually builds up in soil and sediment,