

Mobility and enrichment of trace metals in beach sands from the Miri Coastal area, Borneo.

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Miri City is the northern gateway of Sarawak and it is the birthplace for the Malaysian oil industry and has very dynamic coastal area which is mainly controlled by the Baram and Miri Rivers, supply significant load of fine sediment and heavy metals respectively to the coastal area. The present study area covers 74 km stretch between Baram River mouth and Bungai Beach, Sarawak, Malaysia. The characteristics of beach sand in this region are mainly controlled by the rivers apart from the coastal processes. Intensive sedimentation by the Baram River and excessive trace metal load by the Miri River are the significant environmental concerns in the study area. Thus, in order to investigate the mobility and enrichment of trace metals in the collected beach sands (n=57; 26 during monsoon; 31 during post monsoon season; POM), modified BCR sequential extraction procedure was adopted and elements associated with different fractions are reported. Among the studied elements (Cu, Cd, Co, Cr, Fe, Mn, Ni, Pb and Zn), Cd, Cu, Pb, and Zn were mainly associated with non-residual fractions while Fe, Co and Ni are mainly associated with residual fractions indicating their natural source while Cu (97%), Zn (92%), Cd (70%) and Pb (69%) concentrations are highly associated with non-residual fraction, indicating high mobility for these metals due to anthropogenic input, which may negatively impact on the coastal ecosystem. Mn and Cr also associated in residual fraction except some sampling locations where these are associated with mobile fractions. The average total concentration (residual + non residual fractions) was compared with standard environmental guideline values and was noted that Cu (both seasons); Cd and Zn concentrations (POM season) exceeded effective range low (ERL) values. Similarly Cu during POM exceeded ERM values, indicating that these elements may have an adverse effect on the living organisms of the studied coastal region. However, enrichment of elements in the non-residual fractions is not uniform over the entire stretch, instead, partly controlled by the local influences which are clearly demarcated by the statistical analysis.