

## Cu, Zn, Fe, and Mn in mangrove ecosystems (sediment, water, oyster, and macroalgae) of Sarawak, Malaysia

### ABSTRACT

Trace metals from industrial effluents discharged into Malaysian mangrove ecosystems, in Sarawak in particular, are of growing concern. Concentrations of trace metals (copper, manganese, iron, and zinc) were determined in sediment, surface water, pore water, green and red filamentous macroalgae (*Chaetomorpha* sp. and *Bostrychia* sp., respectively) and the rock oyster *Saccostrea cucullata* from three estuarine mangrove habitats in Sarawak (Kuala Nyalau, Bakam, and Miri), Malaysia. Trace metal concentrations detected in sediment of these mangrove ecosystems (except for Zn concentration in K. Nyalau) were considerably higher than those specified in USEPA sediment quality guidelines. Sediment trace metal concentrations differed significantly ( $p < 0.05$ ) among the stations studied. In pore water, trace metal concentrations were found to be higher than those in estuarine surface water. The order of trace metal concentrations in *Chaetomorpha* sp., *Bostrychia* sp. and *S. cucullata* was  $Fe > Mn > Zn > Cu$ ,  $Fe > Zn > Mn > Cu$ , and  $Fe > Mn > Zn > Cu$ , respectively. Bioconcentration factors (BCFs) in macroalgae and in one oyster species were inconsistent, although BCFs were much higher in water than in sediment. In sediment, the BCF of Mn was the highest among trace metals in *S. cucullata*, followed by Cu and Zn. BCF of iron (Fe) was relatively low in spite of its high concentration in sediment and water. The findings of this study may prove helpful in carrying out future studies aimed at detecting a potential biomarker in coastal ecosystems of Sarawak, Malaysia.

**Keyword:** Trace metals; Mangrove; Estuary; *Chaetomorpha* sp.; *Bostrychia* sp.; *Saccostrea cucullata*