TRACE METALS IN COASTAL INVERTEBRATES AND SEAWEEDS AROUND PENINSULAR MALAYSIA

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Introduction

The coastal environment of Malaysia receives input of organic and inorganic chemicals via riverine input and direct marine waste disposal outflows. Information on the fate, exposure and effects of heavy metals in tropical coastal environments is extremely lacking. The fate of pollutants entering the marine environment may be studied by measurements of these pollutants in marine bioindicators such as molluscs and barnacles (Phillips and Rainbow, 1993).

Trace metal content of most molluscs is related to body size (Boyden, 1977). Seaweeds are also commonly used to study pollution status of coastal environments as they tend to indicate the soluble trace content of the surrounding waters (Cullinane et al. 1987). Using these indicators, the status of the coastal environment of Peninsular Malaysia with respect to trace metals was thus investigated.

Materials and Methods

Molluscs and seaweeds were collected from rocky-shore environments from around Peninsular Malaysia. *Saccostrea* sp., *Nerita* sp., *Thais* sp., *Littorina* sp. , *Neritina* sp., *Patella* sp. and the barncale, *Tetraclita* sp. and seaweeds were collected from the low-tide mark and immediately kept on ice. Water samples were also collected for trace metal analysis. Salinity was measured at each sampling site. The molluscs and barnacle were sorted according to size classes and the soft tissues taken and dried at 90°C. Seaweeds were similarly dried. The animal tissues were then digested in nitric acid with additions of hydrogen peroxide, while seaweed digestion used nitric and sulphuric acid mixtures. The samples were made up with Milli-Q water and metal (Cd, Cu, Pb, Zn, Cr, Fe) content measured by flame and grahite furnace atomic absorption spectrometry. Standard reference materials, DORM-2, Dogfish Muscle and NBS 1575a Pine Needle were similarly digested and analysed. Metal recoveries were within the certified values. Data were analysed by one-way ANOVA to determine variation in metal concentration between sampling locations.

Results and Discussion

Metal contents differed to a large extent between species, as expected as different organisms differ in their response to metals. Zn and Cu were highest in oysters, *Saccostrea* sp. and *Thais* sp.with levels of up to 5793 μgg^{-1}Zn and 943 μgg^{-1}Cu while levels of Cr, Pb and Cd varied between species and locations. *Thais* sp.had some of the highest Cd levels (up to 12.6 μgg^{-1}) and this is because it is a carnivore and the high levels of metals were concentrated as a result of feeding on the oysters.(Phillips and Rainbow, 1993). The order of bioaccumulation of metals for *Saccostrea* sp. and *Thais* sp were Zn>Cu>Fe>Cr>Cd>Pb while for *Nerita* sp., *Littorina* sp. and *Patella* sp. were Fe>Zn>Cu>cr>Cd>Pb. The trend for the barnacle, *Tetraclita* sp. and *Neritina* sp. were in the order Fe, Zn, Cu>Cr>Cd>Pb. Metal accumulation trends in the organisms studied in relation to body size differed between the metals concerned and sampling locations. The trend noted for a metal in a particular location was not necessarily the same for other locations. This may be due to differences in metal input between locations and differences in food availability, growth rates and other biological factors between locations. Cd, Cr, Pb, Zn and Fe content in some of the species studied showed and inverse relationship with body size with the smallest individuals having the highest levels but only in certain sampling locations. This indicates that the metal content were being diluted by body mass increase with age, as is the usual case in unpolluted environments or in cases where accumulation of metals do not outstrip body growth. This trend was observed for example with Cd in *Saccostrea* sp at Pantai Bari, Terengganu and *Thais* sp. at Teluk Sisik, for Cr and Pb in *Saccostrea* sp. at Teluk Kalong, and Zn in *Patella* sp. and *Saccostrea* sp at Teluk Kalong. This result is in general agreement with other studies (Usero et al. 1996).

For the majority of metals and sampling locations there was no significant correlation with body size ie. metal content in tissues were independent of body size. A positive correlation of some trace metals with body size, ie. increase in metal body burden with increase in body size was found mostly for *Saccostrea* sp. specifically for Zn at Tj. Sura, Cr at Teluk Kalong, Cu and Cd at Pantai Bari and Pb at Teluk Kalong, Pantai Bari, Telaga Simpul, Tanjung Sura and UPM COMAS. Heavy metal content in molluscs from the west coast of Peninsular Malaysia was higher than in animals from the east coast.

For the studies on seaweeds, in general levels of trace metals in seaweeds were higher in samples from sites with industrial development. *Padina australis* was found suitable for indicating Zn, *Sargassum* sp. for Cu and *Padina minor* for Cd.

Conclusions

Molluscs may be used as indicators of trace metal input into the marine environment and that no single organism can fulfil the need for monitoring a range of metals as metal body burdens are dictated by a wide range of physical and biological factors. *Saccostrea* sp., *Thais* sp. and *Tetraclita* sp. are the more suitable organisms due to their wider availablity along the coastline and the positive increase in body metal content with increase in size (esp. *Saccostrea* sp.). Seaweeds are less available on both sides of Peninsular Malaysia and thus limit their use as indicators. In addition particular seaweed species was only suitable for single metals.

References

Boyden, C.R. 1977. Effects of size upon metal content of shellfish. *J. Mar. Biol. Ass.* UK. 57: 675-714.

Cullinane, J.P., Doyle, T.M. and Whelan, P.M. 1987. Use of seaweeds as biomonitors of zinc level in Cock Harbour, Ireland. *Hydrobiologia.* 151: 285-290.

Phillips, D.J.H. and Rainbow, P.S. 1993. Biomonitoring of trace aquatic contaminants. Applied Science Publishers, Barking, p. 371.

Usero, J., Gonzalez-Regalado, E. and Gracia, I. 1996. Trace metals in the bivalve mollusc *Chamelea gallina* from the Atlantic coast of Southern Spain. *Mar. Pollut. Bull.* 32(3): 305-310.

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