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Apportionment of selected heavy metals among abiotic and selected biotic components of the Negombo lagoon

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The present study investigates the apportionment of heavy metals among selected abiotic and biotic components of the Negombo lagoon, for which no information on this aspect is currently available. Water, soil and sediment samples (n=25), mangrove bark/leaves (n=25), snails, fish and shell fish (n=10) were collected and analyzed for heavy metals using microwave digestion followed by ICP – OES. The toxic heavy metals As, Cd, Cr, Pb and Hg were recorded in abiotic and biotic components, in varying amounts. Of these only Cr (N/D - 0.05 mg/ dm^3) was detected in water. Highest ranges in both sediment and soil were also of Cr (sediment 14.45 - 23.24 and soil 5.44 - 32.88 mg/kg), with some sites having limits that exceeded CEA values. From among the abiotic components analyzed, the lowest levels were recorded in water. What was of significance is the fact that, despite the concentrations of the toxic metals in water being below detectable limits, bioaccumulation was evident in the sampled mangrove plants and fauna, implying bio-concentration. Mangrove bark and leaves recorded the presence Cr, Pb and Hg. Toxic heavy metals were also recorded in snails (e.g. up to a maximum (mg/ kg) of 0.12 for Hg, 5.17 for As and 0.83 for Cr, Pb not detected) and in edible species of fish and shell fish (eg. up to a maximum (mg/kg) 21.42 for As, 0.42 for Pb, 0.48 for of Hg and 3.31 for Cr). From among the essential heavy metals (Ba, Cu, Fe, Ni, Sb, Se, V and Zn) the field levels of some exceeded permissible levels at some locations. For example, the levels of Fe (0.82 - 39.70 mg / dm^3) exceeded the acceptable limits of the CEA at one location. Some of the bio-concentration factors recorded were soil: snails for As (4), Cu (79) and Zn (13), water: fish ($dm^3\,kg^{-1}$) for Cr (122), Cu (551), Fe (63) and Zn (2229), water: crab ($dm^3\,kg^{-1}$) for Fe (187) and Zn (2719), water: fish ($dm^3\,kg^{-1}$) for Fe (1169), and Zn (17070). Although some of these metals are essential, the recorded bio-concentration factors may suggest potential toxicity, if present in concentrations beyond threshold levels. Overall most heavy metals depicted the trend sediment > soil > fauna > bark > water > leaves. However, interestingly the specific patterns of accumulation differed between the taxa. For instance, in snails the trend in terms of concentration was Cu > Zn > As, while in crabs it was Zn > Ba> V > Fe. These findings, particularly the levels of As, Cr, Hg and Pb, highlight the dangers to flora and fauna inhabiting the lagoon environment as well as for those consuming these contaminated species, reiterating that seemingly harmless levels of toxic waste in water may mask the realistic accumulation levels in other components of the environment.
Keywords: Heavy metals, lagoon, biotic and abiotic components, bioaccumulation

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