

Heavy metal contamination in urban surface soil of Klang district (Malaysia)

ABSTRACT

This study aimed to determine bioavailability of heavy metal concentrations (Al, Fe, Zn, Cu, Co, Cd, Pb and Cr) in 76 urban surface soil samples of Klang district (Malaysia). This study also aimed to determine health risks posed by bioavailability of heavy metals in urban soil on adults and children. For bioavailability of heavy metal concentrations, a physiologically bioavailability extraction test in vitro digestion model was used. Mean values of bioavailability heavy metal concentrations for this study were found to be the highest in Al (25.44 mg/kg) and lowest in Cr (0.10 mg/kg). Results of Spearman correlation coefficient (r) values showed significant correlations were observed for Al-Fe ($r = 0.681$), Cd-Co ($r = 0.495$), Cu-Zn ($r = 0.232$), Fe-Pb ($r = 0.260$), Fe-Zn ($r = 0.239$). For cluster analysis, output showed that these heavy metals could be classified into four clusters: Cluster 1 consisted of Cd, Cr, Co, and Pb; Cluster 2 consisted of Zn and Cu; Cluster 3 consisted of Fe; and Cluster 4 consisted of Al. For Clusters 1 and 2, anthropogenic sources were believed to be the sources, while for Clusters 3 and 4 the heavy metals originated from natural sources. Health risks were determined in adults and children through health risk assessment. For adults, Hazard Quotient (HQ) value was <1 , indicating no non-carcinogenic risk, while for children, the HQ value was >1 , indicating a non-carcinogenic risk. Meanwhile, for carcinogenic risk, heavy metal contamination in the Klang district might not pose a carcinogenic risk to adults while it may pose a carcinogenic risk to children because TR values in this study were $>1.0E-04$ for children. Output has identified the general health risk in the Klang district. Moreover, this study's findings will contribute to fill in the gap of knowledge on heavy metals' impacts on human health and urban development in the Klang District.

Keyword: Urban soil; Heavy metals; Bioavailability; Health risk assessment