

Spatial assessment of heavy metals in surface soil from Klang District (Malaysia): an example from a tropical environment

ABSTRACT

Heavy metals (Al, Cd, Co, Cr, Cu, Fe, Pb, Zn) in surface soil of Klang district were determined and multivariate analysis was used to understand their potential sources. The total and bioavailability of concentrations were used in identifying the potential risks to the ecology and human health. The means for the total heavy metal concentrations were found to be in the order of Fe > Al > Zn > Pb > Cu > Cr > Co > Cd, while the means for the bioavailability concentrations were found to be in the order of Al > Fe > Zn > Cu > Co > Cd > Pb > Cr. Principal Component Analysis showed Principal Component 1 as being of natural origin whereas Principal Components 2, 3, and 4 were associated with mixed anthropogenic sources, such as traffic and industrial emissions, organic matter, and granulometric fractions. Potential ecological risk assessment indicated an overall low ecological risk. Spatial assessment of non-carcinogenic risks showed that the Hazard Index values were more than one in Johan Setia, due to biomass burning of peat swamps exploited for agricultural development. While for spatial assessment of carcinogenic risks, the Lifetime Cancer Risk values were in the limit (1×10^{-5}), indicating low cancer inducing risks. Nevertheless, with intense development pressure in the Klang district could overlap pollution inputs in the future.

Keyword: Heavy metals; Surface soil; Multivariate analysis; Ecological risk; Human health risk; Spatial assessment