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Spatial Variability of Cadmium and Lead in Surface Soils in-relation to Landuse and Topography

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Abstract

Accumulation of trace elements in soils has become an environmental concern. Understanding spatial variability of trace elements in relation to point and non-point sources is important to identify threats and monitoring mechanisms. Objectives of this study were to explore the spatial variability of cadmium (Cd) and lead (Pb) in relation to the land-use and topography. One hundred and thirty seven surface soil (0-15 cm) samples were collected from a tropical Ultisol soil scape in up-and mid-country in wet zone in Sri Lanka, representing tea, forest, and urban land uses. Total Cd and Pb concentrations were determined by digesting the soils using aqua regia (Trace-metal grade) and analysed using Graphite Furnace Atomic Absorption Spectrophotometer, following USEPA method 7010.Extractable concentrations of Cd and Pb were determined using Mehlich 3 extraction. Soil pH, electrical conductivity, cation exchange capacity, available P, total P, amorphous Fe, total Fe and Mn were determined using standard methods. Total and Mehlich 3 concentrations of trace elements showed positively skewed data distributions. Across all the land uses, the total Cd and Pb concentrations ranged from 0.05 to 0.40 mg kg^{-1} (median: Tea=16, Urban=13, Forest=19) and 3 to 37 $mgkg^{-1}$ (median: Tea=0.13, Urban=0.14, Forest=0.16) respectively. Mehlich 3 Cd and Pb concentrations were low and ranged from 0.01 to 0.62 $mgkg^{-1}$and 1 to 26 $mgkg^{-1}$, respectively. Potential bioavailability of Cd in tea, urban and forest land uses was 40%, 32% and 32% respectively, meanwhile for Pb it was 40%, 60% and 40% respectively. Regression analysis explained that the relationship of total Pb and Mehlich 3 extractable Pb concentrations with elevation was significant ($p<0.05$); However, only about 4-7% of variation of them was explained by elevation. Cd concentration was not significantly related to elevation. Variability of concentrations of Cd and Pb were not related to land use. Soil associations were also not related to spatial variability of total concentrations of Cd and Pb in soils. Spatial variability of total concentrations of Cd and Pb will be presented with maps including land use, soil association and elevation distribution.

Keywords: Potential bioavailability, Spatial variability, Topography, Trace elements

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