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BIOAVAILABILITY OF SELECTED TRACE ELEMENTS IN A DRY ZONE SOIL MAP UNIT OF SRI LANKA

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Available trace element concentration in a soil determines the potential environmental risk. Furthermore, available fraction as a percentage of total metal content is a valid indicator of the relative availability of metals in soils. Solubility and bio-availability of trace elements vary widely due to changes of physicochemical properties of soil. Therefore, this study evaluated the total and Diethylenetriaminepentaacetic acid (DTPA) extractable fractions of Cu, Pb, Ni, Zn and Cd in soils and their relationships with soil properties in soil map unit of the dry zone of Sri Lanka.

Eighty six soil samples (0-30 cm) were collected from Madawachchiya-Ranorawa-Elayapattuwa-Hurathgama-Nawagattegama soil map unit of the Dry-zone of Sri Lanka. Soils were analyzed for pH (1:2.5 soil: 1M KCl), Electrical Conductivity (EC) in 1:5 suspension, organic carbon (OC) content and texture. Soils were digested with 4M nitric acid and analyzed for total Cu, Pb, Ni, Zn and Cd concentrations. Standard reference material (SRM-2586) from National Institute of Standard and Technology was used for the quality control. Bioavailable fractions were analyzed using DTPA extraction at pH 7.3.

Satisfactory recoveries were obtained with the SRM-2586 for Cd (87%) and Pb (92%) in 4M nitric acid digestion. Microwave digested SRM sample tallied with the given certified values for Cd and Pb ensuring the validity of the data generated. Organic carbon percentages ranged from 0.12 to 1.9% indicating low organic matter in studied soils. Clay percentage of soils ranged from 2.24-41.71% reflecting a high textural variability within the map unit. EC had the highest coefficient of variance (107.81%) indicating a wide range of distribution for EC values. All the soils were in low or no salinity level according to observed range (0.02-0.41dS/m) for EC. Soil pH values were at the range 4.12-8.03. Mean DTPA extractable and total metal contents followed the order of Pb (2.01 $mgkg^{-1}$) > Cu (0.62 $mgkg^{-1}$) > Ni (0.5 $mgkg^{-1}$) > Zn (0.29 $mgkg^{-1}$) > Cd (0.05 $mgkg^{-1}$) and Zn (20.12 $mgkg^{-1}$) > Ni (10.65 $mgkg^{-1}$) > Cu (9.74 $mgkg^{-1}$) > Pb (7.67 $mgkg^{-1}$) > Cd (0.62 $mgkg^{-1}$). Total metal contents were below the mandatory limits given by the European Union. Furthermore, mean value of comparative mobility followed the order of Pb (31.92%) > Cu (6.81%) > Ni (5.79%) > Zn (1.42%). Study revealed that the relative availability of Pb is comparatively high compared to that of Cu, Ni and Zn in soils. Relative mobility of Cd was not calculated since more than 50% of the samples fall below the detection limit (0.012 $mgkg^{-1}$). Organic carbon content was a key property which controlled the total Cu (r=0.37), Pb (r=0.24) and Zn (r=0.51) and DTPA extractable Cu (r=0.27), Pb (r=0.23) and Zn (r=0.3) whereas DTPA extractable Zn (r=-0.32), Ni (r=-0.27) and total Zn (r=-0.22) contents were also related to soil pH. DTPA extractable Cu (r=0.27) and Zn (r=-0.26) were related to soil EC. Clay percentage was also related to the DTPA extractable Cu (r=-0.27), Pb (r=-0.23) and total Pb (r=0.4) contents in soils.

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