

## **Concentrations and chemical forms of heavy metals in some ultisols in Johore, Peninsular Malaysia**

### **ABSTRACT**

The concentrations of heavy metals in soil are associated with biological and geochemical cycles and are influenced by anthropogenic activities such as agricultural practices, industrial activities and waste disposal. A total of 36 surface soil samples (Typic Kandudult, Rengam Series) were collected from some major vegetable growing areas developed over granite. Twelve soils from areas not cultivated with vegetables but also developed over granite were also sampled for background values. The pseudo-total heavy metals, (Cu, Pb, Zn and Ni) were determined by the aqua-regia method. Chemical properties such as pH, organic carbon and CEC were also analysed. Some selected cultivated soil samples (24 of Ultisols and 12 of background soils) were analysed for chemical partitioning using a modified Tessier's procedure (F1: exchangeable fraction, F2: fraction bound to organic matter, F3: fraction bound to amorphous iron oxides and F4: residual fraction). Mean values of the total heavy metals for the cultivated soils are Cu (23.3 mg kg<sup>-1</sup>), Pb (18.0 mg kg<sup>-1</sup>), Zn (49.4 mg kg<sup>-1</sup>) and Ni (6.0 mg kg<sup>-1</sup>). Comparison of these values to the contents in the background soils show that Cu and Zn have significantly increased. However, all these values are below the contaminated levels established for the country's agricultural soil limits (95th percentile). From the partitioning study, the general trend in the Ultisols for Pb and Ni is residual > oxalate >exchangeable>organic. For Zn and Cu, the oxalate extractable phase is highest followed by the residual phase. Zinc and Pb contents in the soils are also positively correlated with the pH of the soil.

**Keyword:** Copper; Zinc; Vegetable soils; Chemical fractionation