

## Cadmium and zinc in acid tropical soils: II. influence of humic acid addition on soil properties and their adsorption

### ABSTRACT

Cation exchange capacity (CEC) is one of the most important factor in influencing the adsorption of cadmium (Cd) and zinc (Zn) in some acid tropical soils from Tawau, Sabah, Malaysia. The effect of humic acid addition on chemical properties of the soils was evaluated in an incubation study. Humic acid was added to the three soils, Katai (Typic Hapludult), Koyah (Oxic Dystropept), and Table (Typic Hapludox) at concentrations of 0, 50, 100, 150, and 350 mg carbon (C) kg<sup>-1</sup> soil and incubated for 30 days. Changes in pH, organic-C, CEC, and adsorption of Cd and Zn were measured on these soils. With the exception of the Table soil, soil pH increased with increasing levels of humic acid addition; the same trend was also observed for organic-C and CEC of the soils. The adsorption of Cd and Zn by the soils can fully be explained by the Freundlich equation ( $r = 0.916^{**} - 0.987^{**}$ ). The soils had a greater ability (almost 2-fold) to adsorbed Zn compared to Cd. The highest Cd and Zn adsorbed by the soil were 22.32 mg Cd kg<sup>-1</sup> for the Table soil and 42.3 mg Zn kg<sup>-1</sup> for the Koyah soil. Sequential extraction of soil amended with humic acid showed that Cd and Zn can be partitioned into five operational geochemical fraction viz. exchangeable, bound to carbonate, bound to iron (Fe)-manganese (Mn) oxides, bound to organic matter, and residual forms. A larger portion (50%) of Cd was in exchangeable form and the lowest (9%) in organic-bound form. Zinc in Fe-Mn oxides form accounted for about 49% of the total 5% in organic-bound form.

**Keyword:** Humic acid; Soil; Adsorption; Acid tropical soil; Cadmium; Zinc