Cadmium and zinc in acid tropical soils: I. soil physico-chemical properties effect on their adsorption

ABSTRACT

Interactions of heavy metals, such as cadmium (Cd) and zinc (Zn) at the soil particle surfaces play an important role in controlling their leaching losses to the underground water and their availability to plants. Adsorption isotherms for eight soils [Apas (Rhodic Hapludox), Batang (Typic Plinthudult), Jarangan (Xanthic Hapludox), Katai (Typic Hapludult), Koyah (Oxic Dystropept), Lumisir (Typic Plinthudult), Paliu (Typic Hapludult), and Table (Typic Hapludox)] from major cocoa (Theobroma cacao L.), oil palm (Elaeis guineensis Jacq.), and rubber (Hevea brasiliensis Muell Agr.) growing areas in Tawau, Sabah, Malaysia were determined at concentrations of 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100 mg Cd or Zn mL-1 in a 0.025M calcium chloride (CaCl2·2H2O) solution. The adsorption of Cd and Zn by the soils can successfully be explained by the Freundlich equation (r = 0.832** - 0.977**) as compared to the Langmuir equation (r = 0.130ns - 0.977**). The ability of the soils to adsorb Cd and Zn differed markedly with the highest obtained in Table soil (18.4 mg Cd kg-1 soil) for Cd and Koyah soiil (29.97 mg Zn kg-1) for Zn. The important soil parameters in controlling the adsorption of both Cd and Zn in acid tropical soils were cation exchange capacity (CEC) (r = 0.888**), total aluminium (Al) content (r = 0.675**), and extractable-Al (r = 0.875**).

Keyword: Adsorption; Acid tropical soils; Cadmium; Zinc; Soil