



Ionic strength and pH_{50} effects on cadmium, copper, nickel and zinc adsorption in variable charge soils

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Adsorption is the net accumulation of chemical species at the soil-solution interface, with the decrease of its concentration in soil solution. Is a phenomenon that depends on several soil attributes and the knowledge of its mechanisms is of concern. The pH is the most important environmental factor influencing not only the chemistry of heavy metals in solution, but also its interaction with soil solid phase. The pH value at which half of the added metal is adsorbed is designated pH_{50} , which values for a series of bivalent metal cations at the same initial concentration and in the same background electrolyte solution offer a relative measure of the selectivity of the adsorbent for the metal cations. The adsorption of metal cations was studied in surface and subsurface samples from an alfisol [Rhodic Kandiudalf (RK)] and from highly weathered oxisols [Anionic "Rhodic" Acrudox (AR); Anionic "Xanthic" Acrudox (AX)] of the State of São Paulo, Brazil. Adsorption envelopes were elaborated by reacting soil samples with individual aqueous solutions containing nitrate salts of the adsorptive heavy metal (Cd, Cu, Ni and Zn) at the initial concentration of 5 mg L^{-1} , but having an increasing pH value from 3.0 to 8.0. To the alfisol (RK), pH_{50} values for all metal cations showed no variation with respect to sampling depth. For oxisols, pH_{50} values were higher for metal cation adsorption in surface samples than for subsurface ones. Fenolic and carboxyl groups of organic matter can deprotonate even in low pH values and this fact favors the increase of the negative charge, available for electrostatic attraction. Most of 50% of Cu initially added were adsorbed by soils along the pH range studied. This fact indicated that the adsorption of 2.0 mg L^{-1} of Cu can occur at pH values below 3.0. Cadmium exhibited the highest pH_{50} values, independently of the depth. Nickel and Zn presented intermediate pH_{50} values. As the smaller the pH_{50} , the

more selective the adsorbent for the metal, the follow affinity sequence was suggested: $\text{Cu} > \text{Zn} > \text{Ni} \cong \text{Cd}$. Ionic strength played important effect on pH_{50} for all metal cations, mainly in alfisol. For surface samples from oxisols, pH_{50} values increased as the ionic strength increased. Conversely, decrease of pH_{50} values was observed in subsurface layers. As the major adsorption of Cu is mediated by inner-sphere complex formation, ionic strength showed no effect on Cu retention, included its pH_{50} values.