
Brazilian Red Latosol a Typic Soil as an Exchanger: A Thermodynamic Study Involving Cu, Zn, Cd, Hg, Pb, Ca and Na

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Abstract: The thermodynamic cationic exchange process involving divalent (Cu, Zn, Cd, Hg, Pb and Ca) and monovalent (Na) cations in Brazilian red Latosol soil was studied. Using a batchwise method, the exchange was monitored as a function of the added cation concentration and the aqueous suspension of the soil at different temperatures. The isotherm series obtained were adjusted to a modified Langmuir equation, whose results were compared with the proposed Rawat method. The cationic exchange equilibria constants ($\ln K$) vary from 1.97 to 9.80 for the Langmuir equation and 7.06 to 13.50 for the Rawat method. The variation in enthalpies obtained by applying the van't Hoff equation gave, for Langmuir and Rawat procedures, exothermic values for Cu (65.5 and 97.3), Cd (36.9 and 45.6) and Pb (43.0 and 50.7) kJ mol^{-1} , and endothermic values for Zn (40.8 and 30.5), Hg (15.0 and 11.3), Ca (30.4 and 40.0) and Na (32.7 and 42.3) kJ mol^{-1} . The exchanges proceed spontaneously, as indicated by the free energy values: Cu (14.2 and 27.2), Zn (21.6 and 32.0), Cd (16.1 and 23.2), Hg (13.8 and 22.9), Pb (22.6 and 28.3), Ca (17.0 and 25.9) and Na (9.9 and 19.3) kJ mol^{-1} at 323 K. These results suggest that the interaction occurs by complex formation between the organic matter of the soil matrix and the cations dispersed in aqueous solution.

Key Words: Adsorption • Ionic Exchange • Isotherm • Langmuir Method • Red Latosol Soil

Clays and Clay Minerals; April 1997 v. 45; no. 2; p. 125-131; DOI: [10.1346/CCMN.1997.0450201](https://doi.org/10.1346/CCMN.1997.0450201)

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