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Langmuir and Freundlich parameters of selenium adsorption

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Selenium is a trace element present naturally in soils. It is an essential element for animals and plants because it is required for normal enzyme function. Thus, Se has been listed as a priority pollutant and attention has been paid to its biogeochemistry and environmental behavior. Soils can be contaminated by many human actions including discharge of Se at the soil surface, through disposal of city wastes, sewage sludge and pesticide application, or the subsurface releases from landfills. The understanding the chemistry of selenium in soils, especially with amphoteric behavior, is important for prediction of the environmental consequences and for development of prevention/remediation strategies. Surface samples (0.0-0.2 m) of 3 uncultivated tropical soils [one Typic Hapludoxes (TH), one Rhodic Acrudox (RA) and one Anionic Acrudox (AA)] were extracted from native forests and from reforestation sites from São Paulo State, Brazil, in order to obtain a large variation of attributes from highly weathered soils. Adsorption isotherms were elaborated from batch adsorption experiment. Samples (2g) of each soil were mixed with 20 ml aliquots of a 0.01 mol $L^{-1}NaNO_3$ background solution containing 5; 10; 25; 50; 100 and 250 mg L^{-1} of Se (Na_2O_3Se). The soil-solution system were shaken for 24 h at 120 osc min^{-1}, and the solid and liquid fractions were separated by centrifugation at 14000 g. An

aliquot of the supernatant was sampled and analyzed by atomic spectrometry absorption (AAS). Se adsorption ($[Se]_{ads}$) was estimated by subtracting the amount Se determined in the equilibrium solution ($[Se]_{eq}$) from the Se initially added. Adsorption isotherms ($[Se]_{ads}$ *vs* $[Se]_{eql}$) were elaborated from experiments results and compared with isotherms fitted according Lagmuir ($[Se]_{ads}$=Ads_{max}($K_L[Se]_{eq}$/1+ $K_L[Se]_{eq}$) and Freundlich (Ads=$K_f C_{eq}^n$) equations. Langmuir equation fitted well to the soil experimental results, when compared with Freundlich model. The RA and AA isotherms following L-type (exponential) behavior, characterized by a decrease in the adsorption when the adsorption surface becomes saturated with the solute, while TH isotherms following C-type (linear) behavior, suggesting that the number of available ligands for the adsorption stayed constant or it was increased according to the addition of larger concentrations of the solute. All parameters pointed AA with high affinity and potential for Se retention. No correlations were observed between soil attributes and parameters Ads_{max} and n. Langmuir coefficient (K_L) was correlated with organic carbon content (r = 0,99*) and with amorphous iron content (Fe_{ox}) (r = 0,99*). Freundlich (K_f) coefficient (K_f) was correlated with organic carbon content (r = 0,99*), with amorphous iron content (r = 0,99*) and with crystalline iron content (Fe_{CBD}) (r = 0,99*).