



Parameters of selenium adsorption in Brazilian Oxisols

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Selenium (Se) has emerged as an important environmental contaminant, and has gained the attention of natural resource managers and water quality regulators around the world. In nature, Se exists in different oxidation states, but selenate (SeO_4^{2-}) should be found in oxidizing environments. Selenate is a weakly basic group VI oxyanion of environmental interest due to its potential for bioaccumulation in food chain, toxicity to plants and animal, and bioavailability and mobility in natural aqueous and terrestrial systems. Selenium pollution is a worldwide phenomenon and is associated with a broad spectrum of human activities, ranging from the most basic agricultural practices, such as the use of pesticides and fertilizers, to the incorrect destination of sewage sludge originated from urban and industrial processes. Therefore, understanding the chemistry of selenate in soils is important for minimizing potentially hazardous environmental effects. Sorption studies have been utilized to understand mobility and bioavailability of Se in oxyhydroxides, clay minerals and in soils from temperate regions. However, very limited information is available on Se adsorption behavior in highly weathered tropical soils. Surface samples (0.0-0.2 m) of 8 uncultivated tropical soils [three Typic Hapludoxes (TH-1, TH-2 and TH-3), two Rhodic Eutrudoxes (RE-1 and RE-2), two Xanthic Hapludoxes (XH-1 and XH-2), a Rhodic Hapludox (RH), a Rhodic Acrudox (RA) and an 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 $0.01 \text{ mol L}^{-1} \text{NaNO}_3$ background solution containing 5; 10; 25; 50; 100 and 250 mg L^{-1} of Se ($\text{Na}_2\text{O}_3\text{Se}$). 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 ($[\text{Se}]_{ads}$) was estimated by subtracting the amount Se determined in the equilibrium solution ($[\text{Se}]_{eq}$) from the Se initially added. Adsorption isotherms ($[\text{Se}]_{ads}$ vs $[\text{Se}]_{eq}$) were elaborated from experiments results and compared with isotherms fitted according Langmuir equation: $[\text{Se}]_{ads} = \text{Ads}_{max} (\text{K}_L [\text{Se}]_{eq} / (1 + \text{K}_L [\text{Se}]_{eq}))$. Langmuir equation fitted well to the soil experimental results, and all the isotherms following L-type behavior. Variations in Se adsorption performance by the soils were also observed depending on the soil and Se initial concentration, which reflected the maximum adsorption (Ads_{max}) and the Langmuir affinity coefficient (K_L). Selenium Ads_{max} were between 135 (TH-3) and 2.245 mg kg^{-1} (XH-1), while K_L values varied from 0.002 (TH-2) to 0.326 L kg^{-1} (TH-3). They were in agreement with the wide variation found in bibliographic references. As there are few numerical parameters related to Se adsorption in Brazilian tropical soils, these results are important as references to take decisions and to focus on prevention or remediation strategies in contaminated areas.