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Sorption–desorption of Sb(III) in different soils: kinetics and effects of the selective removal of hydroxides, organic matter, and humic substances

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Abstract

To examine the Sb(III) retention by three soils with different properties (Ferrosol, Primosol and Isohumosol), kinetic batch experiments were carried out for Sb(III) adsorption–desorption, followed by Sb release using a sequential extraction procedure. In addition, hydroxides, organic matter, and humic substances were selectively removed by washing the soil with oxalate, sodium dithionate–citrate–bicarbonate, H_2O_2, and NaOH. The effects of removing these substances on Sb(III) retention were investigated by comparing the Sb distribution coefficients and desorption rates. The results indicated that exogenous Sb(III) was adsorbed onto all three soils rapidly at first and then more slowly. After 168 h of adsorption, most of the adsorbed Sb(III) was irreversibly retained in stable fractions by the Ferrosol. Oxidation reactions negatively affected Sb(III) retention by the Primosol and Isohumosol, and a large proportion of the Sb adsorbed remained mobilizable. The oxalate washing markedly enhanced Sb retention but the sodium dithionate–citrate–bicarbonate washing decreased Sb retention in all three soils. The H_2O_2 and NaOH washings affected Sb retention by the Ferrosol more than Sb retention by the Primosol and Isohumosol. Changes in the pH and hydroxides caused by the washing strongly affected Sb