

Oxidation Rate and Phases of Chromium in Soils: Implication for Land Disposal

Jae Gon Kim and Joe B. Dixon

Texas A&M University, Department of Soil and Crop Sciences, College Station,
TX77843-2474, USA

Land disposal of chromium (Cr) containing waste is an environmental concern due to the oxidation and the subsequent toxicity and mobility of Cr in soils. The oxidation rate of Cr(III) to Cr(VI) and the phases of oxidized Cr(VI) (labile and solid forms) in 11 moist soil samples were determined. Chromium oxidation rate in the soils reached a steady state or decreased after 16 days reaction. The major controlling factors for Cr oxidation capacity of the soils were content of reactive manganese (Mn) oxide and pH. The Cr oxidation in the soil samples increased as increasing reactive Mn oxide content and decreasing pH. Content of water extractable organic carbon and cation exchange capacity as minor factors had negative effect on the Cr oxidation capacity. Content of iron oxide had a positive effect on the Cr oxidation capacity and it was also a minor factor. Concentration of labile Cr(VI) (adsorbed and solution forms) in the soils was controlled by barium chromate (BaCrO_4) without barite (BaSO_4) or Cr substituted barite [$\text{Ba}(\text{S,Cr})\text{O}_4$] in the presence of barite. The soil with barite had much lower concentration of labile Cr(VI) than the other soils. Based on the laboratory experimental data for Cr oxidation rate and phases of oxidized Cr(VI), the soil with low content of reactive Mn oxide, high pH, and barite recommended for the safe land disposal site for Cr containing waste.

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