

Adsorption Behavior of Aqueous Uranium on Kaolinite under Various Disposal Conditions

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This work investigated the adsorption behavior of aqueous uranium on kaolinite under various disposal conditions. Batch-wise adsorption and precipitation experiments and equilibrium model calculation were performed over a pH range of 4–10 and CO₂ concentration range of 0%, 0.03%, and 10%. Experimental precipitation behaviors are in agreement with the results of equilibrium model calculations using the geochemical code MINTEQA2. Aqueous species of UO₂²⁺ exists mainly at pHs 5 or below and solid phases of β-UO₂(OH)₂ at a neutral pH. The aqueous phases having a negative charge such as UO₂(OH)₃⁻, (UO₂)₂CO₃(OH)₃⁻, and UO₂(CO₃)₃⁴⁻ are dominant species at a high pH. Adsorption behavior of uranium on kaolinite in the low pH range can be explained by the complexation reaction on mineral surface and the precipitation of uranium. The significant increase of adsorbed amount at pH 4–6 is due to the surface complexation at edge site of kaolinite. In the high pH range, precipitation of uranium contributes mainly to the adsorption quantity. The rapid decrease of adsorbed amount in the high pH range can also be caused by anionic uranium species mentioned above.