

The Uranium Sorption Characteristics of Ca-bentonite and Na-bentonite under Different Ion strengths and Concentrations

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This study investigated the sorption characteristics of uranium (U) on different types of bentonite (Ca-type: B1, B3, and Na-type: B2) under various ion strength (IS) conditions. Batch sorption experiments were conducted under two sets of conditions: varying initial concentrations (0, 0.1, 1, 10, and 50 mg/L) at an IS of 0 M, and varying IS conditions (0, 0.001, 0.01, and 0.1 M, NaNO₃) with an initial concentration of 1 mg/L. The result with different initial concentrations showed that the sorption mechanisms of all three bentonites were described by Freundlich isotherm, with Freundlich constants (n) measured as 0.89 for B1, 0.78 for B2, and 0.63 for B1. In the batch experiments with different IS conditions, B1 showed the highest uranium sorption efficiencies at IS of 0, 0.001, and 0.01 M, with values of 97.01%, 95.59%, and 88.77%, respectively. However, B2 showed the highest efficiency at IS 0.1 M, reaching 70.82%. The uranium sorption efficiencies for B1 and B3 decreased with an increase in IS, while no significant change across the IS range was observed for B2. The differences between the minimum and maximum uranium sorption efficiencies were observed to be 27.04% for B1, 8.48% for B2, and 15.74% for B3, respectively, indicating that B2 is less affected by competitive sorption of ions compared to B1 and B3. These findings highlight the importance of considering IS variations in groundwater when selecting bentonite materials and designing engineered barriers for radioactive waste repositories.