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Study of 85Sr transport through crushed granite in the presence of colloids particles

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The formation and stability of clay colloids from the engineered barrier system of deep geological repository for radioactive waste may have a direct impact on safety in two aspects: firstly, generation of colloids may degrade the engineered barrier and colloid transport of radionuclides may reduce the efficiency of the natural barrier.
The presented work is focused on the study of the effects of bentonite colloids on strontium 85Sr transport through crushed granitic rock. The main aim of experiments was to compare strontium and bentonite colloids behavior passing through crushed granite and quantification the effect of bentonite colloids on strontium retardation. The strontium migration was investigated under dynamic conditions in column set-up which provides an approximation to real conditions, existing in the environment. Firstly, we studied the transport behavior of strontium through crushed granite without presence of clay colloids. Then we performed column experiment with colloid suspension without presence of radioactive tracer. Finally, we conducted column experiment with prepared suspension of bentonite colloids with sorbed strontium. The values of transport parameters such as the sorption and desorption retardation coefficients (R) or sorption and desorption distribution coefficients (Kd) were calculated from experimental breakthrough curves.
The transport experiments were carried out with 10-6 mol/l solution of SrCl2 spiked by 85Sr in deionized water. The carrier concentration, initial activity of aqueous phase (about 0,7 kBq/cm3 of 85Sr) and flow rate were constant during the experiments. The crushed granitic rock from Melechov massive (Czech Republic) was used as a solid phase, the grain size of granite was 0,125 –0,63 mm. The purified bentonite B75 (commercial product, Keramost, a. s.) in Na+ form was used for colloids preparation. Stable suspension of purified bentonite B75 and distilled water was prepared with concentration 100 mg/ml and clay particles volume mean diameter 396 nm.
The experimental suspension of radiocolloids was prepared by mixing SrCl2 solution radiolabelled by 85Sr and bentonite colloids solution. The contact time between strontium and the colloids before column experiments was five days. The percentage of initially adsorbed strontium 85Sr onto bentonite colloids was approximately 90 %.
The results showed completely different behaviour of strontium and colloids particles during transport through crushed granite. Regardless of the strontium presence in colloids suspension, the colloids particles passed through column without retardation and behaved as conservative non-sorbing tracer. On the other hand, the retention of strontium on granite was observed, which suggest higher affinity of strontium towards granitic rock than towards bentonite colloids and showed the reversibility of the sorption of strontium on bentonite colloids.

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