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Sorption of Ni and Eu in a multi-element system

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At present the immobilisation of High Level Waste (HLW) in vitreous matrices followed by their burial in deep geological repository systems, composed of natural and engineered barriers to isolate the long lived radionuclides from the biosphere is the most preferred procedure. Granitic rock formations are being considered as host rocks for such geological repositories1. The study of the sorption of radionuclides onto geological media is, therefore, an important part of the safety assessment of deep geological disposal of radioactive waste. Due to the many combinations of adsorbents, data collection in multicomponent systems (MCS) is complex; therefore mathematical models have been developed to predict multicomponent (MC) sorption based on the adsorption properties of each element2. The problem of predicting adsorption based on the information of single component isotherms is still a challenge in adsorption studies. Multi-element sorption systems were examined in the last century, however, none of these studies dealt with competitive adsorption and only a few dealt with the selectivity of the sorption processes3. Several isotherm models have been used to model experimental data obtained from mixed radionuclide systems. One of the commonest of these models shown below.

• Qmix/Q0 > 1, the sorption is promoted by the presence of other metal ions,
• Qmix/Q0 = 1, there appears to be no observable effect and,
• Qmix/Q0 < 1, the sorption is suppressed by the presence of other metal ions in solution.

Static batch sorption experiments with 0.2 g of granitic rocks and different granitic minerals with 40 cm3 of non active Eu and Ni solutions have been performed in systems of single and multiple elements. Solutions were doped with 63Ni and 152Eu, acting as analogues for di- and tri-valent elements. Equilibration periods were between 7 and 10 days, after which radiometric methods (Liquid scintillation counting and gamma spectroscopy were used to determine the sorption patterns.
The results obtained showed that generally Eu sorption to the 6 granitic materials studied is affected by Ni competition, except in the case of Adamellite granite. Ni sorption to granitic materials was only not affected by the presence of Eu in solution in the case of biotite mica.

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