

SORPTION OF TECHNETIUM AND ITS ANALOGUE RHENIUM ON BENTONITE MATERIAL UNDER AEROBIC CONDITIONS

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The uptake of technetium on bentonite materials has been studied from the point of view of characterization of long-term radioactive elements behavior in nuclear waste repository.

Bentonite R (locality Rokle, Czech Republic) and two types of model groundwater (granitic and bentonite) were selected for the sorption experiments. It is generally known that bentonite materials show an excellent cation-exchange capacity and, on the other hand, a poor uptake of anions. Technetium occurs under aerobic conditions in its most stable oxidation state (+VII) as pertechnetate, which makes a question of its sorption on bentonites more complex when compared with e.g. Cs⁺ or Sr²⁺. To increase the K_d values for technetium sorption on bentonites, it is necessary to carry out the experiments under anaerobic conditions in the presence of reducing agent, which is capable to lower the oxidation state of technetium which enables its successful immobilization.

The aim of our research has been to find out the conditions suitable for the technetium sorption on selected bentonite under oxidizing condition.

The sorption experiments with ⁹⁹Tc on bentonite have been carried out by batch method. The influence of the addition of different materials (e.g. activated carbon, graphite, Fe²⁺) with bentonite, the effect of solid:aqueous phase ratio and a pH value on the percentage of technetium uptake and on the K_d values were tested.

Perrhenate was selected as an analogue of pertechnetate in non-active experiments of capillary electrophoresis (CE) and isotachophoresis (ITP). The percentage of rhenium sorbed on bentonite material was determined from the decrease of perrhenate peak area (CE) and from the shortening of the ITP zone corresponding to perrhenate. Both electromigration methods provided comparable results. The results obtained in this study with non-active material were compared to those of technetium acquired by radiometry and polarography. The 8 days kinetics of the perrhenate and pertechnetate sorption on bentonite was described mathematically with a tendency to predict long-term behavior of studied systems.

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