Geophysical Research Abstracts
Vol. 20, EGU2018-19786, 2018
EGU General Assembly 2018
© Author(s) 2018. CC Attribution 4.0 license.

Sorption of Np(V) and Cs(I) on engineering clay barriers

Anna Semenkova, Vladimir Petrov, Viktoria Krupskaya, Daria Korob, Anna Romanchuk, and Stepan Kalmykov

Sorption of Np(V) and Cs(I) on engineering clay barriers.

A. Semenkova1), T. Poliakova1), V. Petrov1), M. Evsyunina1), V. Krupskaya1,2),
P. Verma3), D. Korob4), A. Romanchuk1), S. Kalmykov1)

1) Lomonosov Moscow State University, Moscow, Russia
2) Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry of RAS, Moscow, Russia
3) Bhabha Atomic Research Centre, Mumbai – 400 085, Mumbai, India
4) State Scientific Institution "The joint institute for power and nuclear research - Sosny", Minsk, Belarus

Deep geological repositories are conceptualized and engineered with buffer/backfill materials to prevent radioactivity release in the future. Clays were found to be a promising candidate for backfill material in engineered barrier systems due to their favorable chemical and physical properties under deep geological conditions, with efficient radionuclide retention capacity. Taking into account actinides long half-lives (e.g. 2.13·10**6 years for 237Np) for prediction their behavior in the environment during thousands of years it is necessary to understand and to model their chemical reactions where sorption reactions are dominating. This investigation focuses on the study of Np(V) and Cs(I) molecular level sorption behavior on various clay samples with different properties.
In order to examine effect of structural features of clay minerals (structure 2:1 and 1:1), interlayer cation (Na/Ca/Li-form of montmorillonite), surface area and presence of accessory minerals (iron oxides, calcite, quartz) on radionuclide sorption different clay samples were used. In this work we studied clay samples from different deposits, which are considered as potential backfill materials for repositories (from Russia, Belarus, India and Spain).
Various techniques, e.g. XRD, XRF, BET absorption, Mossbauer etc. were used to characterize these clays. Sorption experiments with varying of pH value, ionic strength and concentration of radionuclides (for Np 10**-14 to 10**-6 M, for Cs 10**-9 to 10**-6 M) were done.
It was shown that even small presence of impurities of iron oxide strongly affects the sorption of Np(V) at its trace concentrations, but the effect decreases with increasing concentrations of radionuclide. However, for cesium the most important features that influence on its sorption onto clay minerals are interlayer cation and background electrolyte.
Isotherms of neptunium and cesium, obtained in the work, allowed us to determine the types of sorption sites and their concentration. This data let us to model Np(V) and Cs(I) sorption using 2SPNE SC/CE model.

This work was supported by the Russian Foundation for basic Research (No. 17-53-04049)