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Sorption of americium(III) ions on the bentonite of the Volclay type or red clay

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Storage of radioactive wastes requires various protective barriers against leaking of the stored radionuclides: metal canisters (tanks), buffers made of adsorbent of metal ions, and often the surrounding rocks. On the other hand, humidity from the outside may penetrate the storage tanks. Various biopolymers and naturally occurring inorganic adsorbents were intensively examined as inexpensive and abundant materials able to slow down to a significant degree the velocity of migration of the radionuclides [e.g. 1,2].
Commercial materials - Volclay MX80 bentonite, aluminum silicate clay formed from volcanic ash, and the mine red clay coming from the Palega clay pit in the vicinity of Kielce were used in presented study.
All examinations were made in parallel: with normal adsorbent and with the irradiated material (dose of 100 kGy). The latter seems to be of interest because of its possible application as the engineered barrier in radioactive waste repositories. Powder X-ray diffraction studies revealed that the materials are of layered structure, both in natural and in the irradiated forms. A decrease in the distance between the layers occurs upon the irradiation.
Water was collected in the Institute of Nuclear Chemistry and Technology (Warsaw). Post-decontamination liquids were simulated by dissolving citric acid in the water to obtain 1 M solution prior to the radionuclide addition.
Sorption of americium(III) was studied as a function of contact time, initial pH of water and mass of the sorbent, respectively.
An attempt to revitalize of the Am(III)-loaded sorbents was done by shaking the material at room temperature with different types of desorbing agents.

Conclusions:
The experiments proved that both the red clay and the bentonite can adsorb efficiently Am(III) ions from aqueous solutions. They can be used for removing of radionuclides potentially contaminating water from aqueous solutions and they have been found suitable to make barriers in the National Radioactive Waste Repository in Rozan (Poland).

Studies were performed in frame of the Strategic Project Technologies Supporting Development of Safe Nuclear Power Engineering Domain 4 Development of spent nuclear fuel and radioactive waste management techniques and technologies.

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