

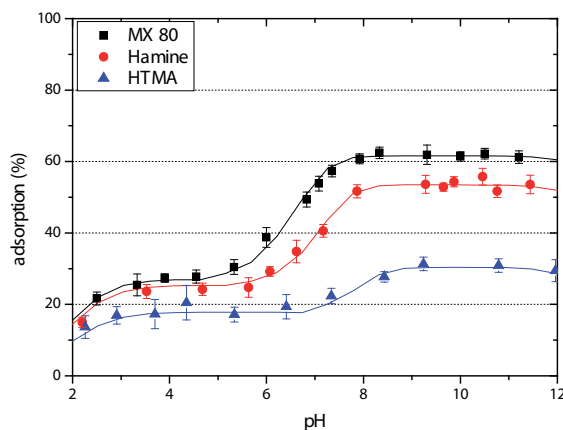
# RETENTION OF CESIUM BY ALKYLAMMONIUM SALT MODIFIED BENTONITE: EXPERIMENTS AND MODELING

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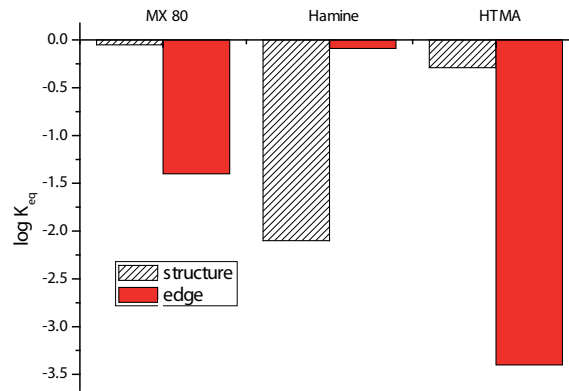
Application of bentonite as engineering barriers as well as back-filled material to radioactive waste repository is widely conducted around the world. It was reported that organic-modified bentonite is able to adsorb anionic radionuclides but its sorptive capabilities toward cationic radionuclides would decrease at the same time. In order to evaluate the influence of alkyl moiety of modification reagents on sorption of cationic radionuclides, surface modification of bentonite by hexadecyltrimethyl ammonium (HTMA, 3<sup>o</sup>) and by hexadecylamine (Hamine, 1<sup>o</sup>) was prepared. Their sorption capabilities were examined by Cs sorption experiments and quantified as sorption equilibrium constants (in terms of log K) by using surface complexation model MINEQL+ 4.6.

In order of the decrease of sorption capability, it is observed that MX 80 > Hamine-modified > HTMA-modified bentonite (Figure 1). Moreover, similar to the performance of MX 80, Hamine-modified bentonite reached a sorption plateau under alkaline environments while HTMA-modified one seemed to be insensitive to the pH variation.



**Figure 1:** Cs sorption to raw bentonite (MX 80), Hamine-modified (Hamine) and HTMA-modified bentonite under various pH environments. Dots: experimental results; lines: fitting by MINEQL+.

To explain the observations, it was assumed that Cs sorption was mainly contributed by structure (= X) and edge (= SOH) sorption sites on bentonite surfaces (Figure 2). It was observed that the log K of structure sites of both Hamine- and HTMA-modified bentonite was more negative than that of raw bentonite. It was taken as evidence that either Hamine or HTMA species were less capable of exchanging with Cs ions than Na ions (exchangeable cation on MX 80 surfaces) do. This also implied that the sorption affinity of Hamine was greater than HTMA toward structure sites. However, it was difficult to explain the influence of organic modification on sorption at edge sorption sites. The HTMA-modified bentonite had the most negative log K value, while Hamine-modified one showed the least negative log K. It could be



**Figure 2:** The determined log K values of structure and edge sorption sites.

only explained by the structure changes of the organo-clay crystals, but further spectral evidences were required. By comparing with log K of MX 80, it was only safe to say that the influence of interlayer cations of Na, Hamine, and HTMA were quite different.

#### References:

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