ADSORPTION KINETICS OF STRONTIUM ION IN CARPATHIAN BASIN BENTONITE SAMPLES

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Radioactive wastes are very complex systems. A very lot of radioactive metal ions are in the radioactive wastes. Therefore, it is important to know the interaction between the geological formations and radioactive metal ions.

The speed of this interaction is determined by adsorption. It would be important and interesting to know the speed of adsorption and steps of adsorption.

In the last years some papers (Cigna et al., 2000; Fuhrmann et al., 2001; Poinssot et al., 1999) dealt with the interactions between radioactive metal ions and the environment, but the papers hardly dealt with adsorption kinetics of strontium (Liu et al., 1995).

One of the main component of radioactive wastes is ^{90}Sr, which has a medium half-life (about 28 years) and high-energy β-radiation. Adsorption kinetics of strontium ion was measured on Carpathian Basin bentonite samples with radioactive tracer method. ^{85}Sr was used for radioactive tracer, because this radioactive isotope is γ-emitter, so the γ-radiation may be measured more exactly than the β-radiation.

Keeping volume of solution quantity of the sample and Sr(II)-ion concentration constant, the reaction time was changed. The adsorption increased with increasing reaction time to a relative equilibrium adsorption yield.

The kinetic data were evaluated by forms of first rate kinetic equation with different term, generally used for adsorption of ions of low concentration. In the case of five samples (Istenmezeje black, Istenmezeje yellow, Egyházaskesző, Mád–Újhegy, Sajóbábony), the adsorption process could be divided into two steps such as film diffusion and particle diffusion. In the case of the other two samples (Kuzmice gel and Mujdeni gel) the adsorption process could be divided into three steps, where the third step is gel diffusion. The presence of higher amounts of cristobalite can explain the gel phase in these two samples. The rate constants of the steps were determined.

References

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Table 1: Mineral composition of Carpathian Basin samples (XRD analysis by P. Kovács-Pálffy)

	Istenmezeje black	Istenmezeje yellow	Mád–Újhegy	Egyházas-kesző	Sajóbábony	Kuzmice gel	Mujdeni gel
Montmorillonite	54	74	21	89	50	41	42
Illite	–	2	–	–	10	–	–
Rectorite	–	–	10	–	–	–	–
Quartz	4	1	58	–	6	1	–
Cristobalite + opal CT	33	17	–	–	5	54	54
Amorphous	8	5	3	6	20	3	4

Table 2: Kinetic results

k_1 (min^{-1})	1.24	1.64	1.51	2.70	1.83	2.18	2.33
k_2 (min^{-1})	0.08	0.08	0.07	0.27	0.18	0.36	0.38
k_3 (min^{-1})	–	–	–	–	–	0.02	0.06