UPTAKE OF RADIONUCLIDESOF CAESIUM AND COBALT ON MODIFIED ZEOLITE AND THEIRS DEPOSITION IN MATRICES ON BLAST FURNACE SLAG

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One of the possibility for radioactive waste liquid immobilisation is the incorporation of radionuclides onto ion exchangers. From this point of view the natural zeolite are very promising because they are cheep and their radiation stability is high. The sorption ability of zeolite is very good for some metals Ag,Cu,Pb and Cs, but on the other hand , it is negligible for Co. The zeolite sorption ability can be improve by chemical treatment. The main idea of all experiments was to find a way to increase the sorption ability of zeolite for Cs and Co. By means of chemical treatment amonium, potassium, sodium and H - form of zeolite were prepared. The chemical modifications of zeolite were carried out with

- 2M solution of $NaNO_3$, NH_4NO_3,KNO_3
- 0.1 M solution of HCl
- NaOH solution of different concentration.

The methode of model radioactive solution was used to find the sorption ability for Cs and Co of every modified zeolite mentioned above. The model solution were 0.05 M solution of Co labeled by ^{60}Co or Cs labeled by ^{137}Cs. The highest sorption ability was observed for zeolite modified by NaOH. This was the reason why further detailed experiments on the influence on the influence of NaOH on zeolite sorption ability were done. In these experiments 0.16 M, 0.5 M, 1.5M, 2 M, 4 M and 6 M NaOH modifiing solution were used. In order to determine the influence of competitivw ions K^+, Na^+, Ca^{2+}, H^+ and Cs^+ or Co^{2+}, the distribution coefficients (K_d) of Co and Cs were measured as a function of competitive ion concentration. These experiments show that K_d decrease from low to higher concentration of competitive ions. It is interesting, the influence of Cs^+ions on sorption of Co is negligible, althought the excellent sorption ability of zeolite for Cs is well known. Probably the uptake of Co and Cs are of different type and therefore Cs and Co are not competitive ions.

The influence of pH on uptake of Cs and Co by modified zeolite was searched as well. The variation of K_d of Cs with the pH for modified zeolites is very similar to that for natural zeolite. The dependence of K_d for Co on pH is also very similar to that for natural zeolite but only up to pH 7. At this point is a dramatic decrease of K_d. This result, together with the incompetitive uptake of cobalt and caesium, shows the uptake of Co is not an exchange reaction but some type of chemisorption. On the other hand , the variation of distribution coefficient with concentration of competitive ions shows that modified zeolite by NaOH are excellent material for the simultaneous uptake of cobalt and
caesium.

The very important chatacteristic of sorbent material is the leachibility in natural enviroment. The experiment showed that in acid solution the leachibility of Co from modified zeolite is not adequately low. But in combination with appropriate matrix this drawback is suppresed. The cement matrices on Portland cements have been found appropriate for zeolite to immobilisate Co and Cs in low and medium level radioactive wastes. The matrices on blast furnace slag basis are able to avoid of decreasing of strength of cement casts even in very unconvenient composition of waste waters. Generally , it seems that this double step procedure

consisting in uptake of radionuclides to zeolite and its incorporation into cement casts to be preferred.

The experimental data (leaching tests, compressive strenght measurement and porosity) were measured for the case the Co and Cs from model water solution and radioactive waste water were uptaken on chemicaly modified zeolite and were subsequently incorporated into cement casts on blast furnace cement slags (BSF) basis (Iron Works Košice, Slovak Republic). The activator was water glass in amount corresponding to 3.7 wt.% of Na_2O of dry weight of BSF. The compressive strength and porosity showed decreasing with amount of added zeolite and with degree of treatment of zeolite, but in every case was satisfactorily high, for both model water solution and waste water. The leachibility was tested in water, in basis solution and in acid solution. The leachibility in water and basic solution was negligible , in acid solution it was less than 4 % which is inside of value of applied measure methode.

The compressive strength, porosity and leaching experiment are hopefull and show good mechanical stability and good retention of observed radionuclides in samples exposed in leaching solutions.