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# RADIOTRACER STUDY OF THE ADSORPTION OF Fe(III), Cr(III) AND Cd(II) ON NATURAL AND CHEMICALY MODIFIED SLOVAK ZEOLITE

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In order to minimize the contamination of environment with metals in ionic form the more types of natural and chemicaly modified zeolites were examinated to their uptake of Fe(III), Cr(III) and Cd(II) from water solutions by batch radioexchange equilibration method.

Excellent and relatively cheap inorganic ion exchanger - zeolite - offer the advantages of high capacity, good selectivity, reproducible stoichiometry, radiation resistance and compatibility with glas and cementation waste forms. The fundamental building block of the zeolites is a tetrahedron of four oxygen atoms surrounding a relatively small silicon or aluminium atom. The structure consists of $SiO_4$ and $AlO_4$ tetrahedra arranged so that each oxygen atom is shared between two tetrahedra. Because aluminium has one less positive charge than silicon, the framework has a net negative charge of one at the site of each aluminium atom and is balanced by the exchangeable cation. The cavities and channels in this structure can hold metal cations (mostly alkali metals and alkaline earth metals) or molecules (e.g. $H_2O$). The structure of a zeolite determines its specific physical and chemical properties, such as ion-exchange ability and adsorption, reversible dehydration and hydration.

The chemical treatment of zeolites with excess NaOH is excepted to reduce the effect of naturally occuring cations on their occlusion. The changes in the structure of zeolite in general increase its sorption properties mainly for multivalent cations [1,2].

In this study was used zeolitic tuff from deposit Ni□ný Hrabovec (content of clinoptilolite 50 -70 %) with the grain size from 1,2 to 2,2 mm. The priority of Slovak zeolite is the absence of mordenite, which has a fibrous structure and can be regarded as carcinogen material.

The granulas of zeolite were modified wih the folloving NaOH solutions: 0,5, 1, 2 and 4 $mol.l^{-1}$ at 80 °C for 4 hours [3].

For the determination of equilibrium time period zeolite was mixed with 15 ml 0,05 $mol.l^{-1}$ $FeCl_3.6H_2O$ or $Cr(NO_3)_3.9H_2O$ or $CdCl_2$ solutions labeled with $^{59}Fe$ or $^{51}Cr$ or $^{115m}Cd$ in glass bottle via different ratios of mass zeolite (50, 100, 150, 200, 250, 300 mg). The mixture was gently shaken during 7 days. The 5 ml of solution was decounted for gama-ray counting by NaI/Tl/ detector every 24 hours.

The sorption of Fe, Cr and Cd on all types of zeolites was studied by radioexchange method and the sorption of Fe and Cr also by flame atomic absorption method. From sorption curves were the sorption coefficients calculated.

The adsorption of Fe(III), Cr(III) and Cd(II) on the zeolites modified with NaOH increases with the concentration of NaOH solution. For the zeolites modified with 4 $mol.l^{-1}$ NaOH solution the adsorption value for Fe and Cr was about 30 % that is about six time increase, and for Cd about 50 % that is about two time increase as compared with the natural zeolite.

The correlation between the radioexchange method and flame AAS method was good, in the range from -4,2 to +3,2 %.

The results obtained in this work show that zeolites modified with NaOH solution are suitable for adsorption of Fe(III), Cr(III) and Cd(II) from underwater, waste water, feed water and coolant water from nuclear power plants. The adsorbed zeolites can be solidified by convention way.

Nontheless, each specific problems should be examined individually, for in solution as heterogenous as natural waters and radioactive waste waters, unpredictable specific interactions of the numerous factors involved in this process frequently lead to unexcepted results.

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