

SORPTION OF SELECTED HEAVY METALS (Cr(III), Cu(II), Pb(II)) ON SMECTITE-CLINOPTILOLITE SHALES OF THE OUTER FLYSCH CARPATHIANS (POLAND)

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Hazardous wastes contaminated with heavy metals often cause environmental pollution to surface waters, ground water and soils. Natural zeolites and bentonites are frequently used for remediation or as liner materials. The effectiveness of the treatment results from ion exchange properties of zeolites and adsorption properties of bentonites.

The aim of the work was comparison of sorption properties of raw clinoptilolite-montmorillonite claystone with the zeolite fraction separated from this rock. The claystone crops out near Rzeszów (SE Poland) as the Trójca Red Shale Member of the Variegated Shales Formation (Upper Paleocene–Lower Eocene) within the Skole Unit of the Outer Flysch Carpathians (RAJCHEL, 1990). The rock consists of 60–80 % Ca-montmorillonite, 15–30% clinoptilolite, and 15–30 % quartz, feldspars, illite, illite-montmorillonite, kaolinite and chlorite (WIESER, 1969).

Adsorption of aqueous Cr(III), Cu(II), and Pb(II) (0.05 to 270 mg/g of the adsorbent) was tested in 2 % suspensions. For desorption 1M NH₄OAc at pH 7 was used. This experimental setup allows to determine the metal-to-solid range within which the adsorbent is the most effective. The samples after adsorption were examined with SEM/EDS.

The removability of heavy metals in question from their solutions is relatively high. At low initial concentrations of solutions the metals were completely removed. The maximum sorption of all the metals by both investigated sorption materials was higher than their CEC. The adsorption properties of raw clinoptilolite-montmorillonite claystone are better than of pure zeolite fraction. The desorption experiments revealed that a certain part of the sorbed metals did not desorb. The quantity of this unremovable portion depends on the metal and its concentration in the solution.

Scanning electron microscopy (SEM) did not reveal any morphological changes or new precipitates formed on the samples after adsorption. Energy dispersive spectroscopy (EDS) allowed for the detection of adsorbed metals in the samples.

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References

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