

## SORPTION OF CHROMATE BY CLINOPTILOLITE AND MONTMORILLONITE MODIFIED WITH ALKYLAMMONIUM SURFACTANTS

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Clay minerals and zeolites modified with quaternary alkylammonium cations are frequently studied because of their potential application as environmental remediation materials. Some of these sorbents obtained using hexadecyltrimethylammonium bromide were shown to have the ability to remove Cr(VI) from aqueous solution. The aim of the presented work is to compare the chromate sorption capacity of selected minerals modified with hexadecyltrimethylammonium ( $C_{16}$ ) and dioctadecyldimethylammonium ( $2C_{18}$ ) surfactants.

In this study, clinoptilolite (Cl) from Dylagówka and montmorillonite (M) from Chmielnik (both localities in Poland) were used as starting materials. Their CECs determined by adsorption of alkylammonium ions are 16 and 95 meq/100g, respectively. The minerals were treated with  $C_{16}$  and  $2C_{18}$  bromides in the amounts of 1.0 and 1.5 CEC. The products were characterised by IR spectroscopy, XRD as well as C and N determinations.

The sorption of chromate on the modified minerals was measured spectrophotometrically as a function of pH and concentration of Cr(VI) at the sorbent-solution ratio 20 g/dm<sup>3</sup>. The amount of chromate removed from the solution gradually decreased with pH increasing in the range 1.3–10. At pH 2.6–3.1, the maximum sorption of Cr(VI) by the organo-zeolites

(103–124 mmol/kg) was observed for the samples Cl- $C_{16}$ -1.5 and Cl- $2C_{18}$ -1.5 (Fig. 1) modified using 1.5 CEC concentration of  $C_{16}$  and  $2C_{18}$  surfactants. Considerably lower values (37–46 mmol/kg) have been obtained in the case of the sorbents prepared at 1.0 CEC concentration of the alkylammonium ions (Cl- $C_{16}$ -1.0 and Cl- $2C_{18}$ -1.0). Similar relationship has been found for the organo-montmorillonites (samples M- $C_{16}$ -1.0, M- $C_{16}$ -1.5, M- $2C_{18}$ -1.0 and M- $2C_{18}$ -1.5) (Fig. 1), however, the maximum uptake of chromate (155–281 mmol/kg) was significantly higher in comparison with that observed for the organo-zeolites. At low concentrations of Cr(VI) (0–2 mmol/dm<sup>3</sup>), its amount removed from the solution does not depend on the size of the alkylammonium ions bound to the mineral surface. In contrast, for more concentrated solutions the sorbents prepared using  $C_{16}$  surfactant show, as a rule, higher sorption capacity towards chromate than that obtained with  $2C_{18}$  salt.

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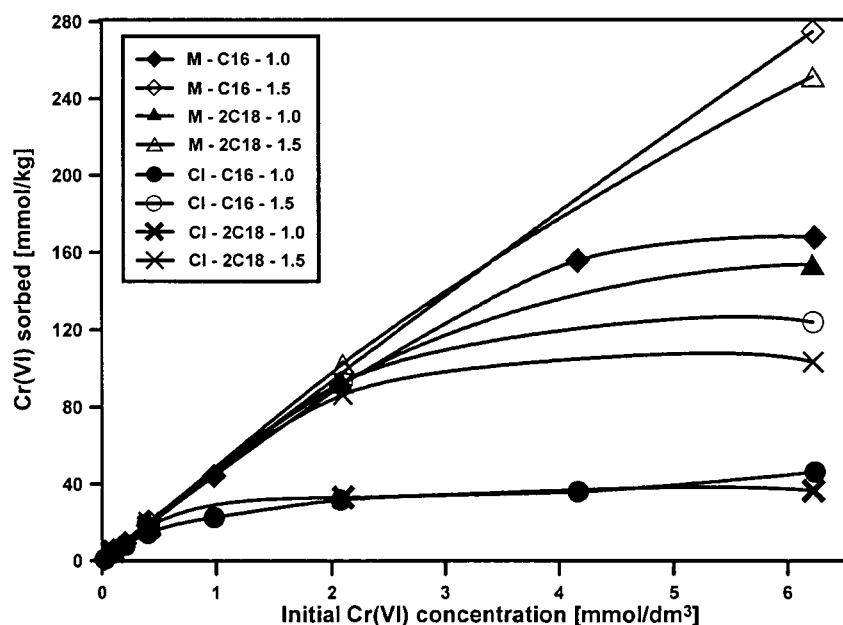


Fig. 1: Sorption of Cr(VI) by clinoptilolite (Cl) and montmorillonite (M) modified with  $C_{16}$  and  $2C_{18}$  surfactants.