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Influence of alkali and acidic treatment on sorption properties of Latvian illite clays

Vitalijs Lakevics, Valentina Stepanova, Ieva Skuja, Inga Dusenkova, Augusts Ruplis
Institute of General Chemical Engineering, Riga Technical University, Latvia
vitalijs.lakevics@rtu.lv

INTRODUCTION

Latvian illite containing clays, due to their wide distribution, physically-chemical and colloidal properties, have potential application as low-cost and eco-friendly adsorbents for industrial waste purification from organic dyes [1], for discoloration of rapeseed oil [2], petroleum, oil [3] and heavy metals [4].
The increasing interest towards modified clays is explained by a necessity to create environmentally safe sorbents. Clays can be modified with inorganic acids and metal salts, which are part of the clay [5], alkali [6], organic additives [7], etc.

The aim of this work is to study the adsorption of methylene blue from water solutions on to natural and modified Latvian illite containing clays and compare their sorption properties.

EXPERIMENTAL METHODS

Latvian illite containing clay samples with grain size below 63μm from Tūja (devonian), Laža (quaternary) and Strēļi (jurassic) deposits were modified with hydrochloric acid and alkali. The phase compositions of the clay samples were analyzed by X-ray powder diffraction. The sample morphology was studied using field emission scanning electron microscopy. Specific surface area of all clay samples was measured using BET method utilizing adsorption of N_2 gas. The organic dye methylene blue adsorption on the clay samples was studied.

RESULTS AND DISCUSSION

Treatment with various concentrations of NaOH and HCl solutions - 5%, 10%, 15% - alters the structure and adsorption properties of natural clay samples. Dependence of methylene blue adsorption on BET specific surface area of the clay samples from the modifier concentration, samples treatment conditions is presented in table 1.

Table 1 Treatment and obtained properties of samples

Sample code	Modifier/ treatment temperature, °C/h	BET specific surface area, m^2/g	Adsorption of methylene blue, g/g
S	-	32,9	0,11
S5H	HCl/95/4	54,7	0,08
S10H	HCl/95/4	92,6	0,06
S15H	HCl/95/4	100,0	0,05
S5N	NaOH/80/1	18,7	0,08
S10N	NaOH/80/1	26,2	0,09
S15N	NaOH/80/1	29,9	0,10

CONCLUSIONS

For the first time, sorption properties of the clay samples from various Latvian deposits were characterized. It was found that, increasing HCl concentration from 5% to 15%, BET specific surface area of the modified clay samples increases proportionally to the acid concentration. Increasing concentration of the alkali from 5% to 15%, BET specific surface area of the modified clay samples decreases.

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