CERECO - 2014
The 5th International Conference on Carpathian Euroregion
ECOLOGY
Berehove, Transcarpathia, Ukraine, 26-28 March, 2014

BOOK OF ABSTRACTS

organized by the Ferenc Rákóczi II. Transcarpathian Hungarian Institute,
Berehove, Transcarpathia, Ukraine, University of Miskolc, Hungary, in
collaboration with the Institute of Sorption and Endocology, National
Academy of Sciences of Ukraine and Carpathian Euroregion Council
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ELECTROKINETIC POTENTIAL AND FLOCCULATION OF CLAY MINERAL PARTICLES BY POLYELECTROLYTE AND SURФACTANT MIXTURES

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Polymers are widely used as flocculants for suspensions in many industrial applications, such as mineral processing, papermaking, water treatment and biotechnology. In recent years there has been considerable interest in the use of multi-component flocculants, especially dual-polymer and polymer-surfactant systems. In the latter case, there can be significant advantages over the use of single polymers.

The objective of our study was to elucidate the laws and mechanisms of flocculation of kaolin and bentonite particles by anionic and cationic surfactants, polyelectrolytes (PE) as well as their binary mixtures. The effect of the surfactant/polyelectrolyte dose, charge density (CD) of the polyelectrolyte, mixture composition, ratio between positive and negative charges in the mixture, sequence of the components addition on the electrokinetic potential, kinetics of aggregation, size and strength of flocs formed has been determined. Flocculation experiments were performed in a flow system using a Photometric Dispersion Analyzer PDA-2000. Electrokinetic potential of particles was measured by Zeta NS (Malvern) instrument.

It has been shown that addition of cationic polyelectrolytes/surfactants to the suspension leads to a significant decrease in the negative $\zeta$-potential and to a change in the sign of the charge of particles. Changes in the $\zeta$-potential are more pronounced for samples with higher charge density. Addition of anionic polyelectrolytes/surfactant gives a more than twofold increase in the $|\zeta|$-potential of both bentonite and kaolin particles. In mixtures of cationic and anionic polyelectrolytes, whatever the sequence of addition, the particles acquire
-potential that is typical for particles bearing only anionic polyelectrolyte.

A synergism in flocculation capacity in mixtures of moderate and weakly charged polyelectrolytes was observed. Mixtures of medium/low charged anionic polyelectrolytes and medium or low charged cationic flocculants gave optimum flocculation at mass ratios, corresponding to many-fold excess of negative charges over positive ones in the adsorbed layer. Deviation from the optimum composition gave slower flocculation and significantly smaller floc sizes. In mixtures of cationic PE+ cationic surfactant the best effect/maximum flocs size was achieved in the event of addition of pre-prepared mixture to the suspension. An initial intensive short stirring the suspension accelerates the aggregation process and increases the size of flocs independently of the sequence of polymers addition. The laws observed were explained by features of polyelectrolytes conformation in adsorbed mixed polymer layers.

Examples on the application of dual polymers and surfactant/polymer mixtures in purification of municipal wastewaters, recycled and wastewaters of mineral processing, in papermaking and wastewater sludge treatment are given.