ADSORPTION OF SOME MONOSACCHARIDES ON PILLARED CLAYS: PRELIMINARY RESULTS

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Pillared clays are a special class of microporous materials that can be obtained by interlayering expandable clay minerals with polymeric oxide, as pillars. The Si-PILCs and Al-PILCs have attracted considerable attention in many organic reactions, adsorption processes, and environmental protection. The paper shows the preliminary results of the adsorption behaviour in the monosaccharide-water-pillared bentonite systems. Separation factors, adsorption excess isotherms of monosaccharide-water mixtures, and adsorption equilibrium diagrams show the complex interaction inside of pillaring bentonites.

The bentonite from Valea Chioarului used in our experiment has a complex composition and contains particularly smectite (64%), illite-smectite interstratifications and numerous traces of feldspar and quartz with cation exchange capacity 92 meq/100g bentonite was used clays, a mixture of swelling agent and pillar precursor. The swelling agent is incorporated within the interlayer species of the clay, serving to prop open the layers in such a way as to allow incorporation of the organometallic compound (tetraethylorthosilicate, TEOS) as polymeric oxide precursor. The pillared clay is obtained after calcination at 673°K. The samples were characterised by XRD patterns, FTIR spectra and adsorption isotherms. The D-glucose (Fluka) and D-fructose (Merck) solutions were used. The equilibrium state was checked by measuring the concentration in the interval 8 to 72 hours.

In our experiments because of the adsorption equilibrium between water and clay is determined only by measuring the change of the bulk concentration, the calculated amount of adsorbed saccharide reflects a global isomeric mixture adsorption. The measure of the adsorption of a liquid mixture is the adsorption excess Γ_2^1:

$\Gamma_2^1 = n^0 (x_2^0 - x_2^1)/m$; where: n^0 is the total number of moles in the original solution; $(x_2^0 - x_2^1)$ is the change in the mole fraction of the monosaccharide solution caused by adsorption; m is the mass of the sample (g).

It is evidently that the raw bentonite prefers the adsorption of water, while pillared clays, both the calcined and not calcined samples, adsorb D-fructose preferentially. As a consequence of the limited solubility of the monosaccharides in water only a small portion of the adsorption excess isotherms could be determined.

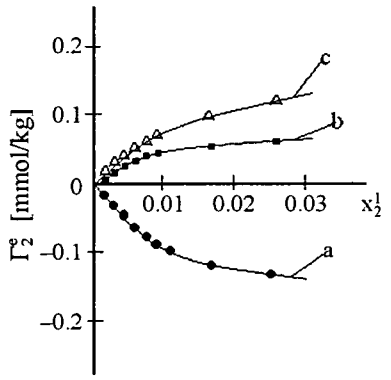

Fig. 1: Adsorption excess isotherms of D-fructose water mixtures on: a) raw bentonite; b) sample not calcined; c) sample calcined.

The obtained data show the ability of the bentonite from Valea Chioarului (Romania), for pillaring processes. The pillaring process was developed the bentonite capacity for monosaccharides separation. Separation factors, adsorption excess isotherms and adsorption equilibrium diagrams show the formation of some strong interaction between monosaccharide and clay surface.

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