Research of clay minerals in order to obtain pharmaceutical and cosmetic composite materials

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At present, composite materials based on clay minerals (natural and synthetic) are widely used in the pharmaceutical and cosmetic industry. The use of such materials allows one to improve the quality of pharmaceutical and cosmetic products due to their regulated dispersions (abrasives, fillers) and the capability to form a wide range of compounds with inclusions of various functional properties. The use of clay minerals for medicinal applications has gained a great practical experience that confirms the need of further search of new special-purpose compositions using raw materials of natural origin.

The aim of this work was to investigate the properties of natural clay minerals, which can be used for biomedical and cosmetic applications, and the possibility of controlling their dispersion by introducing fine silica; as well as structural and adsorption properties of the composites. Figure shows diffractograms of clays used in composites.

The phase composition of the samples is presented in Table 1. From the data, it can be seen that the white-pigeon clay contains well-crystallized kaolin with a mixture of α-quartz.

The XRD data showed low crystallinity of montmorillonite, which is a part of the blue clay. A sufficient amount of impurities in the form of alpha-quartz and calcite has been determined. The results of adsorption-desorption of nitrogen (Table 2) indicate that all clays have a low specific surface.

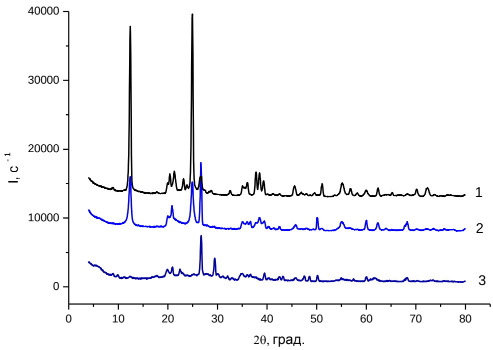

Fig. The diffractograms of clays: kaolin (1), white-blue clay (2), light-blue clay(3)

Table 1. The phase composition of the clays

№	Sample	Phase composition
1	Kaolin	Kaolinite $Al_4(OH)_8\ Si_4O_{10}$
2	White-blue clay	Kaolinite, $Al_4(OH)_8\ Si_4O_{10}$ – 73 % α-quartz.SiO_2 – 27 %
3	Light-blue clay	α-quartz., SiO_2 – 66 % Calcite $CaCO_3$ – 34 % Montmorillonite $Na_{0.3}\ (Al, Mg)_2\ Si_4O_{10}\ (OH)_2 \cdot nH_2O$

As can be seen from Table 2, the clays of the kaolin series have a lower specific surface area than bentonite clay has. Features of the adsorption-desorption nitrogen isotherms are different. The appearance of hysteresis, characteristic for slit-like pores, indicates that adsorption occurs between the lattice spacing of montmorillonite. The addition of highly disperse silica to the system increases the dispersion and affects the course of adsorption-desorption processes.

Table 2. Textural characteristics

№	Sample	S_{BET}, m^2/g	V_p, cm^3/g	*R*(BJH),nm	
				Ads.	Des.
1	Kaolin	8	0,04	30	29
2	White-blue clay	29	0,15	23	21
3	Light-blue clay	28	0,04	11	8
4	Kaolin/A300	19	0,11	27	25
5	White-blue clay/A300	33	0,15	21	20
6	Light-blue clay/A300	39	0,08	13	11

Surface patterning using As_2S_3: Mn–Se nanomultilayer structures

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Chalcogenide glasses and films have unique properties: high transparency in the IR region, photoinduced change of properties, quasi-stability, ion-conductivity of doped chalcogenide glasses and films. Nanomultilayer structures on the base of chalcogenide glasses attract much