Selected physicochemical properties of hydroxyapatite and blue clay composite

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INTRODUCTION

The main subject of interest of numerous scientific and industrial centres is preparation of new, modern and technologically advanced materials which are at the same time accessible, effective in their action, minimizing the process course time and cheap. Clay and hydroxyapatite are one of the most important groups in this area.

Composites of clay and hydroxyapatite are in early stage of development, but can also be an interesting adsorbent with new properties.

MATERIAL AND METHOD

Synthesis of HAP/white-blue clay composite was carried out as follow. Into a three-necked round-bottomed flask certain amount of blue clay and redistilled water were placed. The flask was heated on a water bath (100°C), reaction mixture was stirred mechanically. Next into the suspension were dropped calcium acetate and potassium hydrogen phosphate solutions. The mixture was kept boiling for an hour. After that, the suspension was cooled down, sediment was decanted and washed with redistilled water. Composite was dried. In the same way (wet method) was prepared pure HA.

HAP, clays and their composites were characterized by following tests: XRD, XRF, the porosity (nitrogen adsorption-desorption method), zeta potential, surface charge density.

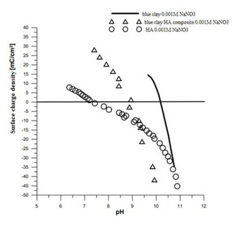


Fig. 1. Surface charge density as pH function for pure HA, blue clay and composite.

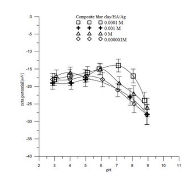
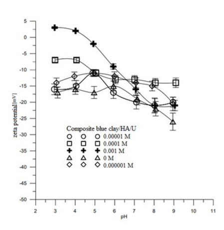


Fig.3 Zeta potential as the function of pH for system composite blue clay/HA in dependance on different concentration of Ag ions

Fig.4 Zeta potential as the function of pH for system composite blue clay/HA in dependance on different concentration of U (VI) ions



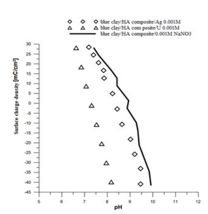


Fig. 2. Surface charge density as pH function for system composite/0.001M NaNO3 in the presence of U and Ag ions.

	HAP	HAP/Ag	HAP/U	HAP/blue clay	HAP/blue clay/Ag	HAP/blue clay/U	blue clay	blue clay/Ag	blue clay/U
BET surface area [m²/g]	55	52	25	22	17	14	21	11	3.47
Langmuir surface area [m²/g]	80	77	37	30	24	19	31	14	5.09
BJH cumulative adsorption surface area of pores from 1.7nm to 300nm diameter [cm³/g]	0.32	0.32	0.13	0.11	0.10	0.07	0.03	0.024	0.017
BJH cumulative desorption surface area of pores from 1.7nm to 300nm diameter [cm³/g]	0.32	0.32	0.13	0.11	0.10	0.08	0.04	0.025	0.017
Average pore diameter (4V/A by BET) [nm]	23.50	24.46	20.36	20.74	23.68	21.06	7.33	9.64	19.49
BJH adsorption on the average pore diameter[nm]	24.44	26.34	20.75	22.08	28.75	30.38	10.22	25.17	23.03
BJH desorption on the average pore diameter (4V/A) [nm]	22.93	24.84	13.51	15.57	20.9	16.68	8.12	10.11	13.64

Table 1. Surface characteristics of HAP, Hap/white clay nanocomposite and white clay – comparison of the properties before and after the adsorption of uranyl and silver ions

CONCLUSIONS

- XRD studies show that adsorption of silver or uranium (VI) ions lead to obtaining a new crystalline forms.
- Based on ASAP analysis we can note, that composite as well as pure HA and clay are mesoporous materials. After the process of ions adsorption on HA, clay and composite average pore size increase because of plugging the pores on a surface.
- XRF analysis indicates presence of many different elements in structure of clay and composite what has big influence on electrochemical properties.
- Analysis of surface charge show differences in pH_{pzc} point for composite and it's components. Moreover, appearance of Ag and U(VI) ions impact on this parameter and on zeta potential value.
- Additional tests will be performed in order to characterize HAP/clay composites. These composites are can be use as adsorbents or ingredients of cosmetics.