Structural properties and adsorption of uranyl ions on the nanocomposite hydroxyapatite/white - blue clay

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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 by wet method.

Clays and composite white-blue clay were characterized by following tests: the porosity (nitrogen adsorption-desorption method), zeta potential, surface charge density.

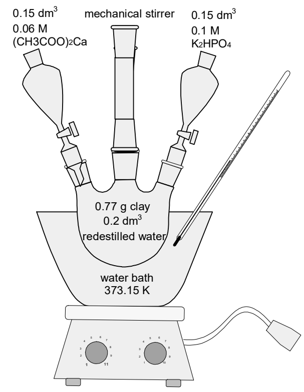

Fig.1 Synthesis of nanocomposite HA/white-blue clay

RESULTS

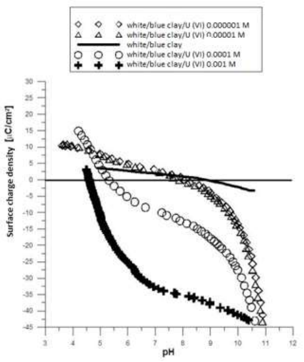

Fig. 2. Surface charge density as pH function for white-blue clay on dependance on different concentration of U (VI) ions

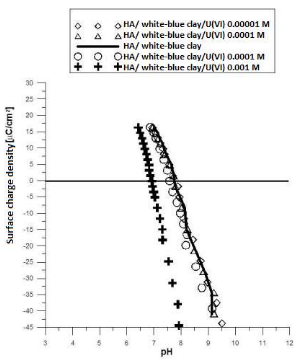

Fig. 3. Surface charge density as pH function for HA/white-blue clay composite on dependance on different concentration of U (VI) ions

	HAP/white-blue clay	HAP/white-blue clay/U(VI)	White-blue clay	White-blue clay/U(VI)
BET surface area [m²/g]	29	20	36	9
Langmuir surface area [m²/g]	43	32	53	14
BJH cumulative adsorption surface area of pores from 1.7nm to 300nm diameter [cm³/g]	0.17	0.09	0.17	0.07
BJH cumulative desorption surface area of pores from 1.7nm to 300nm diameter [cm³/g]	0.17	0.09	0.17	0.07
Average pore diameter (4V/A by BET) [nm]	23.02	25.1	19.57	22.13
BJH adsorption on the average pore diameter[nm]	24.51	53.3	19.75	23.15
BJH desorption on the average pore diameter (4V/A) [nm]	15.96	16.67	19.21	23.1

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

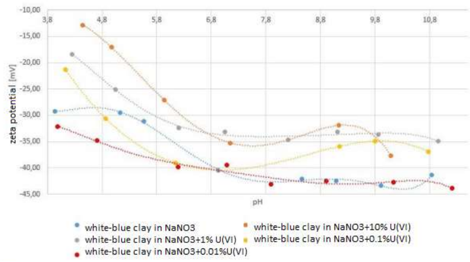

Fig.4 Zeta potential as the function of pH for system white-blue clay in dependance on different concentration of U(VI) ions

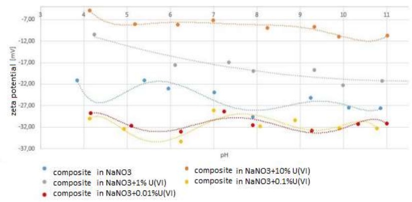

Fig.5 Zeta potential as the function of pH for system composite white-blue clay/HA in dependance on different concentration of U (VI) ions

CONCLUSIONS

- Based on ASAP analysis we can note, that composite as well as pure clay are mesoporous materials, although the surface area of pure clay is bigger than composite´s. After the process of U(VI) ions adsorption on clay and composite average pore size increases, because of plugging the pores on a surface.
- Analysis of surface charge density show differences in pHpzc point for composite and pure clay in dependance on U(VI) ions presence. With increasing the uranyl ions concentration, the pHpzc value is founded more acidic.

  Increasing the concentration of U(VI) ions cause the decreasing of surface charge density, connected with releasing the hydronium ions from clay and composite surface.
- Moreover, appearance of U(VI) ions impact on stability of composite dispersion. When the concentration of U(VI) ions is significant, the absolute value of zeta potential is low. For pure clay, the zeta potential value decrease when pH increases, independently if U (VI) ions are present. The high concentration of U(VI) ions decreases the clay dispersion stability.
- On the composite hydroxyapatite/white-blue clay takes place the adsorption of uranyl ions. Additional tests will be performed in order to characterize HAP/clay composite. These composites can be potentially use as adsorbents.

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