EVALUATION OF THE ACID–BASE SURFACE PROPERTIES OF NANOSCALE $Fe_3O_4/Al_2O_3/C$

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The carbon component of nanostructures increases the specific surface area of the magnetically sensitive carrier, giving it the properties of biocompatibility with a living organism and ensuring stable functioning in the biological environment. Among the studied ones, the most promising are Fe_3O_4/C core-shell NPs, which are well ordered due to the formation of chemical bonds between the core and the carbon shell. Such structures are characterized by high drug capacity, including for drugs.

The aim of our work was syntesys and to study the adsorption activity of magnetoresponsive core-shell nanocomposites $Fe_3O_4/Al_2O_3/C$ by the type of core-shell towards the chemotherapeutic drug. Nanoscale single-domain Fe_3O_4 in the superparamagnetic state was synthesized by the Elmore method and used as a mineral magnetoresponsive matrix. Research show that the best way to achieve the stability of magnetite in the sucrose pyrolysis temperature range, during the formation of carbon coatings in the structure, may be to modify the surface of alumina (Al_2O_3). The Fe_3O_4/Al_2O_3 NC has thermal stability characteristics sufficient to preserve the magnetic properties of the core [1].

According to the results of potentiometric studies, a conclusion was made about the acid-base characteristics of the surface. According to the experimental values (pH_0) and (pH_{eq}), which were obtained during hydrolytic adsorption in solutions, the change ($\pm\triangle pH$) was calculated and graphs of the dependence $\pm\triangle pH = f(pH_0)$ were constructed. The pH_{IIP} values of the $Fe_3O_4/Al_2O_3/C$ surface in a NSS medium were determined (Fig.).

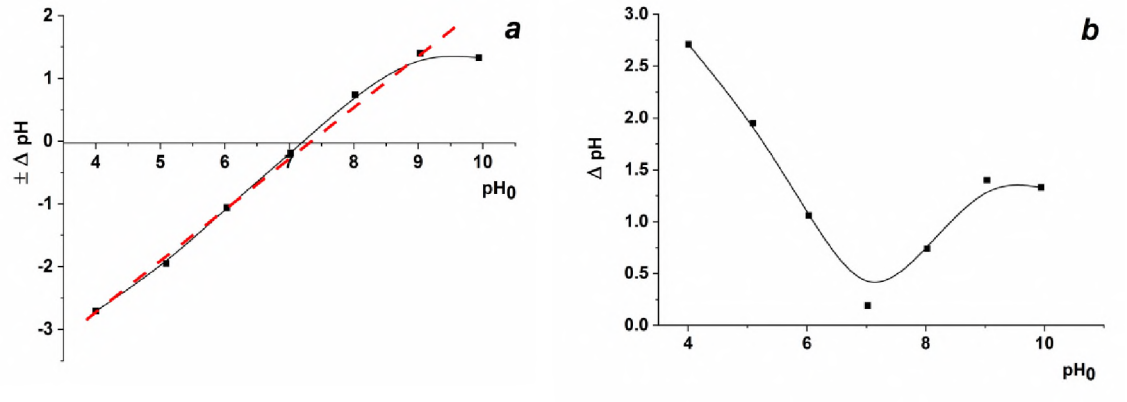

Fig. Dependence $\pm\triangle pH$ on pH_0 (*a*); hydrolytic adsorption curve for the surface of $Fe_3O_4/Al_2O_3/C$ of the NSS medium (*b*)

The determined pH_{IIP} of the surface corresponds to a pH value of 7.2, and the shape of the hydrolytic adsorption curve corresponds to the presence on the surface of different types of acid-base active centers. The shape of the hydrolytic adsorption curve indicates increased activity of the main centers. At pH < pH_{IIP} the hydrolytic adsorption processes take place with the participation of the main centers, which is due to the ability to protonate surface active groups: $(\rceil\!-\!X^0 + H^+ \rightarrow \rceil\!-\!XH^+)$, and at pH > pH_{IIP} hydrolytic adsorption processes occur with the participation of acid centers (deprotonation of surface groups or binding to hydroxyl ions: $(\rceil\!-\!X^0 + OH^- \rightarrow \rceil\!-\!X\!-\!OH^-)$.

1. Gorbyk, P., Petranovska, A., Kusyak, N. et al. (2021). Adsorption of cisplatin by the surface of the magnetic sensitive nanocomposite $Fe_3O_4/Al_2O_3/C$ // Him. Fiz. Tehnol. Poverhni. – 2021. – 12 (4). – P. 291-300.