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Nataliia V. Kusyak, Andrii P. Kusyak, Oksana A. Dudarko, Nataliia M. Korniichuk, Alla L. Petranovska. Petro P. Gorbyk

Adsorption of doxorubicin on the surface of magnetically sensitive nanocomposite Fe3O4/Al2O3/C

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Abstract

$Fe_3O_4/Al_2O_3/C$ nanocomposite was synthesized and characterized by a complex of physicochemical methods. The completeness of carbonization was confirmed by the method of TPD MS, and the results of TEM, EDX and changes in the values of the specific saturation magnetization proved the formation of the structure of $Fe_3O_4/Al_2O_3/C$ by the type of core-shell. According to the results of potentiometric studies, the characteristics of acid -basic centers were quantitatively and qualitatively assessed. The adsorption of Doxorubicin (DOX) on the surface of $Fe_3O_4/Al_2O_3/C$ was performed and the adsorption process depending on the contact time, pH of the solution and DOX concentration was studied. The experimental results of kinetic studies were analyzed for compliance with of Boyd, Morris-Weber and Elovich the theoretical models, models of pseudo-first and pseudo-second orders. Langmuir and Freundlich isotherm models were used to model adsorption processes. Under the conditions of the experiment (pH = 5) active basic centers ($C = 8.46 \cdot 10^{-5}$ mol·g^{-1}, $K_i = 1.296 \cdot 10^{-5}$ ($pK = 4.887$)). Adsorption processes occur by a mixed diffusion mechanism, limiting processes are intraparticle diffusion and chemisorption processes of molecular and ionic forms of DOX. The highest correlation coefficient was $r^2 = 0.971$, the correlation of theoretical and practical values of the adsorption capacity (A mg g^{-1}) indicates the possibility of using the Freundlich model to describe the adsorption of DOX on the surface of $Fe_3O_4/Al_2O_3/C$. Desorption processes practically do not occur at pH 7.4 (change of value A from 30.56 to 30.12 mg g^{-1}, which is − 1.83%), at pH 5 percent of desorbed DOX is higher − 2.88% (change in value A from 30.21 to 29.51 mg g^{-1}).

Keywords: adsorption | carbonization | Doxorubicin | drug delivery | magnetosensitive nanocomposites

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