COMPARATIVE ANALYSIS OF BIOCOMPATIBILITY OF CHEMICAL AND BIOGENIC Fe_3O_4 NANOPARTICLES

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Introduction. Due to their unique physicochemical and biological properties, the application of nanoparticles (NPs) in medicine opens up new possibilities for enhancing the effectiveness of diagnosis and treatment of various diseases, including tumors. Numerous data regarding the biological properties of iron oxide NPs demonstrate their potential for biomedical research, and the use of green synthesis methods leading to the formation of biocompatible biogenic NPs contributes to expanding the scope of their research. **Research aim.** The aim of this study was to investigate the complex impact profile of biogenic and chemically synthesized paramagnetic Fe_3O_4 NPs of the core-shell structure with the anticancer drug fluorouracil (Accord, UK). **Materials and Methods.** Biogenic and chemical syntheses of paramagnetic Fe_3O_4 NPs were performed as indicated [1]. The size and shape of NPs were determined using TEM, SEM, XRD. The cytotoxicity of NPs was assessed on the breast cancer cell line ZR-75 (ATCC CRL-1500) by colorimetric method, with NP loading ranging from 4 to 0.25 μg per well. **Results.** Biogenic synthesis resulted in spherical Fe_3O_4 NPs with a hydrodynamic particle size 750-1500 nm, while chemical synthesis produced NPs ranging from 4 to 24 nm in diameter. Previously, it was found that biogenic and chemical Fe_3O_4 NPs did not induce erythrocyte hemolysis and did not exhibit genotoxicity or antibacterial properties [1]. It was observed that neither chemical paramagnetic Fe_3O_4 NPs nor biogenic ones showed antitumor activity at any of the tested concentrations. However, when used in combination with fluorouracil, biogenic Fe_3O_4 NPs exhibited antitumor activity only at low concentrations (49±4.5% cytotoxicity at 0.25 μg/well), whereas chemical Fe_3O_4 NPs, when used in combination with fluorouracil, not only did not induce cell death, but instead led to an increase in proliferative activity and the number of viable cells by 43±5% (2 μg/well). **Conclusion.** Biogenic and chemical paramagnetic Fe_3O_4 NPs do not possess cytotoxic properties. The growth-stimulating effect observed with chemical Fe_3O_4 NPs may result from the blocking of the active fluorine atom in the structure of fluorouracil due to the formation of a complex with the components of the Fe_3O_4 NP shell. At high concentrations, chemical Fe_3O_4 NPs also exhibit a growth-stimulating effect on E.coli K12, indicating the commonality of this mechanism of action [2]. This research was funded by MESCS RA SC, grant number 10-2/24-I/RAU-BIOL, 21T-1F243.
Keywords: ZR-75 breast carcinoma, biocompatibility, core-shell structure, NP, Fe_3O_4.

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