Proceedings of the 9th World Congress on New Technologies (NewTech'23)
Brunel University, London, United Kingdom - August 09-11, 2023
Paper No. ICNFA 140
DOI: 10.11159/icnfa23.140

Magnetic Smart Systems for Theranostic

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Cancer is one of the most widespread group of diseases causing about 14.6% of all human deaths, representing a major public health problem worldwide. The standard treatment is usually causing side effects which can be reduced by targeting delivery with various nanostructures, including magnetic nanoparticles. Due to the fact that bare Fe_3O_4 nanoparticles are highly susceptible to dissolution in acidic and oxidative conditions as well as to the *in vivo* conditions, coating an outer protective layer is very important for maintaining the stability of the magnetic component until cellular internalization. Also, the proper choice of the shell will be essential in assisting the internalization of these nanostructures inside the tumor cells and further delivering the antitumoral agents directly inside the cells. As functionalization agents, natural catabolism products will be used. such as dicarboxylic amino acids, hydroxyacids and ketoacids.

Magnetite nanoparticles were prepared by precipitation method [1] in the presence of different stabilizing agents (poly ethylene glycol (PEG), glutamic acid and aspartic), using $Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$ and $FeCl_3$ as precursors.

The Fe_3O_4/aminoacid (AA) and Fe_3O_4/PEG/aminoacid (AA) nanoparticles were characterized by Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM-HRTEM) as well as chemical stability in specific media. The detailed structural characterization using the specified techniques confirmed the successful formation of the organic/inorganic Fe_3O_4/aminoacid (AA) and Fe_3O_4/PEG/aminoacid (AA) hybrid core@shell structure. The X-ray diffractograms obtained on the magnetic nanopowders coated with PEG and/or amino acids indicate the presence of magnetite core, and thus the specific peaks of crystalline magnetite can be observed. TEM and DLS analyzes showed a good stability and polidispersity of these systems with an almost spherical shape.

The antitumoral activity is assured by the presence of hydrophobic and hydrophilic agents, the mechanism of delivery being different. Along with the synthetic, hydrophilic cytostatics (cisplatin, irinotecan, etc.) natural, non-toxic antitumor agents, such as Bisabolol and Lycopene are considered.

Acknowledgement: The authors acknowledge the financial support of the "Sisteme inteligente cu eliberare controlata pentru tratarea cancerului utilizand o abordare personalizata (SmartACT)" project PN-III-P1-1.1-PED-2021-1342, contract TE 96 din 17/05/2022.

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