Optimization of Magnetic Nanoparticle Load in Fluorescent Magnetic Nanocarriers for Application in Magnetic Hyperthermia

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Cancer is one of the main causes of death in the world, and its conventional treatments (surgical removal, radiotherapy and chemotherapy) are invasive techniques and has many undesired effects. Nanoscience researchers has proposed alternative approaches to cancer therapeutics, less invasive and with a more specific target in tumor cells. An important step to that is the development of nanocarriers to deliver diagnostic and therapeutic agents to cancer cells, including magnetic nanoparticles. They can be used to stimulate the process of apoptosis, a “programmed” cell death, through magnetic hyperthermia, a phenomenon of heat dissipation by magnetic materials exposed to alternating magnetic fields. The objective of this project was to increase the magnetic nanoparticle load of MalbIR, a fluorescent magnetic nanocarrier for oncology developed in 2017 by researchers of Federal University of Goiás, to enhance its efficiency for magnetic hyperthermia applications. Thus, it was necessary the production of manganese ferrite nanoparticles ($MnFe_2O_4$), which was carried out by the coprecipitation method, and the characterization of nanoparticles and nanocarriers, through techniques such as x-ray diffraction, vibrating sample magnetometry, fluorescent tomography, and heat efficiency analysis. The objective was achieved through the proposed methodology. The characterization showed that the nanocarrier produced preserved its magnetic and fluorescence functionalities, and increased its heat efficiency. Therewith, it can be a contribution in the studies of magnetic hyperthermia in oncology, especially with regard to the MalbIR nanocarriers capacity of killing cancer cells.