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Research Article

Synthesis, Characterization and Hyperthermic Evaluation of PEGylated Superparamagnetic $MnFe_2O_4$ Ferrite Nanoparticles for Cancer Therapeutics Applications

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Abstract

Poly(ethylene glycol) (PEG)-coated superparamagnetic $MnFe_2O_4$ ferrite nanoparticles are of great interest for application in magnetic fluid hyperthermia (MFH) due to their heat generation capability in an external alternating magnetic field, besides biocompatibility, and surface properties. MFH has emerged as a promising therapeutic approach for cancer treatment and is based on controlled heating tumor tissue through the accumulation of $MnFe_2O_4$ ferrite nanoparticles within cancer cells. In the present work, $MnFe_2O_4$ superparamagnetic ferrite nanoparticles via the chemical combustion method are synthesized. The preparation of PEGylated $MnFe_2O_4$ ferrite nanoparticles, which involves the attachment of such molecules at the surface, without the need for coupling agents or prior modification on the species involved. The conjugation of folate onto $MnFe_2O_4$ ferrite nanoparticles is confirmed by FTIR spectroscopy. The $MnFe_2O_4$ ferrite nanoparticles are colloidal stable. The obtained targeted PEGylated $MnFe_2O_4$ ferrite nanoparticles show superparamagnetic behavior with a saturation magnetization of 78.68 emu·g^{-1} at 300 K. Their specific absorption rate (SAR) ranged from 43.2 to 19.5 W g^{-1} in an alternating magnetic field of 5—20 kA m^{-1}. The heat generated is sufficient to raise the sample temperature to the therapeutic range used in MFH establishing this system as promising candidates for use in MFH treatment.

Conflict of Interest

The authors declare no conflict of interest.

Open Research

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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