SYNTHESIS, CHARACTERIZATION, AND HEAT MODELING STUDY OF DOX-HCL-LOADED ZNFE2O4 MAGNETIC NANOPARTICLES MODIFIED WITH CHITOSAN AND FOLIC ACID

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Abstract

In this study, the structural morphology and magnetic effects of magnetic ZnFe2O4 nanoparticles loaded with the cancer-fighting drug doxorubicin hydrochloride (DOX-HCl) were investigated. These nanoparticles have been found to have potential biomedical applications in targeted drug-delivery systems. The zinc ferrite nanoparticles were prepared by a chemical coprecipitation method and coated with chitosan. The nanoparticles were loaded with DOX-HCl and their surfaces improved by folic acid, which can be activated to target specific cancer cells. The specific absorption rate (SAR) values of the ZnFe2O4-chitosan-DOX-HCl nanoparticles were investigated at a frequency of 200 kHz and 1.5 kA/m amplitude in order to obtain Brownian relaxation time parameters. X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), transmission electron microscopy (TEM), vibrating sample magnetometry (VSM), and ultraviolet-visible spectrophotometry (UV-Vis) were used to characterize the bulk properties of these nanoparticles. In addition, the impact of the nanoparticles under an alternating current (AC) magnetic field and their heat-generation ability were investigated using an experimental setup. The average nanoparticle size was found to be 8.5 nm. Magnetic hysteresis loops confirmed the superparamagnetism of the nanoparticles. The saturation magnetization was 6 emu/g. UV-Vis was used to measure the amount of drug loaded onto the nanoparticles. The amount of drug absorption was significantly higher after 12 hour, totaling 75%. The specific absorption rate parameter was 80.66 W/g, and the Brownian relaxation time was 188 10–9 s.

Keywords: Superparamagnetism, zincferritenanoparticle, doxorubicinhydrochloride, folatereceptor, heatability, hyperthermia

Author did not supply full text of the paper.