323b Synthesis and Functionalization of Magnetite (Fe3o4) Nanoparticles for Cancer Treatment

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The use of magnetic nanoparticles and oscillating magnetic fields emerges as an alternative route in the battle against cancer. In this form of cancer therapy, commonly referred to as magnetic fluid hyperthermia or magnetocytolysis, magnetic nanoparticles are delivered to a cancer tumor and, upon the application of an oscillating magnetic field, a localized temperature increase is obtained with tumor remission. Magnetite (Fe3O4) nanoparticles were synthesized through co-precipitation, and functionalized with crosslinked dextran and fluorescein isothiocyanate dextran for magnetocytolysis studies using human colon cancer cells (Caco-2). The co-precipitation synthesis method utilized aqueous solutions of ferric and ferrous chloride ions in the presence of 9.26 kDa dextran (used to improve dispersion of the nanoparticles in cell culture media, without introducing potentially cytotoxic surfactants) with ammonium hydroxide as the reducing agent. Crosslinking with epichlorohydrin (ECH) was performed afterwards to avoid desorption of the dextran during subsequent handling of the particles and during biological assays. Fourier Transform Infrared (FTIR) spectroscopy indicated the presence of dextran in the magnetite samples. X-Ray diffraction indicated the presence of a phase with crystalline structure consistent with that of magnetite. SQUID magnetometry was employed to measure the DC magnetization response of the samples, demonstrating superparamagnetic behavior at room temperature and providing estimates for the magnetic core diameter ranging from 6 to 13 nm. Transmission electron microscopy (TEM) was used to verify the expected nanoscale size of the particles. Fluorescent magnetite nanoparticles prepared with fluorescein isothiocyanate dextran were used in particle transport studies through laser confocal microscopy. The results of various assays aimed at studying the effectiveness of the nanoparticles at killing Caco-2 cells will be presented.