Poster

SYNTHESIS OF SUPERPARAMAGNETIC NANOPARTICLES FOR STEM CELL TRACKING

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Stem cells show great promise in treating certain, so far incurable, pathologies and the search for more applications of these cells is currently the subject of intense research[1]. To determine the success of such stem cell therapies, a non-invasive monitoring of the cells is often required. Magnetic resonance imaging (MRI) couples detailed anatomical information to the possibility of visualizing and tracking these stem cells *in vivo* by labeling them with superparamagnetic nanoparticles (SPMNPs). Under an applied magnetic field, these nanoparticles are magnetized and generate induced magnetic fields, which can perturb the magnetic relaxation processes of the protons in water molecules surrounding these nanoparticles. This phenomena leads to the shortening of the spin-spin relaxation time (T2) of the proton, which results in the darkening of MR images. Stem cells labeled with SPMNPs can therefore be tracked *in vivo* as they now induce a hypo intense spot in the MR image.

The ideal SPMNPs to label stem cells must efficiently be taken up by the cells and must render high contrast in MRI. Commercial particles often suffer from inhomogeneous size distributions which complicates quantification and their ability to be detected is limited due to relatively low magnetization saturation values.

In this paper, we report the first steps of pursuing improved SPMNPs as MRI contrast agents for stem cell tracking. We have synthesized Fe_3O_4 nanoparticles using the thermal and hydrothermal decomposition method to ensure narrow size distributions. FePt SPMNPs were investigated to obtain nanoparticles with high magnetization saturation values. Subsequently, the nanoparticles were chemically coated to obtain a stable dispersion in water. Different capping agents were used to functionalize the SPMNPs and render them stable in highly concentrated salt solutions. The properties of the SPMNPs were thoroughly characterized. Size and morphology characteristics were investigated using Dynamic Light Scattering (DLS) and Transmission Electron Microscopy (TEM). Fourier Transform Infrared Spectroscopy (FTIR) and Thermogravimetric Analysis (TGA) revealed the surface properties of the particles. Magnetic characterization was performed using Alternating Gradient Field Magnometry (AGFM). Currently, the study of the contrast generating properties of the nanoparticles in MRI is in progress.

References:

[1] Mimeault M. et al., Clinical Pharmacology & Therapeutics, **82** (2007) 252-264.

Figures:

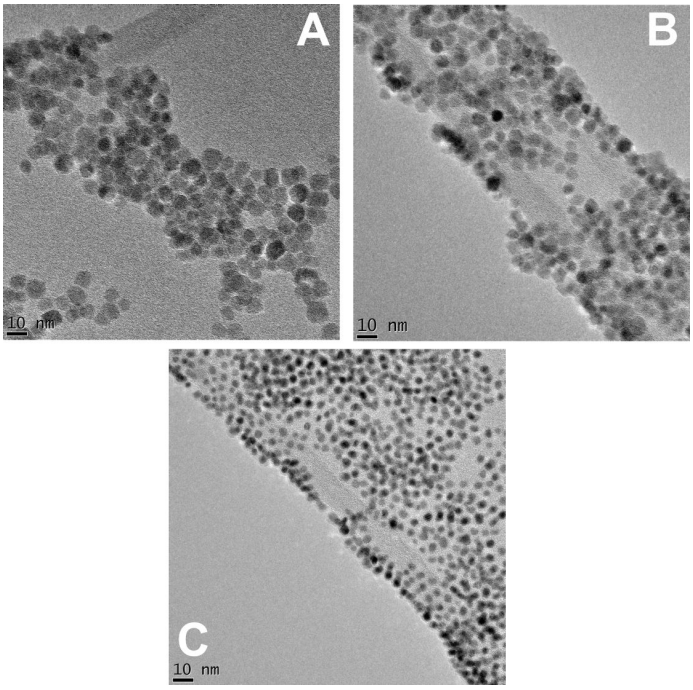

Fig. 1 TEM-images of Fe_3O_4 (A, B) and FePt (C) SPMNPs synthesized using the hydrothermal decomposition (A) and the thermal decomposition (B, C) method.