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PEGylated superparamagnetic magnetite nanoparticles for magnetic fluid hyperthermia therapy

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Background and Aims: In this study polyethylene glycol (PEG) conjugated magnetite nanoparticles (MNPs) were developed.
Methods: For this purpose, we synthesized well-dispersed 10 nm superparamagnetic MNPs by co-precipitation of Fe2+ and Fe3+ in an ammonia solution and stabilized subsequently with citric acid. While successful magnetic tumor targeting of MNPs has been achieved in a number of models, the rapid blood clearance of magnetically suitable particles by the reticuloendothelial system (RES) limits their availability for targeting. Aimed to develop long-circulating MNPs capable for sustained tumor exposure via the circulation, thus potentially enhanced magnetic tumor targeting, PEG chains covalently attached to the particle surface. The microstructure and morphology of the nanoparticles were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FTIR), whereas the magnetic properties were investigated by vibrating sample magnetometry (VSM).
Results: It was found that the nanoparticles demonstrated well defined superparamagnetic behavior.
Conclusions: The results show a high magnetic saturation and high self-heating capacity. These nanoparticles with high self-heating capacity are a promising candidate for cancer hyperthermia treatment.

Keywords: PEGylation; Superparmagentic magnetite nanoparticles; Hyperthermia