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Rapid microwave method for the synthesis of magnetic nanoparticles as MRI contrast agents with high relaxivities

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Magnetic nanoparticles (MNPs) form a major class of nanoscale materials with the potential to revolutionize current clinical diagnostics and therapeutic techniques. Composition, size, morphology and surface chemistry of these nanoparticles can now be tailored by various processes to not only improve magnetic properties but also affect the behavior of nanoparticles *in vivo*. Due to their unique physical properties and ability to function at the cellular and molecular level of biological interactions, MNPs are being actively investigated as the next generation of contrast agents for magnetic resonance imaging (MRI). There is considerable interest in developing magnetic nanoparticles and their surface modifications with therapeutic agents. The study involves the synthesis of biocompatible HPPH [2-(1-Hexyloxyethyl)-2-devinyl pyropheophorbide-a], a cancer drug coated with iron oxide nanoparticles and to evaluate their efficacy as MRI contrast agents. A simple and rapid microwave method to prepare Fe_3O_4 nanoparticles has been developed. The relaxivities (R_2) of the coated magnetic nanoparticles were also measured and the results showed that R_2 of the Fe complex (Fe_3O_4 + Polymer + Drug) was higher than that of bare Fe nanoparticles and polymer coated Fe nanoparticles. The relaxivities of polymer coated Fe NPs and Fe complex NPs increase than bare Fe NPs due to the increase in hydrodynamic sizes. The drug was successfully conjugated to the Fe_3O_4 nanoparticles which could further be used for various applications. The results with various amounts of molar concentrations will also be discussed.

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