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Iron Oxide Magnetic Nanoparticles as MRI Contrast Agents

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Abstract : Iron oxide (Fe3O4) magnetic nanoparticles (MNPs) are one of the most attractive nanomaterials for various biomedical applications. An important potential medical application of polymer-coated iron oxide nanoparticles (NPs) is as imaging agents. 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. MNPs are being actively investigated as the next generation of magnetic resonance imaging (MRI) contrast agents. Also, there is considerable interest in developing magnetic nanoparticles and their surface modifications with therapeutic agents. Our study involves the synthesis of biocompatible cancer drug coated with iron oxide nanoparticles and to evaluate their efficacy as MRI contrast agents. A simple and rapid microwave method to prepare Fe3O4 nanoparticles has been developed. The drug was successfully conjugated to the Fe3O4 nanoparticles which can be used for various applications. The relaxivity R2 (reciprocal of the spin-spin relaxation time T2) is an important factor to determine the efficacy of Fe nanoparticles as contrast agents for MRI experiments. R2 values of the coated magnetic nanoparticles were also measured using MRI technique and the results showed that R2 of the Fe complex consisting of Fe3O4, polymer and drug was higher than that of bare Fe nanoparticles and polymer coated nanoparticles. This is due to the increase in hydrodynamic sizes of Fe NPs. The results with various amounts of iron molar concentrations are also discussed. Using MRI, it is seen that the R2 relaxivity increases linearly with increase in concentration of Fe NPs in water.

Keywords : cancer drug, hydrodynamic size, magnetic nanoparticles, MRI
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