Synthesis and surface modification of antiferromagnetic MnO nanoparticles for bioimaging as T_1 contrast agent.

H. R. Neves[1] and L. C. Varanda[1]
[1]*IQSC, Universidade de São Paulo, S. Carlos, SP, Brazil*

Nanomaterials have been widely studied as a result of their interesting physical and chemical properties, which offer a large number of possibilities for applications in biomedicine and others science fields. The nanoparticles (NPs) use has attracted attention for the potential improvement in cancer therapy and the development of strategies for non-invasive diagnosis[1]. The superparamagnetic iron oxide nanoparticles (SPION) is the main material studied as contrast agent in magnetic resonance imaging (MRI) due to its ability to reduce T_2 relaxation times in different tissues and lower toxicity compared than Gd^{3+} and Mn^{2+} complexes used nowadays[2]. However, this superparamagnetic NPs accumulation can be confused with signals from calcification, bleeding or metal deposits, and the high magnetic susceptibility distorts the background image[3]. Thus, some aspects are desirable from potential materials to replace SPION, such as nanoparticulate form for simple surface modification and labeling with targeting agents, and positive T_1 contrast ability[3]. The antiferromagnetic MnO NPs attend all these requirements and overcome the drawback of using SPION. In our study, using a modification of Hou and workers method[4], MnO NPs were synthesized by the thermal decomposition of Mn(II) acetylacetonate, under a N_2 flux in a mixture of oleic acid and oleylamine resulting in spherical nanoparticles with average size of 21 ± 3,9 nm. The ligand-exchange step was used to replace the oleic acid adsorbed on the as-synthesized NPs surface by 3-aminopropyltriethoxysilane (APTMS)[5]. After that, a biocompatible and water-dispersible core/shell structure was obtained by the NPs coating with carboxymethyl dextran[5]. Both the as-synthesized and coated NPs present controlled size and shape and the final NPs size distribution are compatible with the expected for biomedical applications.

Keywords: magnetic resonance imaging, antiferromagnetic nanoparticles, T_1 contrast agent, nanomaterials, MnO.

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lvaranda@iqsc.usp.br