Magnetic properties and cytotoxicity of iron oxide nanoparticles with different coatings

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In the last decades, nanostructured materials have been widely and successfully explored in a wide range of engineering and biomedical applications [1]. Among the nanomaterials, superparamagnetic iron oxide nanoparticles (SPIONs) are interesting materials for biomedical applications due to their capability to be manipulated and localized using an external magnetic field [2], and to enhance contrast in MRI imaging. In this study, SPIONs with different biocompatible coatings (dextran, chitosan, carboxysilane, polyethylene glycol and silica) were synthesized. The physico-chemical properties of the coated NPs were characterized, including the magnetization curves and r_2 and r_1 relaxivity of aqueous dispersions using nuclear magnetic resonance imaging (MRI). The size of coated-SPIONs ranged from 14-36 nm and their crystalline structure were consistent with the ferrite spinel. Magnetization curves are typical of superparamagnetic behavior, but saturation magnetization is dependent on the surface coating. The r_2 transverse relaxivity values ranged from 60.2-80.4 $mM^{-1}.s^{-1}$, except for chitosan-coated SPIONs, which present higher values, possibly due to particle aggregation. The r_2/r_1 ratios were between 4.03-56.3, typical of commercially available negative contrast agents for MRI. *In vitro* toxicity assays performed with VERO cells indicated acceptable values of cell viability at iron concentration up to 2 mM, except for silica-coated SPIONs. The SPIONs coated with carboxysilane and polyethylene glycol showed the best biocompatibility. Silica- and chitosan-coated SPIONs showed the highest levels of cytotoxicity among all groups.

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References:

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