Iron Oxide Nanoparticles as Contrast Agents for Magnetic Resonance Imaging Applications

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Magnetic Resonance Imaging (MRI) is a widespread technique used in the clinical field for the diagnosis of diverse diseases, such as stroke or cancer, since it allows the visualization of internal tissues and organs. In comparison with other imaging techniques, it displays some remarkable characteristics like high spatial resolution and noninvasiveness. However, a major drawback of this technique is its sensitivity: the natural contrast between healthy and damaged tissue is very low, which may complicate the diagnosis. Nowadays, contrast agents are used to increase the relaxation rates of surrounding water proton spins, which significantly enhances the clinical image resolution.

The currently used contrast agents in clinics have mostly gadolinium as the magnetic ion, but its use has several drawbacks, such as toxicity and low lifetime in the blood stream. Therefore, the development of novel contrast agents based on *e.g.* iron oxide is of fundamental importance to avoid toxicity and improve lifetime and multifunctionality of the system.

Here, we report on the parameters affecting the Superparamagnetic Iron Oxide Nanoparticle (SPION) relaxivity (Fig. 1). The parameters studied were the synthesis technique (hydrothermal and coprecipitation method), the polymeric coating (hydrophilic and hydrophobic polymers), and doping with magnetic and non-magnetic ions (Mn^{2+} and Zn^{2+}). The *in vitro* validation was performed to probe the suitability of these SPIONs for biomedical applications. Hence, data of different SPIONs will be shown regarding magnetic and relaxivity properties, cytotoxicity, uptake behavior and MRI imaging capability.

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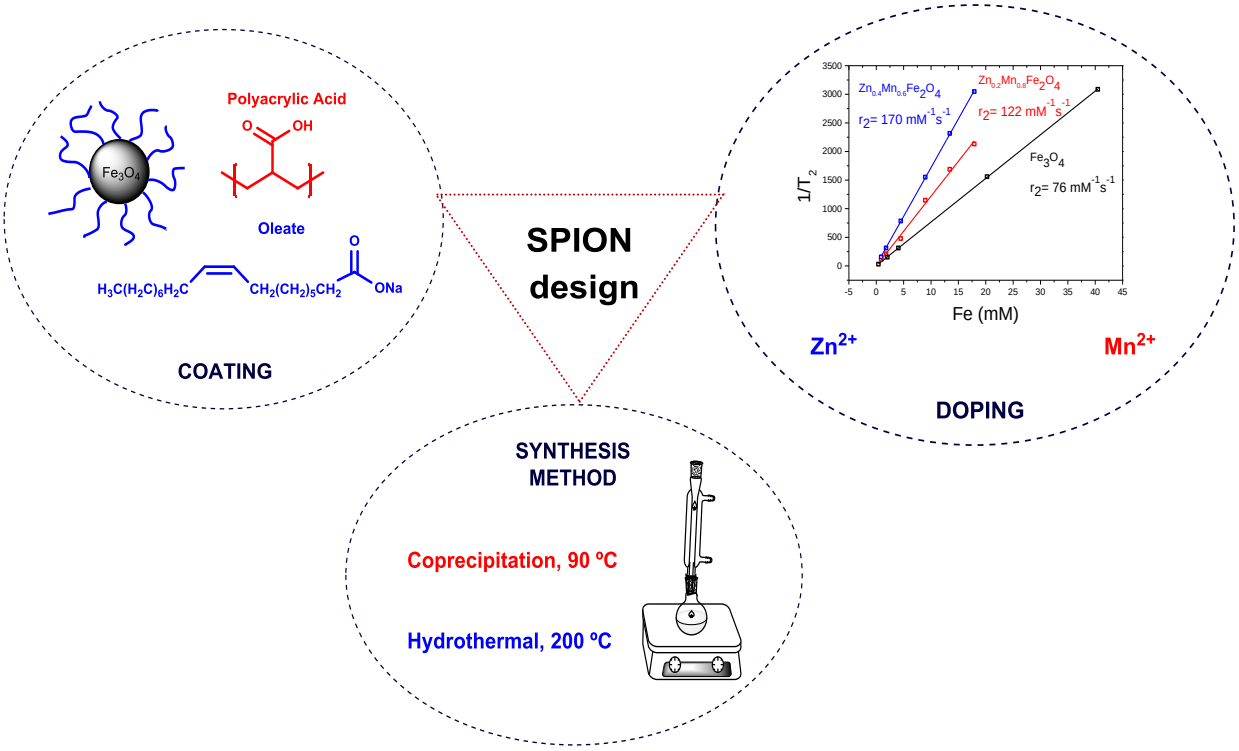

Figure 1: Parameters studied, which affect the relaxivity values.