MAGNETISM AND BIODISTRIBUTION OF HIGH QUALITY IRON OXIDE NANOPARTICLES SUITABLE FOR APPLICATIONS IN BIOMEDICINE

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Magnetic nanoparticles (NPs) [1] are promising materials for *in vivo* and *in vitro* applications in biomedicine, *e.g.* in targeted and selective drug delivery, magnetic resonance imaging or bio-sensing. In this framework, iron oxide is a first choice material due to its low toxicity and ease to be functionalized. Generally speaking, a nano-volume is desired for the magnetic entity with the highest possible saturation magnetization and superparamangnetic behaviour at room temperature. Methods for producing uniform γ-Fe_2O_3/Fe_3O_4 NPs of high magnetic quality meeting the criteria mentioned above are well described in literature [2,3], with the drawback of those NPs being usually hydrophobic, such that ligand exchange to a hydrophilic coating is required. In this work, we report on the bio-distribution in rodents of injected, hydrophilic high quality magnetic γ-Fe_2O_3/Fe_3O_4 NPs, synthesized by thermal decomposition of an organic Fe precursor in an organic phase in the presence of oleic acid as surfactant. The NPs were water dispersed by ligand exchange from oleic acid (as synthesized) to dimercaptosuccinic acid (DMSA) [2,3]. Zero field cooling and field cooling (ZFC/FC) curves and magnetization measurements of the particles dispersed in frozen liquid evidence that no aggregation is produced due to the ligand exchange process . Further more, no loss in saturation magnetization is produced during the process, while superparamagnetic behaviour is preserved, suggesting that those NPs are suitable for bio-applications. The water dispersed NPs have been introduced in living rodents by either subcutaneous or intravenous injection. Magnetization measurements of samples of liver, kidney and spleen of those rodents evidence various degrees of uptake of magnetic material depending of the organ, and points out to the intravenous way as an efficient administration way. Subcutaneous injection of the same dose of NPs yields almost no appreciable uptake in the organs. Magnetic data enable to quantitatively estimate the amount of magnetic material in each organ. Finally, the effect on the bio-distribution of implanting magnets in the body of the rodent is also studied.

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