Oxidation Stable Ferromagnetic Iron Nanoparticles: A Promising Candidate for Biomedical Applications

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One of the great interests on single domain iron nanoparticles in modern nanotechnology lies in their size dependent magnetic behavior. Till date most of the studies have been carried out with superparamagnetic iron nanoparticles where as ferromagnetic particles draw the current attention as their potential application in biomedicine, especially for hyperthermia treatment. The major drawback of metallic iron nanoparticles arises because of their instabily against long-term oxidation. Henceforth, it is a real challenge for a synthetic chemist to make oxidation stable ferromagnetic iron nanoparticles with enhanced biocompatibility.

To achieve stable ferromagnetic iron nanoparticles we synthesized polystyrene coated ferromagnetic iron nanoparticles and then core (Fe nps)–shell (PS) nanoparticles which were further encapsulated with silica/functional silica to acquire oxidation stability. As synthesized nanoparticles were characterized extensively with different analytical techniques (TEM, DLS, VSM, FTIR, TGA). The experimental results reveal that the particles are sufficiently oxidation stable having ferromagnetic property.

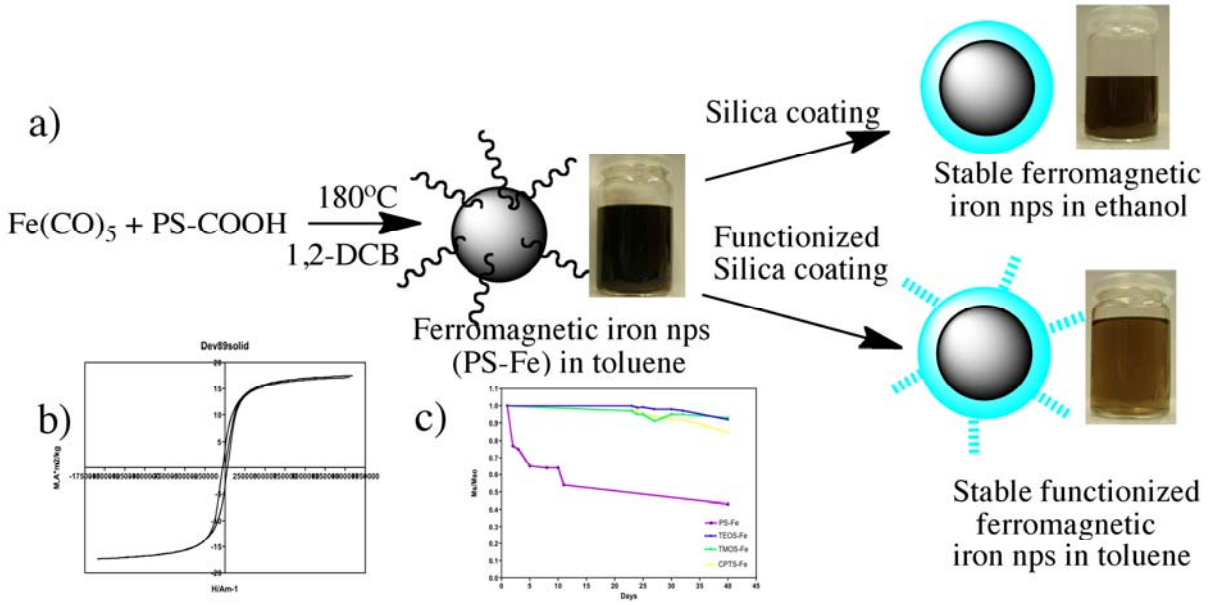

Figure 1: a) Scheme of the preparation of stable iron nps with visual picture of the samples b) VSM of polystyrene coated Fe nps c) magnetization with time curve of all samples.

The results open an opportunity in order to use of these nanoclusters in dramatic enhancement of contrast as MRI contrast agent along with other biomedical applications such as cell separation and magnetically controlled drug delivery system.