Surface Functionalization of Magnetic Nanoparticles for Biomedicine

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Abstract

Magnetite nanoparticles (Fe_3O_4) exhibit the unique electric and magnetic properties based on the transfer of electrons between Fe^{2+} and Fe^{3+} in the cubic sites. Due to the unique properties and advantages of magnetite, such as strong magnetism, good biocompatibility, long durability, low toxicity and low cost, it is widely used in magnetic biomedicine [1–3], heavy metal ions removal, electromagnetic wave absorption and other fields [4-6].
Most of these applications require Fe_3O_4 NPs to be chemically stable, biocompatible and highly dispersible in various pH liquid media. In order to meet all above mentioned requirements, adding a coating to Fe_3O_4 NPs is the most common approach. This fact changes their surface properties and prevents direct contact between the Fe_3O_4NPs.

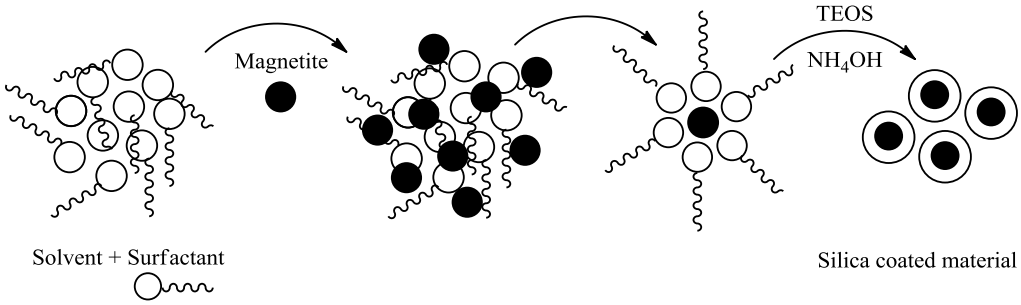

Figure 1. Modification of Magnetic Iron Nanoparticles (INPs).

In this work, magnetite nanoparticles were synthesized by chemical co-precipitation of $FeCl_2 \cdot 4H_2O$ and $FeCl_3 \cdot 6H_2O$ using hydroxide ammonium as precipitants. The chemical co-precipitation method was selected for its simplicity, convenience, reproducibility, and low cost in the use of glassware. The nanostructured materials were characterized by transmission electron microscopy (TEM) and X-ray diffraction (XRD). Iron nanoparticles were modified (Fig. 1) with TEOS as precursor of silica and polyvinylpirolidone (PVP) as surfactant. The objective of this work is to study the variation in the morphological characteristics and physical properties of obtained nanoparticles before and after modification as a function of the different production processes.

References

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