

Synthesis and functionalization of iron oxide nanocubes and their catalytic and bio-sensing applications

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Functional magnetic nanoparticles have a great importance in various fields of applications, including nanoscience, nanotechnology, environmental chemistry and bio-applications. In this respect, and at first, a novel sonochemical approach was developed for the synthesis of size controlled high magnetization magnetite (Fe_3O_4) nanocubes as a core. After that, we have functionalized the magnetite nanocubes surface with various inorganic materials including, silica (SiO_2), Titania (TiO_2), Carbon (C) and Gold (Au). For functionalization of magnetite nanocubes surface, a facile time-reducing sol-gel and sono-chemical approach were developed. Interestingly, the time of the total coating process in case of the sol-gel approach is only two hours with respecting to the reported work which takes more than 20 hours. Noteworthy, in case of the second developed approach of sonochemical method, we used a single reaction for the synthesis and functionalization of magnetite nanocubes to get the core/shell nanostructures. The core/shell nanocubes samples were characterized by X-ray diffractometry (XRD), transmission electron microscopy (TEM), energy dispersive spectrometer (EDS), fourier transform infrared spectroscopy (FTIR), and vibrating sample magnetometer (VSM). The produced functionalized magnetite nanocubes showed excellent efficiency for catalytic applications and also high biocompatibility.