A multifunctional magneto-fluorescent nanocomposite for visual recognition of targeted cancer cells

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Abstract: A multifunctional hybrid nanocomposite material of iron oxide nanoparticles and CdS quantum dots was synthesized by a direct amide coupling reaction. The prepared nanoparticles were characterized by transmission electron microscopy (TEM), atomic force microscopy (AFM), dynamic light scattering (DLS) and zeta potential studies. The TEM studies suggested that the sizes of the particles were in the range of 13.5 ± 1 nm. The energy dispersive x-ray (EDX) analysis confirmed the presence of Fe, Cd and S in the nanocomposites. To check the utility of this nanocomposite as a molecular imaging probe, these nanoparticles were further conjugated with folic acid. The folic acid conjugated nanocomposites were treated with rat glioma cells (C6, folic acid receptor over-expressing cell lines), human lung adenocarcinoma epithelial cells (A549, folic acid receptor negative cell lines) and normal mouse splenocytes for cell uptake and cytotoxicity studies. The nanoparticle internalization to C6 cells was confirmed by green fluorescence emission from these cells. Prussian blue staining studies suggested the intracellular presence of iron oxide. Further it was found that folic acid conjugated nanocomposites were significantly toxic to C6 cells only after 48 h but not to A549 cells or splenocytes. These studies indicated that the prepared nanocomposites have the potential to be used as delivery agent for magnetic and fluorescent materials towards folic acid receptor over-expressing cells and thus can find their application in the field of in vitro imaging diagnosis.

Keywords: quantum dots, magnetic nanoparticles, folic acid receptor, fluorescence imaging, cytotoxicity.

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