Pegylated and amphiphilic Chitosan coated manganese ferrite nanoparticles for pH-sensitive delivery of methotrexate: synthesis and characterization

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Abstract:

Magnetic nanoparticles (MNPs) are the major class of nanoparticles (NPs) with specific functional properties that make them good candidates for biomedical applications. Due to their response to the magnetic field, they can be used in targeted drug delivery systems. In current research, the MNPs were synthesized with the general formula of Fe1-xMnxFe2O4 by the co-percipitation technique. First, the effect of the Fe2+ ions in the system was investigated. Succinid anhydride was used as the first stabilizer to prepare surface for binding two types of polymer, including Polyethylene glycol (PEG) and palmitoylated polyethylene glycol-grafted (Cs-PEG-PA) were introduced as a polymeric shell. The composition, size, structure and magnetic properties of NPs were determined by the particle size analysis (PSA), X-ray diffractometry (XRD), Fourier transform infrared spectroscopy (FTIR) and vibrating sample magnetometer (VSM). Determining the well-defined properties of MNPs, methotrexate (MTX), as a common anticancer drug, was encapsulated into the coated MNPs. The drug encapsulation efficiency was as high as 92.8 % with the magnetization value of 19.7 emu/g. The in-vitro release pattern was studied, showing only 6% of the drug release in pH= 7.4 (as a model of the physiological environment) and 25% in pH= 5.4 (as a model of the tumor tissue environment) after 72 h. Based on these results, we may be able to introduce this specific system as a novel pH sensitive MNP system for MTX targeting to tumor tissues in cancer chemotherapy

Image

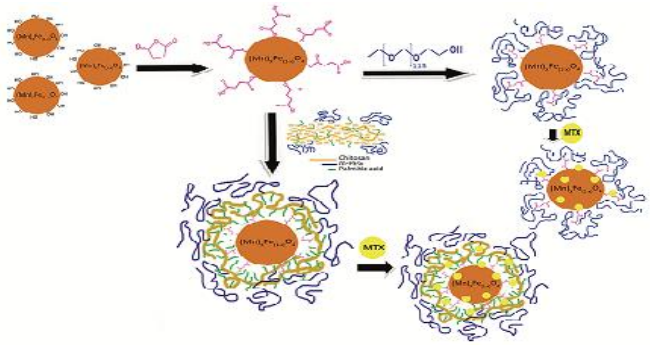


Figure 1: schematic illustration of coating and drug loading of manganese ferrite nanoparticles for pH-sensitivedelivery of methotrexate



Maryam Karimi holds a Master Degree in Materials Science and Engineering by the Islamic Azad University. Where she furthers her research on the physical concepts of ferrofluids, hyperthermia principal, magnetic properties and synthesis methods of Nano sized ferrites to provide a suitable selection of magnetic core, surfactant layer and liquid type for influential cancer treatment.

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