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Synthesis of superparamagnetic $CoFe_2O_4$ with chitosan-g-PEG copolymer coating for biomedical applications

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Background: Nowadays, applications of magnetic nanoparticles have developed in today's treatments, such as gene therapy, chemotherapy, protein therapy, imaging and magnetic hyperthermia therapy. In this work, we prepared superparamagnetic ferrite nanocrystals with polymer coating as new candidate for cancer diagnosis, staging, and treatment (Magnetic fluid hyperthermia).

Methods: Nano-$CoFe_2O_4$ particles with diameter of 12 nm were synthesized, by Chemical Co-precipitation method by using inorganic base. Surface modifications of NPs were done by electrostatic bond between NPs and the trimethylchitosan (TMC). Then the grafts of PEG onto nanocomposites were rapidly formed by covalentbond between TMC-NPs and PEG.

Result: Monodisperse particles, high colloidal stability and superparamagnetic properties were observed, by using the simple method with the certain molar concentration of Co^{2+} in 3M NaOH at 100°C. The design of NP surface was done by grafting an appropriate amount of PEG onto the TMC backbone based on structure and physiology of tumor cells. *In vivo,* the therapeutic success of magnetic NPs relies on the hydrodynamic sizes of NPs between 10 and 100 nm and maximize blood half-life of NPs. The hydrodynamic diameters of synthesized PEG-g-TMC-$CoFe_2O_4$ NPs were between 50-80 nm by DLS. Also, the negative and positive charge of copolymer coating improves the uptake of cationic nanoparticles in cancer cells and increases the distribution of anionic nanoparticles throughout the tumor environment. The properties of $CoFe_2O_4$ and PEG-g-TMC-$CoFe_2O_4$ NPs were analyzed by TEM, DLS, XRD, IR and VSM.

Conclusion: Results showed that, $CoFe_2O_4$ with 12 nm were synthesized by appropriate anisotropy and coercivity instead of iron-oxide NPs with low coercivity in the same size. Also, the amino and hydroxyl groups of copolymer can be utilized as a linker for the protein and drug conjugation by covalent bonds or by weak interactions. So, this polymer nanocomposites can be apply for selective and targeted delivery of drugs or a targeted antibody (nanobody) that recognize tumor antigens on the cancer cells in cancer and radio therapy.

Biography

Narges Pourbagher is an MSc student of Cellular & Molecular Biology at Islamic Azad University of Iran. She is currently Research Assistant at Biosensor Research Center, Endocrinology and Metabolism Molecular-Cellular Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran. She has experience in synthesis of magnetic NPs and the design of biosensor. Now, she is studying targeted therapy with NPs for imaging and thermal therapy.

Synthesis and characteristics nanocomposites single wall carbon nanotubes with some monomers as cancer therapy

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The using some monomers we can preparation new nanocomposites as novel drug for cancer therapy. This work involve synthesis and characteristics nanocomposite base single-wall carbon nanotubes (SWCNTs) functionalized with carboxylate group (COOH) and with biopolymers such as 2-hydroxyethylmethacryate (HEMA) and N-vinylpyrrolidone (NVP) by chemical grafting of on this surfaces HEMA-COOH. These results were confirmed by FT-IR and SEM. The cell culture experiments conducted for pharmaceutical applications were used as cancer therapy.

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