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Synthesis of supperparamagnetic $CoFe_2O_4$ with chitosan-g-PEG copolymer coating for the 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 Coprecipitation 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 covalent bond 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.

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CD146, a novel target that underpin CD44-promoted invasion of breast tumor cell

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CD146, a cell adhesion molecule first identified in highly metastatic melanomas is a tumor promoter of melanoma. However, its role in breast tumor progression is still controversial. In a pilot study, we have identified CD146 as a potential transcriptional CD44-downstream target in the MDA-435 breast cancer cell line, using subtractive hybridization and northern blot analyses. In the present study, using various molecular and cellular approaches, we provide evidence that CD146 is a novel downstream target for CD44-signaling regulating breast tumor cell invasion. More interestingly, this study demonstrates a new role of CD44 in regulating neovascularization and in promoting cancer cell transmigration of blood vessels *via* regulating its downstream target CD146.

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