

THERANOSTIC MATERIALS FOR MRI AND TARGETED DELIVERY BASED ON FUNCTIONALIZED MAGNETITE NANOPARTICLES

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In the last decades, the synthesis of magnetic nanoparticles, in particular magnetite nanoparticles (MNPs), has received increased attention due to their wide range of applications in biomedicine and technology. MNPs can be effectively used for diagnostics and treatment of various diseases. Size, shape, charge and surface chemistry of NPs are fundamental characteristics that determine substantially their properties. Moreover, these characteristics have a big role in the processes of pharmacokinetics and pharmacodynamics. Magnetite nanoparticles are nontoxic, biocompatible and degradable material.

Considering current demographic trends in the world and the nature of the dynamics of morbidity, we can expect that even if the average level of cancer incidence will occur more than 15 million new cases of malignant neoplasms in the population each year. It is obviously that the increase of cancer incidence will be occur substantially due to prostate cancer in men, tumors of the colon and rectum in men and women. Thus the problem of creating universal drug (theranostic materials) for early diagnosis and treatment of malignancy becomes more and more actual.

The opportunity of application of magnetite nanoparticles in MRI and drug delivery is highly dependent on their sizes and magnetic characteristics. In this work we attempted to create materials based on MNPs for prostate cancer therapy and diagnostics. We carried out synthesis of magnetite nanoparticles with different morphology (cubes, rod-like, star-like and flower-like) and with average size from 10 to 50 nm. Obtained nanoparticles were synthesized by thermal decomposition of iron-containing precursors in high-boiling organic solvents, as well as the aging method in aqueous medium. All nanoparticles were characterized by different physicochemical methods such as: transmission electron microscopy, X-ray diffraction, thermogravimetric analysis, ICP - MS. Also magnetic measurements of samples were carried out. For transfer of MNPs from the organic into the aqueous medium and to prevent aggregation MNPs were functionalized and coated with biocompatible copolymers based on polyethyleneglycol and pluronic.

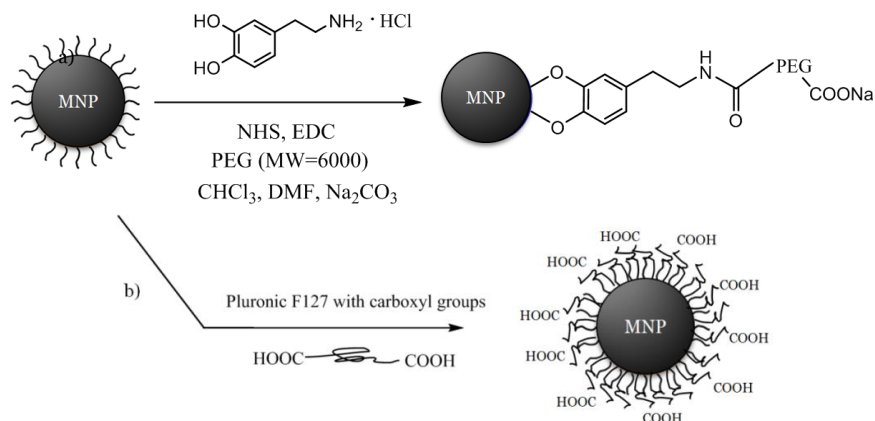


Figure 1 – Mechanisms for the transfer of MNPs into aqueous medium: (a) by covalent binding to dopamine – PEG – COOH and (b) through hydrophobic interactions with modified Pluronic F127

T2 and T1 - relaxivity were studied and on this basis we selected the potential candidate for theranostics. Then we carried out conjugation of the samples, which showed good results in MRI, with a vector specific to prostate cancer. Finally, we carried out experiments *in vivo* with given samples. More detail information about this experiment will be presented.

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