

MAGNETIC MATERIALS FOR SMART THERAPY AND DIAGNOSTICS

Prof. Alexander Majouga, Lomonosov Moscow State University, National University of Science and Technology
"MISiS"

majouga@org.chem.msu.ru

Aleksander Savchenko, National University of Science and Technology "MISiS"

Natalya Lkyachko, Lomonosov Moscow State University

Uyrii Golovin, Lomonosov Moscow State University

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Magnetic nanoparticles have received significant attention recently and are actively investigated owing to their large potential for a variety of applications. Gold-coated magnetic nanoparticles are a class of nanoparticles that have attracted much attention because of their advantageous characteristics, such as their inertness, non-toxicity, super magneticity, ease of detection in the human body, a magnetic core that is protected against oxidation, their facilitated bio-conjugating ability, catalytic surface, and their potential for a variety of biological applications. Gold-coated nanoparticles have great biocompatibility with the human body with the ability to interact with biomolecules such as polypeptides, DNA, and polysaccharides.

Herein we report a synthetic procedure for the preparation of water-soluble Fe_3O_4 , $\text{Fe}_3\text{O}_4@Au$ core-shell and dumbbell nanoparticles, simple protocol for their synthesis, purification by exclusion chromatography and method for functionalization of gold surface with a number of sulfur-containing ligands (L-cystein, 3-mercaptopropionic acid, 11-mercaptoundecanoic acid, lipoic acid, HS-PEG-COOH, 2-aminoethanethiol, and others). Finally, magnetic nanoparticles were functionalized by immobilization of enzymes, PSMA targeted ligands, fluorescent dyes. These magnetic nanoparticles were characterized by transmission electron microscopy (TEM), FTIR, DLS and UV-Vis spectroscopy.

We describe a distinct effect of non-heating superlow-frequency magnetic fields on the kinetics of chemical reactions catalyzed by the enzymes immobilized on core-shell nanoparticles. The observation is unprecedented and suggests the significance of magneto-mechanochemical effects induced by realignment of MNP magnetic moments in an AC magnetic field rather than traditional heating. Such low frequency and amplitude fields are safe and are not expected to cause any damage to biological tissues.

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