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ESR for Controlling Magnetite Nanoparticles Focusing

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Extended Abstract

Magnetic nanoparticles are of great interest of scientists. They are widely investigated as a new generation of targeted drug delivery [1]. Because of their physical properties, using the special gradients of magnetic field, they could be directed to affected site. This solution is particularly important in cancer treatment because standard chemotherapy destroys both cancer and healthy cells.

One of the methods which can be used for magnetite nanoparticles investigation is electron spin resonance (ESR). When the nanoparticles are functionalized (e.g. with a spin label) the results give us the information both about the core and the surface of nanoparticles, about their dynamics and interaction with the environment (e.g. blood) [2].

In this presentation the method with a special configuration of a magnetic field for focusing of nanoparticles with a magnetic core in 3D space will be shown. The values of a magnetic field in the experiments performed amounted to about 22 mT inside the center and 12 mT on the edge of the glassware with the sample. Therefore, the average gradient of a magnetic field was 0.59 mT/mm at a distance from the center to the edge of the glassware. The changes in concentration of nanoparticles during their focusing can be controlled using ESR by measuring samples taken from the center and from the edge of the glassware. It will be shown how it changes depending on the size of nanoparticles core, coating agents and the environment (water, human blood or serum) in which nanoparticles are expected to be focused [3]. Some of studied nanoparticles were functionalized with a spin label TEMPO what made it possible to obtain additional information about their dynamics. Electron spin resonance allows you to get really a lot of relevant information about nanoparticles as potential drug carriers.

The system designed could find potential application to focusing magnetic nanoparticles in targeted anticancer therapy and also to improve the effectiveness of radiotherapy by using magnetic nanoparticles functionalized with drugs as radiosensitizers.

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