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EPR Investigation of 2D Diffusion of Functionalized Nanoparticles in a Magnetic Field

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Extended Abstract

Magnetic nanoparticles of iron oxide, because of their unique magnetic properties, have many potential bioapplications, for example: magnetically controlled transport of anti-cancer drugs, magnetic resonance imaging contrast enhancement and magnetic cancer cells separation. Nanoparticles considered for drug delivery should be characterized by good dispersion in aqueous environment. They are coated with polymers to prevent their agglomeration, improve biocompatibility and stability. Thanks to the magnetic core, using a magnetic field it is possible to deliver magnetite nanoparticle to desired location of the body where the appropriate drug will be released.

In this work PEG-coated magnetite nanoparticles functionalized with Dopamine drug were used. The diffusion process of such nanoparticles was investigated in standardized (sodium alginate and calcium chloride) hydrogel.

The EPR (Electron Paramagnetic Resonance) measurements were performed using X-band (9,4 GHz) Bruker EPR/ENDOR EMX-10 spectrometer. The measurements were carried out at 225K temperature. The nanoparticles solution was injected into the center of a Petri dish filled with above mentioned standardized hydrogel. The Petri dish was placed in a magnetic field of 350 mT for chosen time. Hydrogel samples were then taken on the distance between the point of nanoparticles injection and the place of magnet position. For each sample EPR signal was recorded and analysed and the changes in nanoparticles concentration were determined.

It was concluded that EPR spectroscopy can be used to estimate the rate of magnetic nanoparticles diffusion. This study is important for the future use of such nanoparticles in targeted therapy and their control by an external magnetic field.

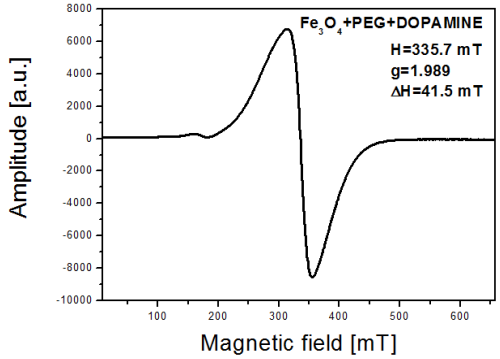

Fig. 1. EPR spectrum of PEG-coated magnetite nanoparticles functionalized with Dopamine.

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