Nanocomposites and nanomaterials

Synthetic nanosized magnetically ordered iron oxides for medical-biological application

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Synthetic magnetic iron oxides' nanoparticles now are widely used for various medical-biological applications [1]. Among them are targeted drugs delivery, NMR contrasting agents, separation of toxic and radioactive substances, etc. One of the important fields of application of magnetic nanoparticles is selective adsorbents for RNA/DNA isolation using methods of magnetic separation.

The aim of this work was to create synthetic nanocomposites magnetite-silica and determine their ability to isolate DNA from bacterial cells lysates. The magnetite nanoparticles were obtained by co-precipitation of iron (II) and iron (III) salts with ammonia, with further formation of silica coating by tetraethoxysilane hydrolyzation in alcohol-water-ammonia mixture. Phase composition of obtained nanoparticles was determined using X-Ray diffraction method and it was shown that the main phase of synthesized nanoparticles was magnetite. The calculated by Scherrer equation the average size of obtained nanoparticles was ~24 nm. The saturation magnetization of silica-modified magnetite nanocomposites was determined using magnetometry method and was equal to 65 $A \cdot m^2/kg$. Such saturation magnetization of synthesized nanoparticles makes them susceptible for magnetic field and, therefore, they could be used for magnetic separation.

Magnetic response of synthesized nanoparticles was estimated and it was shown, that sedimentation of 90% of magnetic nanocomposites at concentration above 0,1 mg/ml were removed from the solution in less then 10 seconds.

Adsorption of DNA at the surface of nanocomposites was determined in binding buffer for DNA purification. It was shown that synthesised nanocomposites have 5 times higher absorbing capacity than commercially available non-magnetic silica carrier. To conclude, created magnetite-silica nanocomposite is promising for DNA isolation from different biological objects.

1. *Gould P.* Nanomagnetism shows in vivo potential // Nanotoday – 2006. – **1**. – P. 34-39.