

DESIGN, SYNTHESIS AND CHARACTERIZATION OF SELF-ASSEMBLED MONODISPERSE MAGNETIC NANOPARTICLES

A.Rakhmetova*¹, D.Kanayeva^{1,2}

¹ NURIS, ²School of Science and Technology, Nazarbayev University, Astana, Kazakhstan; *assel.rakhmetova@nu.edu.kz

INTRODUCTION.

Magnetic nanoparticles (MNPs) are of great interest to different scientific disciplines due to their wide applications in optoelectronics, gas sensing, drug delivery systems, magnetic resonance imaging. Their unique properties and remarkable performances are coming from the particles size, surface structure and interparticles interactions [1].

MATERIALS AND METHODS.

MNPs were synthesized by co-precipitation and thermal decomposition methods. Two different samples were produced: MNPs with oleic acid (Fe_3O_4 -OA) and MNPs with polyethylene glycol (Fe_3O_4 -PEG) by co-precipitation method. Two samples were prepared by thermal decomposition method: MNPs produced in 1-octadecene organic solvent at 310°C (Fe_3O_4 - octadecene) and nanoparticles produced in benzyl ether organic solvent at 300°C (Fe_3O_4 - benzyl ether).

RESULTS AND DISCUSSION.

Figure 1a shows TEM image of Fe_3O_4 -OA sample. From the micrograph, the average size of nanoparticles is 11 nm with relative standard deviation equal to 27%. The average size of nanoparticles prepared with the addition of PEG is 10 nm with relative standard deviation equal to 22% indicating broad size distribution (Fig. 1b). The average size of Fe_3O_4 nanoparticles prepared by high temperature decomposition at 310°C in 1-octadecene is 13 nm (Fig. 1c). Relative standard deviation of 8% indicates narrow size distribution and monodispersity of nanoparticles. Figure 1d shows a micrograph of nanoparticles prepared at 300°C in benzyl ether solvent. Average size of nanoparticles is 9 nm with relative standard deviation of 9% indicating a narrow size distribution.

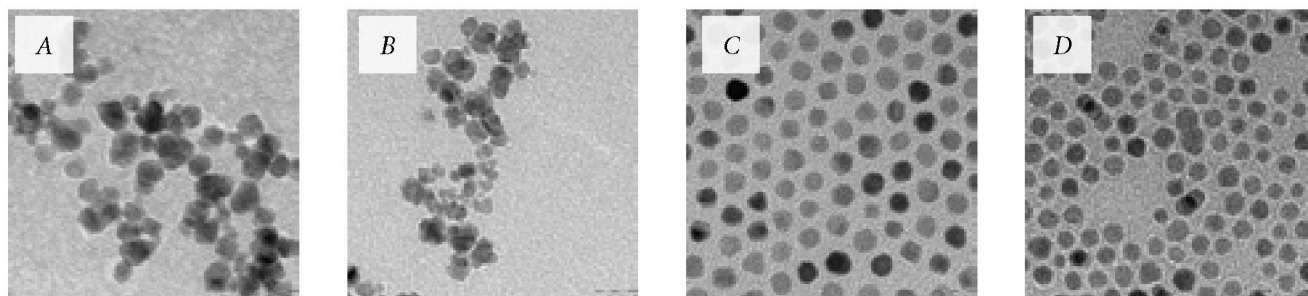


Figure 1. TEM micrographs of a) Fe_3O_4 -OA sample, b) Fe_3O_4 -PEG sample, c) Fe_3O_4 -octadecene, d) Fe_3O_4 - benzyl ether.

CONCLUSION.

Using a co-precipitation method, Fe_3O_4 nanoparticle surfaces were modified with oleic acid or PEG. This method yields particles with broad size distribution. MNPs synthesized by thermal decomposition method appear to have narrow size distribution and monodispersity.

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REFERENCES.

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