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IRON OXIDE NANOPARTICLES BIOCOMPATIBLE FOR BIOMEDICAL APPLICATIONS

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Abstract

In the this work the hydrophilic γ-Fe_2O_3 nanoparticles coated by *L-lysine* were prepared by the polyol-reduction method. The presence of maghemite (γ-Fe_2O_3) phase was confirmed using powder X-rays diffraction (XRD). FT-IR spectroscopy has confirmed the presence of L-lysine on the nanoparticles surface and also the Zeta potential has supported the coated of the nanoparticles with a layer hydrophilic of L-lysine and a good stability in aqueous medium. SEM analysis showed that nanoparticles of γ-Fe_2O_3 prepared have a spherical structural morphology with the tendency of agglomeration and with size in the range 8.36 – 10.69 nm. Hysteresis loop has showed a ferromagnetic behavyours at room temperature.

Keywords:iron oxide, hydrophil, magnetic nanoparticles, biocompatible, biomedical applications

Experimental results

XRD analysis

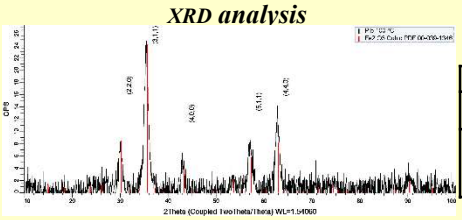
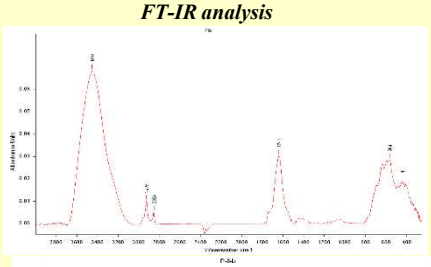


Table 1. XRD analysis main parameters of the γ-Fe_2O_3 nanoparticles samples.

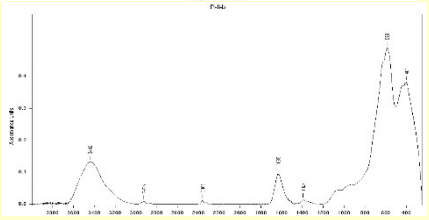
Lattice parameter		Crystallite size (nm)
a_{theor} (Å)	a_{exp} (Å)	
8.3457	8.3910	9.2

Fig. 1. *X-ray diffraction patterns of γ-Fe_2O_3 nanoparticles sample prepared by a polyol-reduction method.*

FT-IR analysis



a)



b)

Fig. 2. *The FT-IR spectra recorded on sample PIb of iron oxide nanoparticles obtained by polyol-reduction synthesis method (a) and on sample PIIb of L-Lysine coated iron oxide nanoparticles (b).*

SEM analysis

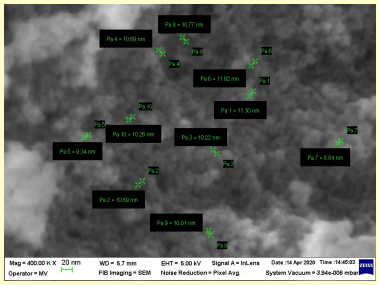


Fig.3. *The SEM image of the γ-Fe_2O_3 -L-lysine coated nanoparticles obtained by polyol-reduction synthesis method (sample PIIb).*

VSM analysis

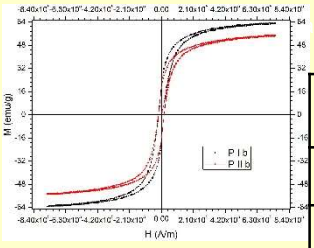


Table 2. Magnetic parameters of the γ-Fe_2O_3 and γ-Fe_2O_3 coated with l-lysine nanoparticles samples

Sample	M_r [emu/g]	M_s [emu/g]	H_c [A/m]/[Oe]
PIb	18.80	63.32	18501.76/ 232.5
PIIb	16.96	54.43	18700.70/ 235

Fig. 4. *The magnetic hysteresis loops for the γ-Fe_2O_3 obtained by polyol-reduction synthesis method (sample PIb) and for L-lysine coated γ-Fe_2O_3 nanoparticles (sample PIIb).*

Zeta potential analysis

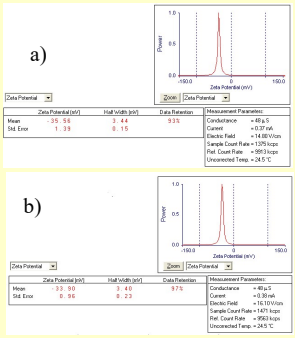


Fig. 5. The Zeta potential analysis of the γ-Fe_2O_3 coated with L-lysine nanoparticles in aqueous medium.

Conclusions

In this study we have developed a facile chemical approach for synthesis of water dispersible iron oxide (γ-Fe_2O_3) nanoparticles in two steps. In the first step were synthesized γ-Fe_2O_3 nanoparticles by a polyol-reduction method. XRD analysis confirmed the unique phase of maghemite with average crystallite of 9.2 nm. The surface coverage of the nanoparticles thus prepared with L-lysine in the second stage was confirmed by FT-IR and zeta potential analysis. The zeta potential values of -35.56 mV (at baseline) and of -33.90 mV (after time of 1 month) recorded on the aqueous dispersion of γ-Fe_2O_3 nanoparticles coated with L-lysine indicate a good dispersibility in water and stability over time. The VSM analysis evidenced a ferromagnetic behavior of the nanoparticles at room temperature. The good magnetic properties (M_s = 54.43 emu/g) and good dispersion and stability in the aqueous medium meet the requirements for biomedical applications.

References

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Acknowledgements: This work was finnancialy suppotted by project PN no.19310103 (5103)/2019 and project no.30 PFE/2018 between National R&D Institute for electrical Engineering ICPE-CA and Romanian Ministry of Education and Research.