MAGNETIC PROPERTIES AND HEMOCOMPATIBILITY OF VARIOUS FERRITE NANOPARTICLES

Anna Katalin Vas[1], Erzsébet Illés[2]

[1]University of Szeged, H-6720, Hungary
[2]Department of Food Engineering, University of Szeged, H-6720, Hungary
e-mail: erzsebet.illes@mk.u-szeged.hu

Abstract

Superparamagnetic iron oxide nanoparticles (SPIONSs) are well-known for their great potential in biomedicine, such as active agents for drug-delivery, MRI contrast enhancement and hyperthermia, hence their possible diagnostic and therapeutic application has been the centre of many studies in recent years. Beside magnetite, nickel-ferrite nanoparticles also seem to have promising magnetic properties for utilization in magnetic hyperthermia. These SPIONs, however, require biocompatibilization by surface functionalization as they are unstable in biological fluids. Graphite oxide (GO) is a hydrophilic material, with high surface area and tunable pH-dependent surface charge properties. By synthesizing GO/MNP nanocomposites, it is possible to further enhance the heat production caused by an alternating magnetic field during hyperthermia sessions.[1][2]

To study the effect of the nickel content and the various polymers used as protective layers on the surface of magnetic nanoparticles, nanocomposites were prepared with 1/5 and 1/10 GO/MNP mass ratios. The nickel content was 0%, 10% and 20%, while two different polymers (PAM and PEGMA-AA) were used to fully coat the nanomagnets. The dynamic light scattering (DLS) data on the coagulation kinetics of the various nanocomposite samples showed that there are notable differences in their colloidal stability. The critical coagulation concentrations were higher when PAM polymer was used and the nickel ratio also seemed to have a significant influence when higher NaCl concentrations were applied. The five-minute-long exposure for an alternating magnetic field showed that increasing the frequency (at the same magnetic field strength) resulted in a higher level of heat production.

Hemocompatibility tests of naked SPIONs were also performed in biorelevant media.[3] Peripheral blood smear experiments did not reveal any signs of coagulation or other damage in different blood cells. Development of remarkable protein corona around the nanoparticles was observed for bare ferritenanomagnets by DLS measurements.

References

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