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Preparation and hyperthermia effect of magnetic fluids

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Magnetic fluid hyperthermia (MFH) can be applied to tumor organs or tissues for the treatment of cancer [1]. In the present work, magnetic nanoparticles of Fe_3O_4 were synthesized by the chemical co-precipitation method and magnetic fluids were coated by surfactants of decanoic and alginic acids on the magnetic nanoparticles [2].

Magnetic properties, phases and microstructure were characterized in terms of VSM, XRD, SEM, TEM and DSC measurements. It was found that, at the optimum condition, the Fe_3O_4 nanoparticles exhibited the high saturation magnetization about of 60 emu/g (see Fig. 1) with a superparamagnetic behavior, had the very narrow size distribution of 9~12 nm with the fraction of more than 60% and were well dispersed in water-based solution. These results suggest that the magnetic nanoparticles have the high potentiality for biomedical applications. In particular, a hyperthermia effect of magnetic nanoparticles was examined. The temperature of the particles was scarcely reached to a value of 42°C which is desirable to destroy the tumor cells for the hyperthermia effect (see Fig. 2).

Reference

[1] A. Jordan, R. Scholz, et al., J. Magn. Magn. Mater. 201 (1999) 413.

[2] S.I. Park, C.O. Kim, et al., IEEE Trans. Magn. In Press.

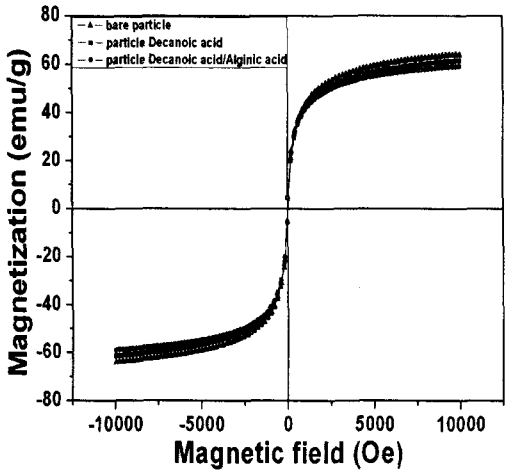

Fig. 1. Magnetization curves of particles without a surfactant (▲) and with single layer (■) and bilayer (●) surfactants.

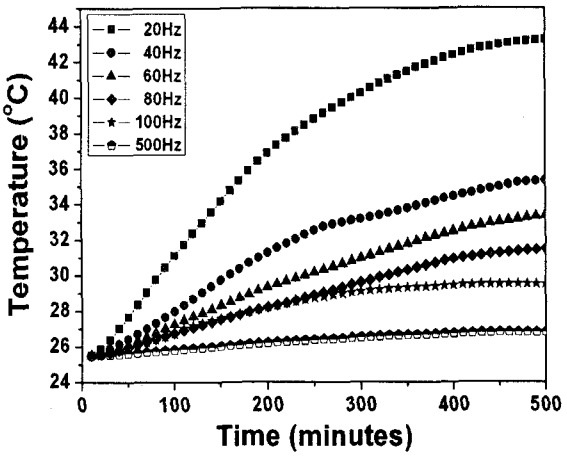

Fig. 2. Time-dependent temperature curves of magnetic fluids for bilayered Fe_3O_4 nanoparticles with synthesis condition of NH_4OH 16ml at various frequencies from 20Hz to 500Hz.