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Synthesis of Monodispersed Fe_3O_4 Nanocrystals for Biomedical Application

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1. 서론

Iron oxide particles, particularly magnetite (Fe_3O_4) and its oxidized form maghemite (γ-Fe_2O_3), are so far the most commonly used magnetic carriers for a variety of biomedical applications such as MRI contrast enhancement agents, hyperthermia, manipulating cell membranes, biosensors, labeling and tracking of cells and drug delivery. However, these applications are still subject to many constraints, for instance, particle size, size monodispersity, magnetization, stability, non-toxicity, biocompatibility, injectability, short blood half-life of magnetic nanoparticles for in vivo applications. Of them, size-control is one critical parameter that manages both physicochemical and pharmacokinetic properties. In fact, synthesis of respective nanoparticles with controllable size and size distribution remains a great challenge. An efficient, economic, scalable and non-toxic monodisperse synthesis of Fe_3O_4 nanoparticles is highly desired for potential biomedical applications and fundamental research.

2. 실험방법

We adopt a strategy to employ polymers as surfactants and octyl ether as solvent to prepare narrowly-distributed nanoparticles at high temperature and report herein on the synthesis and characterization of monosized Fe_3O_4 nanoparticles in one-pot process. In details, the monosized Fe_3O_4 nanocrystals is reduced from Fe(III) acetylacetonate employing polymers as the surfactants and with 1,2-hexadecanediol. Magnetically stirred, the reaction solution was slowly heated to 120°C in 1 hr and kept for 10 min. Then the temperature was rapidly raised to reflux for 1 hr. The nanocrystals were precipitated and centrifuged to remove the solvent/surfactant and dispersed into hexane.

3. 실험결과 및 고찰

XRD patterns confirm the expected cubic perovskite structure and HRTEM images show a tight size distribution of the nanocrystals and display the (311) lattices in the self-assembled nanocrystal arrays. The nanocrystal size is tuned over a wide range from 20 nm down to 3 nm. The magnetic measurements reveal the superparamagnetic behavior of the nanocrystals and the saturation magnetization is found as a function of nanocrystal size, decreasing as the size reduces. The magnetite nanocrystals prepared by the current approach show a long-term chemical

stability.

4. 결론

Hence, it is expected that the monodisperse Fe_3O_4 nanocrystals with tailored size and tunable magnetic properties obtained by the one-pot polyol synthesis are promising for applications such as MRI and biosensors.

5. 참고문헌

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