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A Novel Iron Oleate Precursors (IOP) Method for The Synthesis Of Superparamagnetic Magnetite Using Thermal Decomposition Method.

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In most applications, the particles perform best when the size of nanoparticles is below a critical value depending on the material but is typically around 10nm - 20 nm. Then each nanoparticle becomes a single magnetic domain and shows superparamagnetic behavior when the temperature is above the blocking temperature. Particle size is reached critical value; remanence and coercivity go to zero. These features make superparamagnetic nanoparticles very attractive for biomedical applications such as; drug delivery, hyperthermia for cancer treatment, the purification of enzyme and protein, and also magnetic sensors.

In traditional thermal decomposition method, iron-oleate precursors (IOP) are obtained from salt of iron chloride and sodium oleate. In this study, a novel IOP were presented here. Novel IOP was prepared by the solvothermal synthesis of iron powder (Fe) and oleic acid ($C_{18}H_{34}O_2$) at 200 °C in hexane and used to synthesize the Fe_3O_4 nanoparticles by using thermal decomposition. The solvothermal reaction was carried out at a Teflon-lined-stainless steel autoclave with capacity (50 mL) and maintained for various time (6-72 hours). The effect of reaction time, temperature and concentrations of oleic acid and iron powder on synthesis of iron-oleate complexes were also characterized. The Figure 1 indicates that the characteristic strong bands of iron-oleate complex were observed in the range of 1300 cm^{-1} to1700 cm^{-1} using Fourier transform infrared spectroscopy.

In order to produce superparamagnetic nanoparticles, the iron-oleate complexes were aged at the same boiling temperature (280 °C) in the solvents of 1-hexadecene and triethylene glycol monobutyl ether (EGBE). It is found that the aging period changes depending on the type of solvents used. Aging at EGBE for 30 minutes generated magnetic nanoparticles but aging at hexadecane for the 180 minutes magnetite nanoparticles was formed. The superparamagnetic nature of the magnetite nanoparticles were confirmed by vibrating sample magnetometer. Figure 2 shows the nanoparticles is superparamagnetic. The characterization of superparamagnetic magnetite nanoparticles in relation with the solvents used will be discussed in detail in full paper.

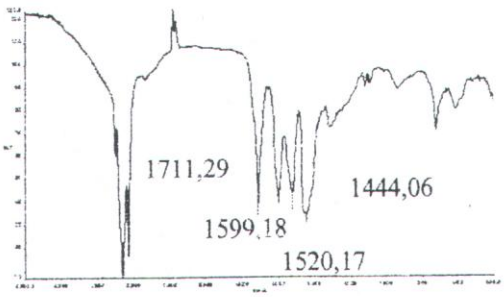

Figure 1. FT-IR spectrum of synthesized iron-oleate complex..

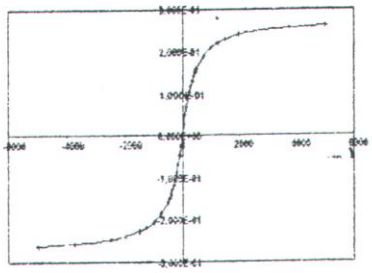

Figure 2. The hysteresis curve of nanoparticles showing superparamagnetism