Investigation of the Effect of pH Environment on the Properties of Magnetite Nanoparticles used in Nano Drug Delivery Production Prepared by Co-precipitation Method

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Abstract: In the present work, magnetic nanoparticles coated with polyethylene glycol and anticancer liver drug in different pH 4 and 8 were synthesized by co-precipitation method. In order to synthesize magnetic nanoparticles, from polyethylene glycol as a stabilizing agent and 5-fluorouracil for anticancer liver agent were used. we have tried to investigate the effect of PH in two acidic and alkaline environments (PH 4 and PH 8) on the properties of coated nanoparticles in drug delivery. Magnetite nanoparticles were first synthesized. In the following, magnetite nanoparticles have been synthesized in anti-cancer drug was intercalated into the interlayer of the layered double hydroxide (LDH). Eventually, changed PH in two acidic and alkaline environments. Structural and magnetic properties of magnetic nanoparticles were investigated by XRD and VSM. The X-ray diffraction results showed that, the sample is composed of iron oxides which construct the core. VSM analysis of synthesized samples in pH 4 and pH 8 showed superparamagnetic property with magnetic saturation values of 27 and 40 emu/g, respectively.

Keywords: *Nano drug delivery, magnetite nanoparticles, co-precipitation method, 5-fluorouracil.*

INTRODUCTION

Magnetic nanoparticles are one of the most widely used nanomaterials. Their unique properties make them more efficient than other nanostructures. These nanoparticles can be used in different application such as biomedicine, especially in the field of drug delivery, because their inherent magnetism accelerates to many purposes, including targeting, which is very important in drug delivery. In recent years, there has been a lot of interest in the preparation of this type of nanostructures as carriers for drug delivery, because these structures are due to the control and slow release of the drug, the protection of the pharmaceutical molecule, the smaller size of particle cell which can have ability to cross biological barriers in the target site, increase drug shelf life in the bloodstream, targeted drug delivery and biocompatibility can be as a system. These properties are very effective, which increases the therapeutic efficacy of the drug. Over the past half century, various advances in related sciences, such as polymer science, chemistry, biochemistry, as well as mechanical and physical sciences, have all contributed to the diverse range of nanocomposites, and introduce a variety of carriers with unique characteristics and performance to medical sciences.

MATERIALS AND METHODS

In order to prepare iron oxide nanoparticles, the mixture of ferrous chloride tetra hydrate and ferric chloride hexahydrate (from Merck, Germany) in the presence of ammonia hydroxide (25% by mass) was exposed to ultrasonic irradiation for 1 h. The precipitates were centrifuged and washed. Then, dispersed in mixture deionized water with polyethylene glycol (from Acros Organics). The coated iron oxide nanoparticles (FPEG) was added into the 5-fluorouracil (from AKSci) and the mixture was stirred for 24 h. The final nanocomposite was re-dispersed in deionized water and layered double

hydroxide solution (Mg/Al) (supplied by ChemAR) was added dropwise into the mixture under vigorous stirring until the pH decreased to 4. The same procedure was done to prepare sample in pH 8.

RESULTS AND DISCUSSION

Superparamagnetic is important in magnetic targeted drug delivery system. Hysteresis loops of synthesized nanoparticles were characterized by a vibrating sample magnetometer (VSM) showing magnetic properties of nanoparticles at room temperature. The saturation magnetization of synthesized sample in pH 4 was about 27 emu/g compared to 40 emu/g for synthesized sample in pH 8. After increase pH, the saturation magnetization was addition which could be the positive effect of the alkaline environments on magnetite nanoparticles. both of the samples confirmed supermagnetic properties due to the high quantity of saturation magnetization. This means that they do not maintain their magnetic behavior after removal of the external magnetic field.

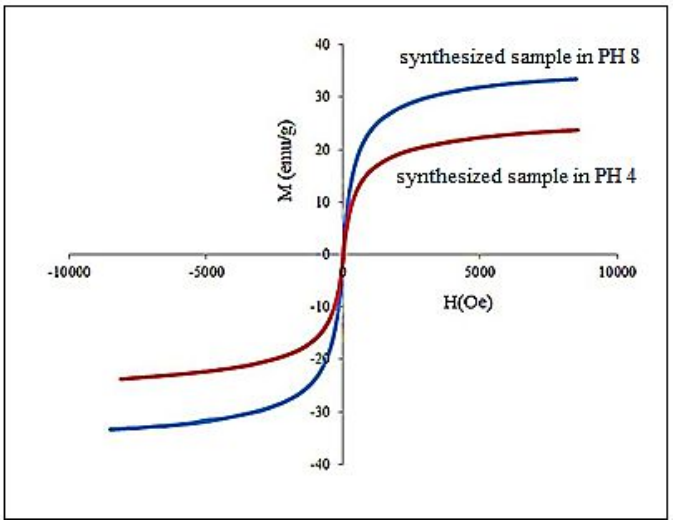

Fig. 1: Magnetization curves of synthesized sample in pH 4 and pH 8.

CONCLUSIONS

It is clear that the environment has a significant effect on the particles. The alkaline environment results in better magnetic properties in nanoparticles due to the drug structure and the negative charge of the drug.

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