**THESIS INFORMATION**

Thesis title: Study on the synthesis of magnetic nanoparticles -

 application in biomedical field

Specialization: Solid state physics

Code: 62 44 07 01

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**1. ABSTRACT**

Iron oxide magnetic nanoparticles (MNP) are applied in biomedical field due to their properties, such as superparamagnetic, high saturation magnetization, low toxicity, high surface to volume ratio, and ability to bind multiple surfactants, functional groups, as well as biological molecules. In this thesis, MNP were synthesized and functionalized to conjugate to biological molecules, such as human serum albumin (HSA), bovine serum albumin (BSA), protein A, streptavidin (SA), anti-GPC3 antibody, anti-HBs antibody and DNA/RNA to examine for in vitro applications, such as immunoassay for detection of glypican 3 (GPC3) from liver cancer cells, hepatitis B surface antigen (HBsAg), and DNA/RNA extraction on automatic systems for molecular biology testing.

**2. NEW CONTRIBUTIONS**

- The superparamagnetic MNP with sizes of 10, 32, 60 and 100 nm, after being synthesized and functionalized, were able to bind HSA, BSA, protein A, SA, anti-GPC3 antibody, anti-HBs antibody, and extract DNA/RNA.

- The MNP 10 nm with magnetic saturation of 63 emu/g gave higher binding efficiency of biomolecules, but were less durable and the higher background level in immunoassay. While, the MNP 32 nm with magnetic saturation of 89 emu/g (approximately 92 emu/g of bulk Fe3O4) were more durable, more stable, lower background level in immunoassay, and could be used for immunoassay and DNA/RNA extraction.

- Using the MNP binding anti-GPC3 and anti-HBs antibodies in immunoassay were able to detect GPC3 and HBsAg at low concentrations. It could be considered that the synthesis of MNP binding antibodies is the new platform in immunoassay for detection of specific antigens with advantages which include enrichment, availability of various tube sizes, shorter incubation time, simple storage, and could be used in diagnosis.

- DNA/RNA extracted by the MNP were purified enough, 10 times more than silica gel, and limited of dectection 15 IU/mL. The extracted DNA/RNA could be used for disease diagnosis, identification (bacteria, fungi, animals) and determination of genetic family relationships. The synthesis of MNP capable of DNA extraction on automatic extraction systems is the key for open PCR system, which increases the quality of molecular biology testing and is suitable for clinical diagnostic laboratories without using very expensive closed PCR system.

**3. PRACTICAL AND POTENTIAL APPLICATIONS OR FURTHER ISSUES TO BE SOLVED**

It is possible to apply the MNP binding anti-GPC3 and anti-HBs antibodies in immunoassay for detection of GPC3 and HBsAg. In addition, the synthesized MNP could be used to extract DNA/RNA from biological samples on automatic systems for molecular biology testing.

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