Abstract

Project Code: MRG5980041

Project Title: Biophysical Characterization of Riboflavin-Functionalized Superparamagnetic Iron Oxide Nanoparticles (Rf-SPIONs) for Riboflavin Carrier Protein Detection

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Abstract:

Riboflavin carrier protein (RCP) has been shown recently as an alternative biomarker for cancer diagnosis. Because RCP level in serum has been found to be elevated in breast cancer, prostate cancer and hepatocellular carcinoma patients comparing to healthy groups. The conventional method for RCP detection is using radioimmuno assay (RIA) which involves radioactive compounds so it is considered to be unsafe and require license for performing the assay. In this research, an alternative method will be developed which is safer, easier and could be more sensitive comparing to the RIA technique. This new approach will be using superparamagnetic iron oxide nanoparticles (SPIONs) which have a great potential in nanomedicine due to the unique properties such as superparamagnetic behavior, stability, biocompatibility and ease of fabrication and surface engineering. Various synthesis conditions for SPIONs will be performed to achieve different sizes and different surface coatings of the NPs. After that the nanoparticles will be further conjugated with different amount of riboflavin (Rf) which is a ligand for RCP to achieve riboflavin functionalized SPIONs (Rf-SPIONs). In order to evaluate which synthesis condition give the best candidate for RCP binding, thermodynamic parameters between the Rf-SPIONs and RCP will be investigated using Isothermal Titration Calorimetry (ITC) and Differential Scanning Calorimetry (DSC) methods. Results of biophysical interaction studies will provide an important information of the role of sizes, surface coatings and quantities of surface ligands to the RCP binding. Fundamental knowledge on the interactions between Rf-SPIONs and RCP will elaborate the effective process of SPIONs synthesis design. This development can be applied to accurate cancer detection at early stage worldwide.

Keywords: Magnetic nanoparticles, riboflavin, binding affinity, Isothermal Titration Calorimetry, Differential Scanning Calorimetry