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Magnetically Retrievable Iron Oxide Nanoparticle Platform for Biosensor Development

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Abstract

The detection of various targets using biosensors has gained much attention throughout the past few decades. Generally, these biosensors are composed of target recognition site and signal transduction site. Usually, the target recognition site of the biosensors is composed of macromolecules such as carbohydrates, protein, peptides, and nucleic acids, due to their remarkable ability to bind to a specific target. The immobilization of these macromolecules is associated with different types of chemical attachments which include the alteration of the molecules. The signal transduction site of the biosensors utilized the fluorescence or colorimetric signal for the detection of the target. Therefore, these biosensors provide higher specificity, accuracy, and on-site monitoring of the target compared to the conventional analytical methods. Different types of biosensors are available to detect various targets, but these biosensors cannot be reused or recycled. Even though the biosensor is used, it has to be discarded and this causes the accumulation of waste materials in the environment. Hence, to overcome these drawbacks, the incorporation of the nanomaterial into the biosensors is advantageous. In this study, magnetically retrievable (3-Aminopropyl)triethoxysilane (APTES) functionalized iron oxide nanoparticles were developed as a novel immobilization platform for biosensors. The magnetite core of the iron oxide nanoparticles was synthesized *via* the co-precipitation method and the magnetite nanoparticles were coated with APTES. The freely available amino group ($-NH_2$) of the APTES is utilized to immobilize the macro-molecules on the nanoparticles *via* bio-conjugation. This limits the use of hazardous chemical alteration of the biomolecules. Since the biosensor is based on the magnetically retrievable platform, used biosensors can be recycled and reused effectively due to their magnetic properties, and bio-conjugation provides easy modifications of the biosensor. The synthesized APTES functionalized iron oxide nanoparticles were confirmed by the Fourier transform infrared spectroscopy (FT-IR) spectrum and the scanning electron microscopy (SEM) images which exhibit the rod-shaped iron-oxide particles with an average size of 25-30 nm. Compared to the other nanoparticle synthesis methods, co-precipitation method is simple, cost-effective, and time-saving.

Keywords: *Co-precipitation, magnetite, APTES*

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