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DEVELOPMENT OF DNA BIOSENSOR BASED ON SILVER NANOPARTICLES UV-Vis ABSORPTION SPECTRA FOR *Escherichia coli* DETECTION

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ABSTRACT

In this research we reported the synthesis of oligonucleotide-silver nanoparticle (OSN) conjugates and demonstrated their use along with magnetic beads as biosensor for *Escherichia coli* detection under magnetic field condition. Oligonucleotide DNA probes were conjugated on silver nanoparticles using alkanethiols linker. Two kinds of alkanethiols linker, 11-mercaptoundodecanoic acid (11-MUDA) and 16-mercaptophexadecanoic acid (16-MHDA) were compared to get the best probe conjugation yield and OSN UV-Vis absorption spectra properties. Three different methods of *Escherichia coli* DNA isolation i.e. Chen and Kuo (1993), Phenol Chloroform Isoamylalcohol (PCI) extraction and boiling lysis were also compared to explore the performance of the biosensor towards the DNA target purity. Detection process through hybridization between the DNA probe and the target was carried out at 55°C for 1 hour incubation time. The results showed that 16-MHDA gave higher conjugation yield and higher OSN UV-Vis absorption spectra than 11-MUDA. The biosensor was able to detect the presence of the DNA target which was isolated from the three isolation methods. The best detection signal was achieved by Chen and Kuo isolation method in which it could detect the presence of the DNA target up to 1.3 ng/μL.

Keywords: DNA biosensor, Silver Nanoparticles, *Escherichia coli*

INTRODUCTION

Along with increasing knowledge of nucleic acid structure and function, detection of specific sequences of DNA has gained increased importance. DNA biosensors based on nucleic acid hybridization have been actively developed because of their specificity, speed, portability, and low cost. Recently, there has been considerable interest in using nano materials for DNA biosensors because of their high surface-to-volume ratios, unique optical, electrical, and thermal properties as well as excellent biological compatibilities. Moreover, nanomaterials could be used to increase the amount of immobilized DNA and maintain its biological activity (Sumar and Kumar, 2008; Xu *et al.*, 2009).

One of metal nanomaterials that can be used as biosensor is silver nanoparticles. Silver nanoparticles have been widely applied as DNA biosensor (Thompson *et al.*, 2008), protein biosensor (Chang *et al.*, 2010) and antibacterial agent (Guzman *et al.*, 2009). For biological applications, silver nanoparticles can be conjugated with biospecific recognition molecules such as antibodies, DNA probe molecules or enzymes. Upon binding with biotarget molecules, the binding event can be detected from individual nanoparticles or nanoparticle clusters by monitoring nanoparticle property change or other responses (Huo, 2007). Silver nanoparticles show absorption band in visible light region and give the optimum UV-Vis absorbance spectra at wavelength around 400 nm (Henglein and Giersig, 1999; Šileikaite *et al.*, 2006). These properties potentially could be used as signal of optical DNA biosensor. Optical detection methods relying on nanoparticle materials functionalized with