Thesis Title	Genomic DNA Detection Based on Electrochemical Labels of Gold Nanoparticle Encapsulated Polyelectrolyte Microcapsules
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Candidate	Miss Naphat Khunrattanaporn
Thesis Advisors	Assoc. Prof. Dr. Werasak Surareungchai
	Dr. Patsamon Rijiravanich
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Division	Biotechnology
Faculty	School of Bioresources and Technology
B.E	2555

Abstract

The spiky gold capsules were successfully fabricated as electrochemical labels to enhance the sensitivity of oligonucleotide and genomic DNA detection by increasing the numbers of gold nanoparticles entrapped in polyelectrolyte microcapsules (PAA-capsule). PAA-capsules were prepared by layer-by-layer assembly of alternating oppositely charged polyelectrolytes onto polystyrene-co-acrylic acid (PSA) templates. The templates were removed by dissolution in an organic solvent to lease hollow shell polyelectrolyte microcapsules. The capsule interior was loaded with polyallylamine (PAA) via pH manipulation. Gold loading into the PAA-capsule to produce spiky gold capsules were performed by two steps: preparation of the seed mediated method and the incubation in growing solution method. The spiky gold capsules were found to contain approx. 1.02×10^{11} Au^{3+} molecules per capsule. DNA hybridization detections using the spiky gold capsule as labels was performed using stem loop DNA (SL-DNA) probes. The probe contained a digoxigenin (DIG) label at one end. The other end of the SL-DNA probe contained a thiol group, enabling assembly with a spiky gold capsule. After DNA hybridization, the stem loop straightens out, hence enabling to an anti-DIG coated magnetic latex at one end and a spiky gold capsule at the other. The quantity of gold attracted to the probes could then be measured by differential pulse anodic stripping voltammetry. A detection limit of 1.84 aM was achieved, the lowest quantity of target oligonucleotide. The genomic DNA of *E. coil* BL21, ATCC8739 and O157:H7 was detected in real samples (milk and fermented palm juice) with detection limits of 2-4 CFU mL^{-1} for an assay time of approx. 105 min.

Keywords: Genomic DNA Detection/ Spiky gold Capsule/ Stem loop DNA/ Gold Nanoparticles/ Anodic Stripping Voltammetry.