

Surface modifications to boost sensitivities of electrochemical biosensors using gold nanoparticles/silicon nanowires and response surface methodology approach

ABSTRACT

This work describes fabrication of a DNA electrochemical sensor utilized of gold nanoparticles/silicon nanowires/indium tin oxide (AuNPs/SiNWs/ITO) as a modified substrate for detection of dengue virus DNA oligomers using methylene blue (MB) as a redox indicator. The response surface methodology (RSM) was applied as one of the advanced optimization methods for fabrication of SiNWs/AuNPs/ITO electrode and immobilization of DNA probes to enhance the sensitivity of DNA detection. Several factors were successfully optimized using RSM, including volume of SiNWs, concentration of dithiopropionic acid (DTPA), volume of AuNPs, DNA probe concentration, and DNA probe immobilization time. RSM approach shows that AuNPs and DNA probe concentration were the prominent factors affecting on the MB current signal and immobilization of DNA probe on AuNPs/SiNWs surface. This new developed sensor was able to discriminate complementary target sequences, noncomplementary and single-base mismatch sequences, for DNA dengue virus detection.

Keyword: Surface modifications; Electrochemical biosensors; Gold nanoparticles; Silicon nanowires