

Electroanalysis on an Interdigitated Electrode for High-Affinity Cardiac Troponin i Biomarker Detection by Aptamer-Gold Conjugates

Abstract

The primary reasons for myocardial infarction (MI) are pericarditis, arrhythmia, and heart failure, causing predominant deaths worldwide. Patients need a potential diagnostic system and treatment before cardiomyocyte damage. Cardiac biomarkers are released from myocytes immediately after a heart attack. Troponin is an efficient biomarker released from dead cells within a few hours. Aptamers are artificial antibodies used effectively in the biosensor field for biomarker detection. Along with aptamers, the application of nanomaterials is also expected to enhance the detection limits of biosensors. In this investigation, selected aptamers against cardiac troponin I (cTnI) were conjugated with gold nanoparticles (GNPs) to diagnose MI and compared with an aptamer-only control group on an interdigitated electrode surface. Based on electroanalysis, cTnI was detected at concentrations as low as 1 fM, and the detection limit improved to 100 aM when the aptamer was conjugated with GNP. In addition, aptamer-GNP conjugates increased the current level at the tested concentrations of cTnI. Control experiments with noncomplementary aptamers and relevant proteins did not result in notable changes in the current, demonstrating the selective detection of cTnI.