

## A portable highly sensitive lab-on-a-chip for cardiac troponin I detection from blood using a washing-free and sandwich-type electrochemical aptasensor

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### Abstract

A highly sensitive portable lab-on-a-chip (LOC) for cardiac troponin I (cTnI) detection was fabricated by the integration of a washing-free microfluidic system, antifouling interface, alternating current electrothermal (ACET) electrode, and electrochemical sandwich-type aptasensor. The microfluidic system was used for separating large particles from the blood sample and propelling the sample inside the detection zone without any external driving force. Mercaptohexanol (MCH) and bovine serum albumin (BSA) were deposited on the aptamer modified working electrode as an antifouling layer in order to prevent the gold surface from the non-specific reaction. The sample which consists of blood, biotinylated aptamer for troponin I (Ap-Tro6-biotin), streptavidin-horseradish peroxidase (SA-HRP), and phosphate-buffered saline (PBS) was then mixed with the hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) and hydroquinone (HQ) in the detection chamber with the assistance of ACET flow. Subsequently, cTnI-Ap-Tro6-biotin-SA-HRP conjugates in the sample were caught by a thiolated aptamer for troponin I (Ap-Tro4-SH) on a modified gold working electrode and formed a sandwich structure. Afterward, differential pulse voltammetry (DPV) was used to detect the redox reaction of the product, i.e., benzoquinone (BQ) from the H<sub>2</sub>O<sub>2</sub> and HQ reaction that was accelerated by the catalytic ability of HRP.

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