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http://dx.doi.org/10.5339/qfarc.2016.HBPP2185

Application of Pulsed Streaming Potentials in Plastic Microfluidic Channels for Quantitative Point-of-Care Determination of Cardiac Markers

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Acute myocardial infarction (AMI) is a well-recognized angiocardiopathy that can be spotted by a rise and fall of "chemical biomarkers" in a clinical context. Biomarkers are then, valuable indicators, together with ischemic symptoms, of an impaired cardiac function. Assay of Cardiac troponin T (cTnT), the biomarker of choice, is now an indispensable element in the medical practice followed to diagnose and control AMI. Though being proved sensitive and cardiospecific, the enhancement of diagnostic sensitivity attained using CTnT, have noticeably come with a reduction in specificity. Herein, we report a new sensing strategy based on pulsed streaming potential for direct determination of CTnT. The current biosensor consists of a patterned microchannel built with commodity thermoplastic cyclo olefin copolymer (COC). Specific binding of "avidin to biotin" on an "EDC-NHS" modified microchannel was used to tether biotinylated "anti-troponin T monoclonal Ab" to our target "CTnT". Furthermore, the selectivity of the created platform was tested with success in serum samples. The analytical response to this system was measured by changes in magnitude of the streaming potential and correlated with the amount of analyte bound to the sensor surface. Different from the well-established biochemical assays adopted for cTnT, the current biosensor does not require labeling (fluorescent, electrochemical or radioactive) or usage of tedious chemical procedures. In addition, a stable quick response is attained under pulsed flow not steady state conditions, which permits a real time analysis. The linear region (1.9–6.5 µg/mL) matches with the clinically relevant concentrations of cTnT in human serum which has a cutoff value of 4 ng/mL.

Cite this article as: Elazazy M, Alvarez J. (2016). Application of Pulsed Streaming Potentials in Plastic Microfluidic Channels for Quantitative Point-of-Care Determination of Cardiac Markers. Qatar Foundation Annual Research Conference Proceedings 2016: HBPP2185 http://dx.doi.org/10.5339/qfarc.2016.HBPP2185.

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