An Automated Electrochemical Immunosensing System for Detection of Cortisol at Point-of-Care (POC)

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Abstract

Abnormal levels of cortisol, a steroid hormone, is indicative of conditions such as Cushing's syndrome, Addison's disease, adrenal insufficiencies and more recently post-traumatic stress disorder (PTSD) [1]. In this work, a simple, low-cost, label-free, electrochemical immunosensing platform is developed for the sensitive and selective detection of cortisol in a fully automated microfluidic system. Electrochemical detection is utilized for the detection of Cortisol using Anti-Cortisol antibodies immobilized on microfabricated interdigitated microelectrodes (μIDE). Polyanaline-Ag/AgO (~5 nm) nanocomposite and nanostructured self-assembled monolayer (SAM) of dithiobis(succinimidylpropionte) (DTSP) [2] have been explored as the immobilizing matrix for Anti-cortisol antibodies. The obtained sensing parameters were in physiological range and immunosensors were also tested successfully on clinical sample of saliva. A simple, low-cost microfluidic system is designed using low-temperature co-fired ceramics (LTCC) technology for the integration of the electrochemical cortisol immunosensor for automation of the immunoassay [3]. The design, fabrication technique and fluidic characterization of the immunoassay are presented. The DTSP-SAM based electrochemical immunosensor on μIDE is integrated into the LTCC microfluidic system and cortisol detection is achieved in the microfluidic system in a fully automated assay. The developed system has been deployed in testing of cortisol in saliva samples of farmworker. Cortisol is used here as a marker to determine exposure to organophosphates, which alter the endocrine system, leading to imbalance in cortisol secretion. The obtained cortisol concentrations from the developed system correlate well with that obtained from ELISA.

References:

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