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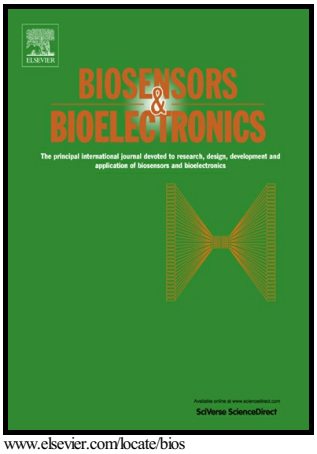

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Highly Sensitive and Specific On-Site Detection of Serum Cocaine by a Low Cost Aptasensor

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Abstract: Cocaine is one of the most used illegal recreational drugs. Developing an on-site test for cocaine use detection has been a focus of research effort, since it is essential to the control and legal action against drug abuse. Currently most of cocaine detection methods are time-consuming and require special or expensive equipment, and the detection often suffers from high cross-reactivity with cocaine metabolites and relative low sensitivity with the best limit of detection reported at sub nanomolar (nM) level. In this work, an aptasensor has been developed using capacitive monitoring of sensor surface incorporating alternating current electrokinetics effects to speed up molecular transport and minimize matrix effects. The aptasensor is rapid, low cost, highly sensitive and specific as well as simple-to-use for the detection of cocaine from serum. The assay has a sample-to-result time of 30 seconds, a limit of detection of 7.8 fM, and a linear response for cocaine ranging from 14.5fM to 14.5pM in standard buffer, which are great improvements from other reported cocaine sensors. Special buffer is used for serum cocaine detection, and a limit of detection of 13.4 fM is experimentally demonstrated for cocaine spiked in human serum (equivalent to 1.34 pM cocaine in neat serum). The specificity of the biosensor is also demonstrated with structurally similar chemicals, ecgonine ethyl ester and methylecgonidine. This biosensor shows high promise in detection of low levels of cocaine from complex matrices.

Keywords:

Capacitive biosensor, aptasensor, AC electroosmosis, point of need, cocaine