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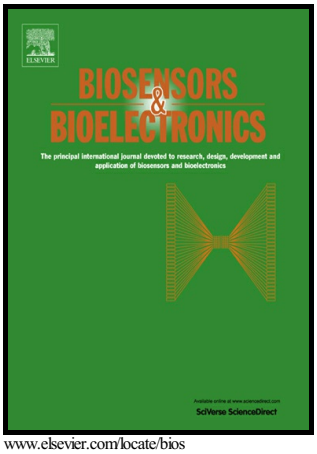

www.elsevier.com/locate/bios

PII: S0956-5663(18)30295-1
DOI: https://doi.org/10.1016/j.bios.2018.04.034
Reference: BIOS10430

To appear in: *Biosensors and Bioelectronic*

Received date: 23 January 2018
Revised date: 14 April 2018
Accepted date: 16 April 2018

Cite this article as: Jian Zhang, Rania Oueslati, Cheng Cheng, Ling Zhao, Jiangang Chen, Raul Almeida and Jayne Wu, Rapid, highly sensitive detection of Gram-negative bacteria with lipopolysaccharide based disposable aptasensor, *Biosensors and Bioelectronic,* https://doi.org/10.1016/j.bios.2018.04.034

Rapid, highly sensitive detection of Gram-negative bacteria with lipopolysaccharide based disposable aptasensor

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Abstract

Gram-negative bacteria are one of the most common microorganisms in the environment. Their differential detection and recognition from Gram-positive bacteria has been attracting much attention over the years. Using *Escherichia coli* (*E. coli*) as a model, we demonstrated on-site detection of Gram-negative bacteria by an AC electrokinetics-based capacitive sensing method using commercial microelectrodes functionalized with an aptamer specific to lipopolysaccharides. Dielectrophoresis effect was utilized to enrich viable bacteria to the microelectrodes rapidly, achieving a detection limit of 10^2 cells/mL within a 30 s' response time. The sensor showed a negligible response to *Staphylococcus aureus* (*S. aureus*), a Gram-positive species. The developed sensor showed significant advantages in sensitivity, selectivity, cost, operation simplicity, and response time. Therefore, this sensing method has shown great application potential for environmental monitoring, food safety, and real-time diagnosis.

Keywords: Gram-negative bacteria, Aptasensor, Dielectrophoresis, Capacitive biosensor, Lipopolysaccharide (LPS)

1. Introduction

Pathogenic bacterial infections and associated foodborne illnesses pose significant public health issues worldwide, and they are of special concern in developing countries, where the medical resources and public hygiene are limited. Therefore, the rapid detection and identification of these bacterial pathogens are of paramount importance for adopting treatment options and to establish adequate control measures. Gram-negative