Sensitive and rapid detection of pathogenic bacteria in small volumes using impedance spectroscopy technique

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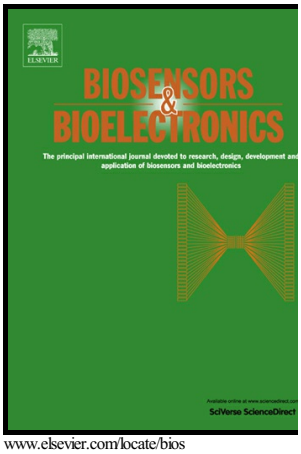

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Sensitive and Rapid Detection of Pathogenic Bacteria in Small Volumes using Impedance Spectroscopy Technique

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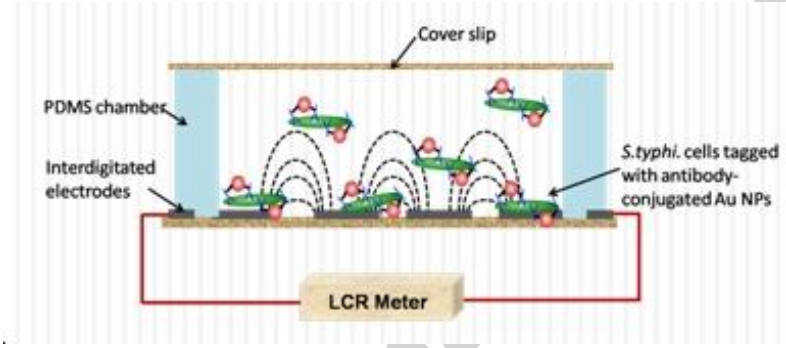
Graphical abstract



Abstract

We illustrate a novel impedance immunosensor which rapidly and sensitively detects typhoid-causing infectious bacteria Salmonella enterica serovar (S. typhi) in 10 μL of sample volume. The bacteria are tagged with gold nanoparticles (Au NPs) via high-affinity antigen-antibody interactions for enhanced signal amplification and selectivity. The cell-particle bioconjugates are then subjected to alternating current (AC) electric fields applied through interdigitated microelectrodes. The immunosensor performance is optimized with respect to electric field frequency, cell concentration, incubation times and the type of blocking agent to achieve a low limit of detection (LOD) of 100 CFU/mL. The approach is extendable to a wide spectrum of clinical diseases and offers an efficient and cost-effective solution for point-of-care diagnosis.

Keywords: Impedance, gold nanoparticle, detection, Salmonella, biosensor, typhoid