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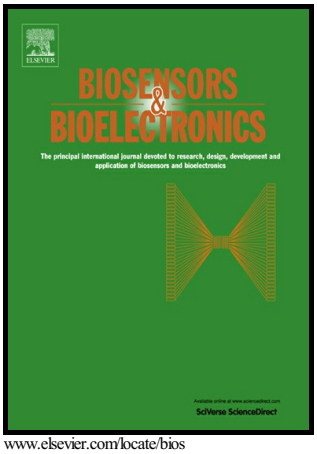

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Label-free nano-biosensing on the road to tuberculosis detection

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Abstract

Tuberculosis, an ailment caused by the bacterium *Mycobacterium tuberculosis* (*Mtb*) complex, is one of the catastrophic transmittable diseases that affect human. Reports published by WHO indicate that in 2017 about 6.3 million people progressed to TB and 53 million TB patients died from 2000 to 2016. Therefore, early diagnosis of the disease is of great importance for global health care programs. Common diagnostics like the traditional PPD test and antibody-assisted assays suffer the lack of sensitivity, long processing time and cumbersome post-test proceedings. These shortcomings restrict their use and encourage innovations in TB diagnostics. In recent years, the biosensor concept opened up new horizons in sensitive and fast detection of the disease, reducing the interval time between sampling and diagnostic result. Among new diagnostics, label-free nano-biosensors are highly promising for sensitive and accessible detection of tuberculosis. Various specific label-free nano-biosensors have been recently reported detecting the whole cell of *M. tuberculosis*, mycobacterial proteins and IFN-γ as crucial markers in early diagnosis of TB. This article provides a focused overview on nanomaterial-based label-free biosensors for tuberculosis detection.

Keywords: Label-free, Nanosensor, Surface Plasmon Resonance, Piezoelectric, Biosensor, *Mycobacterium tuberculosis*

1. Introduction

Fast detection and characterization of pathogens is of utmost consideration in human health care as some pathogens may cause disastrous diseases and conditions that affect people lives. Moreover, it is crucial for the administration of tailored antimicrobial treatment to control the spread of the disease and at the same time reduce drug resistances (Gopinath et al. 2014). Tuberculosis (TB), one of the most catastrophic phenomena that human history ever encountered, is a bacterial disease caused by transmission of one member of the *Mycobacterium tuberculosis* complex (MTBC) bacteria by different means (mostly via