THE ROLE OF BIOSENSORS FOR TUBERCULOSIS DETECTION

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Introduction: One of the main reasons of death from contagious diseases in the world is Tuberculosis (TB). Its main cause is pathogenic bacterium which is named the Mycobacterium Tuberculosis. The efficient way to control TB is to rapidly diagnosis and early treatment. Eastern European and central Asian countries continue to have the highest levels of multi-drug resistant tuberculosis (MDR-TB). Among new cases, the proportions with MDR-TB were highest in Belarus, Estonia, Kazakhstan, Kyrgyzstan, the Republic of Moldova, the Russian Federation. The objective of this review is to evaluate currently available biosensing techniques that are either already in use or under development for detection of TB. A comparison will also be made with conventional multistep techniques

Methods: Biosensors are devices that transform biochemical reactions of isolated enzymes, nucleic acids, organelles, tissues with specific chemical compounds into an optical, thermal or electrical signal, which can be more easily determined and quantified. The primary benefits of biosensors over regular diagnostic techniques can be stated as follows: (1) Technical advantage: single step detection. (2) Ease of use: many of the designed biosensors are worked out with user-friendly interfaces. (3) Quick response: typically a few minutes for most biosensors enabling rapid and better control over the measurement.

Results: a) Electrochemical and electrical biosensors are among the most popular biosensors that are used today in detection of not only TB but also many other diseases. The mechanism of detection relies on specific changes in electrical signals at a surface-functionalized electrode by either chemical reactions or physical interactions. It has main two types of biosensors. 1) Electronic nose-based biosensors: they are designed to recognize changeable substances produced by TB in liquid medium; 2) Nanowire-based biosensors: they are most conspicuously depicted by silicon nanowires that run as field effect transistors.

b) The second type of biosensors is Optical biosensors. 1) Fibre-optic biosensors: optical fiber-derived devices which use optical field to measure biological species such as cells, proteins, and DNA. 2) Surface plasmon resonance-based biosensors Breathalyzer biosensors: have been developed to diagnose pulmonary TB in patients. Typically, in these types of sensors the patients are asked to cough in a masked structure containing a collection tube after administration of a nebulized dose of saline.

Conclusion: TB remains one of the major unresolved global health problems, especially in the developing parts of the world. Most of the biosensors discussed in the present review are still at the developmental stage and lack clinical validation with real TB samples from patients. All sensor methods have their own merits and potential problems with respect to sample preparation, requirement of skilled personnel to handle the sample, sensitivity or cost.