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Zinc Oxide Nanoparticle-Doped Poly (8-Anilino-1-Napthalene Sulphonic Acid/Nat Nanobiosensors for TB Drugs

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Abstract : Tuberculosis (TB) is an infectious disease caused by the bacterium (Mycobacterium tuberculosis) which has a predilection for lung tissue due to its rich oxygen supply. The mycobacterial cell has a unique innate characteristic which allows it to resist human immune systems and drug treatments; hence, it is one of the most difficult of all bacterial infections to treat, let alone to cure. At the same time, multi-drug resistance TB (MDR-TB) caused by poorly managed TB treatment, is a growing problem and requires the administration of expensive and less effective second line drugs which take much longer treatment duration than fist line drugs. Therefore, to acknowledge the issues of patients falling ill as a result of inappropriate dosing of treatment and inadequate treatment administration, a device with a fast response time coupled with enhanced performance and increased sensitivity is essential. This study involved the synthesis of electroactive platforms for application in the development of nano-biosensors suitable for the appropriate dosing of clinically diagnosed patients by promptly quantifying the levels of the TB drug; Isonaizid. These nano-biosensors systems were developed on gold surfaces using the enzyme N-acetyletransferase 2 coupled to the cysteamine modified poly(8-anilino-1-napthalene sulphonic acid)/zinc oxide nanocomposites. The morphology of ZnO nanoparticles, PANSA/ZnO nano-composite and nano-biosensors platforms were characterized using High-Resolution Transmission Electron Microscopy (HRTEM) and High-Resolution Scanning Electron Microscopy (HRSEM). On the other hand, the elemental composition of the developed nanocomposites and nano-biosensors were studied using Fourier Transform Infra-Red Spectroscopy (FTIR) and Energy Dispersive X-Ray (EDX). The electrochemical studies showed an increase in electron conductivity for the PANSA/ZnO nanocomposite which was an indication that it was suitable as a platform towards biosensor development.

Keywords : N-acetyletransferase 2, isonaizid, tuberculosis, zinc oxide
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