Proceedings Volume 11651, Optical Diagnostics and Sensing XXI: Toward Point-of-Care Diagnostics, March 2021

Surface plasmon resonance (SPR) based biosensor for mycobacterium tuberculosis diagnosis

Maphanga, Charles P; Ombinda-Lemboumba, Saturnin; Manoto, Sello L; Mthunzi-Kufa, Patience

Abstract:
Recently, various nanomaterials have been used to develop nanotechnology-based rapid diagnostic tests. Due to their unique optical properties, gold nanoparticles (AuNPs) have been employed to design and develop modern biosensors for the rapid and real-time detection of various diseases or pathogen-specific biomolecules/markers, such as DNA, RNA, proteins, and whole cells. Optical biosensors offer great advantages over conventional analytical techniques. Specifically, they can provide multiple capabilities such as user-friendly operation, real-time analysis, rapid response, high sensitivity and specificity, portability, label-free detection and cost-effectiveness. As a result, this diagnostic approach possesses suitable features to develop point-of-care (POC) diagnostics and monitoring technologies. This study implemented the use of surface plasmon resonance (SPR) biosensing to monitor biomolecular interaction between biorecognition element covalently immobilized on a gold-coated glass substrate and an analyte. A custom-built Kretschmann configuration SPR optical biosensing setup was used to measure angle shift to monitor the biomolecular interaction events on the biosensing layer. To amplify the differences in SPR biosensing due to biomolecular binding events, AuNPs were used and successfully conjugated to the anti-TB antibodies and confirmed using ultraviolet–visible (UV-vis) spectroscopy. Mycolic acids were successfully immobilized on gold-coated substrates and were able to bind to the anti-TB antibodies that were introduced on the substrates, therefore enabling the detection of the captured anti-TB antibodies. As a result, mycolic acids have been realized to be efficient biomarkers to specifically react with anti-TB antibodies and produce a detectable signal for the purpose of TB diagnosis.