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Biosensing multidrug-resistant TB genes using SPR

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Abstract

Tuberculosis (TB) is one of the most prevalent infectious diseases globally. Although it is curable, several factors, such as the inappropriate use of treatment drugs lead to drug-resistant strains of TB. The burden of infection is disproportionately high in low-income and resource-limited settings. Furthermore, this disparity is exacerbated in patients with already compromised immune systems. Therefore, early detection and treatment of TB play an important role in reducing the spread and progression to drug-resistant disease forms. There are currently a few rapid multi-drug resistant TB diagnostic tests available, however, most are limited due to costs and accessibility. Several genes, such as catalase-peroxidase (katG) and enoyl reductase (inhA) genes, contain mutations that are responsible for resistance to the TB drug, isoniazid. We therefore, aim to use a custom-built surface plasmon resonance (SPR) system to detect katG and inhA genes. Deoxyribonucleic acid (DNA) probes, specific for katG and inhA, were used as biorecognition elements to capture katG and inhA target DNA. The katG and inhA gene-specific DNA probes were immobilized on a gold-coated glass sensor chip before the target DNA was introduced for detection. As a negative control, a mismatched probe, unspecific to both genes was used for confirmation of the absence of the two genes in the experimental setup. The specificity and sensitivity of the capture probes to the target DNA were investigated using the gold-coated glass sensor chip on the SPR setup. The changes in the resonance angle dip indicated the hybridization of the target DNA and the capture probe. The results from this study will contribute to the optimization of an optical-based biosensor detecting drug-resistant mutations.