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Fabrication of fluidic-based memristor sensor for dengue virus detection

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Implementation of simple fluidic-based memristor sensor in bio-sensing application was presented. The sensor was fabricated using sol-gel spin coating technique and has nine well functions to increase the conjugation area to trap virus. The sensor fabricated in four sizes wells diameter of 0.5 mm, 1 mm, 1.5 mm and 2 mm. The sensors were modified with anti-dengue virus NS1 glycoprotein monoclonal antibody before applying with dengue virus 1 NS1 glycoprotein. Four concentrations of dengue viruses: 52 nM, 104 nM, 208 nM and 416 nM were prepared and applied to the modified sensor. The ability of the sensor in sensing dengue virus is measured using the off-on resistance ratio to represent the loop area. The results show that the loop area of the pinched hysteresis loop increase as the dengue virus applied to the modified sensor. The loop area also increases as the concentration of the dengue virus increases. The most obvious change in loop area observed for 416 nM dengue virus. The recorded sensitivity for the 2 mm wells diameter is 6.53×10^{-3} $(nM)^{-1}$ which measured in fluidic-based platform. This concludes that the dengue virus produced reaction with the modified sensor and thus changes the sensors behaviors.

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DNA directed immobilization as a tool for design of porous Si based biosensors

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The objective of this research is to design and construct porous silicon (PSi) based biosensing platforms for monitoring proteolytic activity of complex proteases. Proteases regulate virtually every biological process, either during growth or maturation through the modification of protein activity or by controlling turnover. They have the unique ability to irreversibly hydrolyze peptide bonds, which results not only in protein degradation, but also in the introduction of new levels of information content into the signaling pathways. Despite their recognition as drug targets of great potential, the profile of their substrates or degradation products remains to be fully elucidated. To achieve this goal, we have designed and fabricated a simple optical biosensing platform based on PSi nanostructures that allows for real-time monitoring of protease activity and downstream mass spectrometry analysis of the substrate degradation products. An oxidized PSi optical nanostructure, a Fabry-Pérot thin film, is synthesized and is used as the optical transducer element. Immobilization of the protease onto the nanostructure is performed through DNA-directed immobilization. Our studies demonstrate high enzymatic activity of the immobilized proteases, while maintaining their specificity. The catalytic activity of the proteases immobilized within the porous nanostructure is monitored in real time by reflective interferometric Fourier transform spectroscopy, allowing us to both concentrate and quantify the reaction products. We show that we can easily regenerate the surface for additional biosensing analysis by mild dehybridization conditions. The biosensor configuration is compatible with common proteomic methods and allows for downstream mass spectrometry analysis of the reaction products.

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