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Signal Amplification Using Graphene Oxide in Label Free Biosensor for Pathogen Detection

Authors : Agampodi Promoda Perera, Yong Shin, Mi Kyoung Park

Abstract : The successful detection of pathogenic bacteria in blood provides important information for early detection, diagnosis and the prevention and treatment of infectious diseases. Silicon microring resonators are refractive-index-based optical biosensors that provide highly sensitive, label-free, real-time multiplexed detection of biomolecules. We demonstrate the technique of using GO (graphene oxide) to enhance the signal output of the silicon microring optical sensor. The activated carboxylic groups in GO molecules bind directly to single stranded DNA with an amino modified 5' end. This conjugation amplifies the shift in resonant wavelength in a real-time manner. We designed a capture probe for strain Staphylococcus aureus of 21 bp and a longer complementary target sequence of 70 bp. The mismatched target sequence we used was of Streptococcus agalactiae of 70 bp. GO is added after the complementary binding of the probe and target. GO conjugates to the unbound single stranded segment of the target and increase the wavelength shift on the silicon microring resonator. Furthermore, our results show that GO could successfully differentiate between the mismatched DNA sequences from the complementary DNA sequence. Therefore, the proposed concept could effectively enhance sensitivity of pathogen detection sensors.

Keywords : label free biosensor, pathogenic bacteria, graphene oxide, diagnosis
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