ELECTROMECHANICAL DETECTION OF PATHOGENS WITH SELF-ASSEMBLED APTAMER BIOSENSORS

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Monitoring of water samples in remote locations and the developing world is crucial to protect people from infectious diseases primarily caused by enteric pathogens. Routine pathogen detection, which is usually based on cell cultivation methods, is labor intensive and time consuming. Some pathogens may cause diseases with rapid-evolution symptoms. Therefore, fast, sensitive and reliable detection of pathogen contamination is of great significance. Biosensor technologies are currently under intense investigation for detecting pathogens responsible for diseases in various fields. For point of care applications, the detection platform should be cost-effective, fast, sensitive, easy to use and interpret, stable under a wide range of operating conditions, and portable. Aptamer-based biosensors show great potential for integration in a lab-on-a-chip (LOC) for selective and sensitive detection of target microorganisms or viruses. In this work, a label-free aptamer-based quartz crystal microbalance (QCM) biosensor for pathogen detection in water samples was developed. As proof-of-concept study, a single stranded DNA aptamer sequence, well known for detection of Escherichia coli O157:H7 strain, was used. The aptamer capture probe was immobilized by thiol functional groups on the gold-coated quartz crystals. The aptamer sequence was tested as capture probe using complementary and non-complementary DNA sequences as targets. Each step of aptamer immobilization and DNA hybridization was characterized by real-time monitoring of quartz resonance frequency changes. The aptamer probe showed high selectivity for the complementary target. A linear relationship between the complementary DNA target concentration and oscillation frequency of the quartz crystal was demonstrated in the range of 0.01-1μM. Furthermore, the developed QCM aptamer biosensor can be integrated in microfluidic LOC devices and thus allows continuous sample preparation and pathogen detection.