**Toll-Like Receptor modified Au sensors for detection of pathogenic agents in surface water**

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From drinking water to recreational and commercial use, surface waters have a wide range of applications and the contamination of these waters with pathogenic agents poses a serious threat to the population. Detection and quantification of bacteria, viruses and protozoa in water in an efficient and effective way is of great importance. Currently employed methods for this purpose primarily rely on time-consuming pre-concentration procedures, culturing, and some biochemical identifications. Efforts are on to develop novel biosensors capable of rapid and easy detection of pathoegnic agents. A significant group of these biosensors are Impedance-based biosensors which use a transducer surface modified by a bio-recognition element capable of binding to the target analyte. In this research work, we have used Toll-Like Receptor immunoproteins (TLRs), namely TLR3 and TLR4 as the biorecognition elements on Impedance-based biosensors. TLRs target different components of the cell wall such as lipopolysaccharide, lipoteichoic acid, and peptidoglycan or other molecular patterns of pathogens.TLR3 is responsible for recognition of and binding to double stranded RNA (dsRNA) as a molecular pattern of viruses and TLR4 detects and binds to Gram-negative bacterial lipopolysaccharides (LPS). Using TLR3-modified Au biosensors and electrochemical impedance spectroscopy (EIS), detection and quantification of polyinosinic-polycytidylic acid (poly (I:C)) as a dsRNA mimicing molecule has been achived. In order to interact with LPS, TLR4 requires another protein; myeloid differentiation-2 (MD-2). TLR4 is prebound to MD-2 when interacting with LPS. Employing TLR4/MD-2-modified Au biosensor and EIS, LPS samples from different Gram-negative bacteria such as *E. coli* and *Salmonella* have been detected and quantified. The ultimate goal of this project is to detect the pahogenic molecular patterns such as LPS in environmental waters.