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Microbial fuel cell based biosensor as a long term alarm detector for water toxicity

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Water scarcity and poor water quality negatively impact food security, livelihood choices and educational opportunities across the world. For these reasons, access to clean water is one of the 17 goals defined by United Nations. The development of innovative and cost effective systems for long term and *in-situ* freshwater quality monitoring is fundamental to provide access to clean water. Microbial Fuel Cells (MFC) are bio-electrochemical systems able to convert the chemical energy stored into the organic matters into electrical energy, therefore, they can simultaneously treat wastewater and produce energy. More recently, increasing attention has been paid to the potential use of MFCs as sensors for *in-situ* water quality monitoring. The current generated by MFCs directly reflect the metabolic activity of the anodophilic electroactive bacteria. Thus, the presence of a toxicant in the anolyte can affect the microbial metabolism with consequent changes in the current generated. In particular, in MFC-based biosensor the sensing element does not need a physical transducer to obtain a readable signal (electrical power). Moreover, MFC-based biosensor is an early detector; it is simple in operation and can be highly cost effective. These unique characteristics perfectly meet the requirement for long-term *in situ* sensing application. Focusing on the development of real *in situ* application at CSF-IIT, we are investigating the biosensing capability of a mixed community biofilm directly coming from river sediment and in equilibrium with the environment.

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Impedimetric electrochemical sensor for albumin determination based on poly bromocresol purple film modified electrodes

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Human serum albumin (HSA) is the major protein in plasma synthesized principally in the liver and playing significant roles after it is released in the circulation. Albumin is a very important factor of regulation in the exchange of water between the plasma and the interstitial compartment being largely responsible of the colloidal osmotic pressure of blood. Moreover, it is a protein with a notable ability to bind an extensive range of other small molecules helping in the transport of important substances in the human body such as hormones, fatty acids and drugs. A decrease of albumin level in serum is associated with severe illnesses of the kidney as well as other conditions such as liver disease, malnutrition and extensive burns. Therefore, HSA determination is extremely useful in the diagnosis and treatment of many clinical entities. This research work reports on the development and integration of a novel label-free impedimetric sensor based on a poly (bromocresol purple) surface for the specific detection of HSA. The fabricated sensor was incubated with serum albumin, and electrochemical impedance spectroscopy (EIS) was employed to measure the changes in the conductance of the electrode of bromocresol purple (BCP) by reacting with the albumin. In addition, we validated the specificity of the designed sensor to only albumin. Clinical applicability of the sensor was also demonstrated utilizing real serum sample from patients obtaining excellent agreement with the commercial available colorimetric kit. It is expected that the new poly (BCP) sensor will become a successful diagnostic platform for HSA detection in clinical diseases.

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