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Potentiometric glycerol biosensor based on incorporation of glycerol-dehydrogenase on Au using layer-by-layer self-assembled molecular wiring systems

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An intensive interest in glycerol determination exists due to its extensive applications in major industries including medical, food and biofuels. This has led to a quest for a simple, specific, rapid and highly sensitive method for glycerol quantification. This study attempts to develop an enzyme-based electrochemical biosensor for glycerol quantification using NAD⁺-dependent enzyme, Glycerol dehydrogenase (GIDH) immobilized on a modified gold (Au) electrode. The objective of this study is to fabricate a molecular wiring system to anchor GIDH enzyme onto a Au electrode and to evaluate the efficacy of the proposed wiring system to effectively transport generated charges (as a result of glycerol oxidation) from the enzyme active site to the supporting electrode. A novel concatenation of molecules was utilized to attach the enzyme onto the Au surface via layer-by-layer (LBL) self-assembly method. Surface characterization of the enzyme electrodes using cyclic voltammetry and SEM techniques confirmed attachment of enzyme on the Au electrode with the assistance of the tethering molecules. The enzymatic biosensor was assessed for its potentiometric response to glycerol concentrations ranging from low (0.001 M) to very high (10 M). The effects of supporting electrolyte(s) with varying buffers and presence of enzyme stimulators on the electrical potential generated were analyzed and compared. Current sensing-Atomic force microscopy (CS-AFM) was used to elucidate the overall surface electrical conductance of the electrodes. Simple fabrication, high speed of measurement, high sensitivity and possibility of miniaturization are the main advantages of this biosensor.

Biography

Aishwarya Mahadevan is Master's student majoring in Agricultural & Biological Engineering at Texas A&M University. Her current research is focused on electrochemical biosensor development. She received her BTech in Biotechnology from Sathyabama University, India. Before attending TAMU, she gained professional research experience in Indian Institute of Technology - Madras (IIT-M) as Research Associate for an algae biofuel project.

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