CERTAIN INVESTIGATIONS ON THE DEVELOPMENT OF ELECTROCHEMICAL BIOSENSORS FOR THE DETECTION OF CHOLESTEROL

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Abstract: Cholesterol is an essential lipid component of mammalian cell membrane and life is highly impossible without it. Contribution of cholesterol is essential in cell signaling and cell to cell communication. It is also a vital component of brain, liver, nerve, skin, and adrenal glands. Eventhough cholesterol offers benefits to human being, the trouble arises when its level increases. Therefore, the cholesterol level in the body should be less than $5.2x10^{-3}$M i.e. 200 mg/dL. The level beyond $6.2x10^{-3}$M results in hypercholesterolemia. On the other hand, low cholesterol level, i.e. below $3.1x10^{-3}$M (120 mg/dL) is called hypocholesterolemia or hypolipidemia. Hence, determination of cholesterol level in blood stream is vital to monitor the clinical disorders arising due to its abnormal levels. Therefore, a reliable biosensor is required to determine the cholesterol content in blood serum that can be done in real-time. This research work has made an attempt of designing the cost effective, stable and specific cholesterol biosensors with improved detection range at low level using enzymatic and nonenzymatic methods.

The electrochemical cholesterol biosensor based on cholesterol oxidase enzyme immobilized on Gold Nanoparticles – *functionalized* - Multiwalled Carbon Nanotubes (MWCNTs) - Polypyrrole (PPy) Nanocomposite modified electrode is fabricated. The cholesterol detection is demonstrated using Electrochemical Impedance Spectroscopy, Cyclic Voltammetry and Amperometric techniques.

Without the enzyme, bilayer phospholipid membrane based electrochemical biosensor is developed for the detection of cholesterol. Using electrochemical impedance spectroscopy, the interaction of cholesterol with Bilayer Lipid Membrane (BLM) is investigated and an impedimetric sensor is developed.

Bilayer Lipid Membrane is also formed on the agargel surface. A stable membrane is formed within 30 minutes and an impedimetric sensor is developed.

The nature and effect of cholesterol on the cholesterol sb-BLM interaction is also investigated by monitoring the electrical properties of BLM formed using cholesterol-phospholipid mixture. The results indicated the formation of cholesterol rich domains in the BLM. The area occupied by single cholesterol molecule in the BLM domain is calculated.

The developed biosensors using simple, novel and cost effective methods exhibited wide detection ranges. BLM based method of sensing opened a new dimension in biosensor development for cholesterol detection.