Conductive polymer nanocomposite enzyme immobilized biosensor for pesticide detection

Priyanka D. Virutkar, Ashish P. Mahajan, Bhavna H. Meshram, Subhash B. Kondawar*

Department of Physics, Polymer Nanotech Laboratory, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, India

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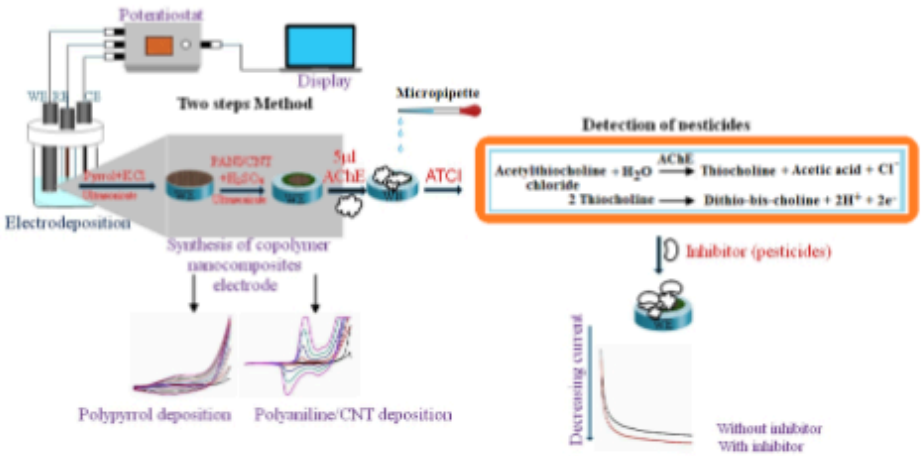
ABSTRACT



Conductive carbon nanotubes based polyaniline/polypyrrole polymer nanocomposite (CNT-PANI-PPy) film was electrochemically synthesized on graphite electrode using cyclic voltammetry. CNT-PANI-PPy film formed a biocompatible environment to entrap enzyme molecule and used as biosensor for pesticide detection. This study shows that enzyme based conductive polymer nanocomposite film itself acts as a mediator. Carbon nanotubes promote electron transfer reactions in presence of Acetythiocholine chloride (ATCl) as a substrate at a lower potential and catalyzed the electrochemical oxidation of enzymatically formed thiocholine. Surface morphology was studied by scanning electron microscopy which shows a porous structure of the modified film beneficial for enzyme immobilization. Electrochemical behavior of the fabricated electrodes evaluated through cyclic voltammetry and electrochemical impedance spectroscopy. The detection of pesticide (acephate) was performed by chronoamperometry and the limit of detection (LOD) of acephate was found to be 0.007 ppm concentration which is quite low.

Keywords: Polymer, Carbon nanotubes, Acetylcholinesterase, Pesticides, Biosensors

INTRODUCTION

The research on the construction of biosensors for various fields applications such as food industry, wastewater monitoring, medical diagnosis, forensics, environmental monitoring has been contributed to the sustainable development of society. A biosensor is an analytical device used for the detection of the analyte in the reaction. It comprises two major components, bioreceptor, which recognizes analyte, and transducer converts biorecognition event into a measurable signal.[1] The use of electrochemical biosensors is increasing now a days due to their simplicity of operation, low fabrication cost, high selectivity and short duration of analysis in comparison to conventional methods such as gas chromatography (GC), high performance liquid chromatography (HPLC), ultraviolet spectroscopy, gas-mass spectroscopy and surface plasmon resonance (SPR).[2,3] Various techniques have been used

* Dr. Subhash B. Kondawar
Department of Physics, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur – 440033, India
Tel: +91-712-2042086 Email: sbkondawar@yahoo.co.in

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