Methods and Applications in Fluorescence

RECEIVED
29 January 2018

REVISED
4 May 2018

ACCEPTED FOR PUBLICATION
16 May 2018

PUBLISHED
29 May 2018

PAPER

# Copolymer based multifunctional conducting polymer film for fluorescence sensing of glucose

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**Keywords:** fluorescence glucose sensing, conducting polymer, fluorescent surface, electropolymerization

## Abstract

A simple, rapid and effective fluorescence sensing platform has been fabricated using a fluorescent conducting polymer surface. For this purpose, a rhodamine based electroactive monomer (RDC) and a functional group containing monomer (SNS) have been copolymerized to develop a conducting polymer based sensor platform having a fluorescence and enzyme-binding surface on ITO electrode. The proposed fluorescence sensing mechanism for detection of glucose is related to the consumption of dissolved oxygen at the double layer of the electrode which is fluorescence quenching agent by glucose-GOx reaction. Concentration of glucose was investigated quantitatively from 0.05 to 1 mM via fluorescence signal measurement. This novel approach could be adapted for the production of various rapid and effective fluorescence sensing platforms for glucose.

## 1. Introduction

Fluorescence sensing is increasingly showing improvement in the field of research and technology [1, 2]. This technique allows to the designation of target reliably easy-to-use instrumentation and low cost. When compared to other detection methods, fluorescence sensing is recognized with superior sensitivity features, fast response and spatial resolution high enough to allow the taking of microscope images [3–5] Functional polymer materials, especially fluorescent conducting polymers, have been considerate as one of the sensing materials due to the molecular wire concept for conjugated chain which leads to increased sensitivity and selectivity [6, 7]. They have been extensively used in chemical detection working as indicators, sensors, and tracers [8, 9]. Generally these chemo sensors have been used as solution form of conducting polymer.

Conducting polymers prepared as thin film, have been adequately searched in novel applications such as OLEDs [10], photovoltaics [11, 12], electrochromic devices [13–18] and chemo/bio-sensors [19–21]. These conducting polymers have been designed via different coupling reactions such as chemical and electrochemical polymerization technique, which supply thin films with various specific chemical or physical properties and different morphologies [22]. It was very useful to see that conjugated polymers are promising materials for the design of bio-functional surfaces. Presence of functional groups such as carboxyl, thiol and amino etc in the conducting polymer structure achieves bioactive molecule immobilization on the modified surfaces. Thus biocompatible and selective sensing platform containing enzymes, polypeptides, antibodies etc are obtained. Previously, it has been depicted that sensing platforms can be combined conducting polymers through electropolymerization process and biomolecule. For example, amino group containing conducting copolymer was synthesized on graphite electrodes by electrodeposition. Then glucose oxidase (GOx) enzyme immobilization was performed for cross-linked via glutaraldehyde on conducting polymer coated surface. Finally designed sensing platform used as glucose biosensor [23]. Since strong covalent bonds formed between conducting polymer surface and biomolecules conducting polymers are promising materials for highly stable bio detection.

Glucose monitoring technologies and methodologies for the treatment of diabetes has been developed