

Electrochemical Fabrication of Polypyrrole/Poly(pyrrole-3-carboxylic acid)/Graphene Oxide Composite Thin Film for Biosensor Application

Rapiphun Janmanee* and Kulwadee Pinwattana

Department of Chemistry, Faculty of Science and Technology,
Pibulsongkram Rajabhat University, Phitsanulok 65000, Thailand

*Corresponding author, E-mail: joyrapiphun@gmail.com

ABSTRACT

An electrochemical fabrication of functionalized conducting polymer/graphene oxide (GO) composite thin film for the detection of biomolecule were reported. Polypyrrole/poly(pyrrole-3-carboxylic acid)/graphene oxide (PPy/PP3C/GO) composite thin films were synthesized by electropolymerization on an indium tin oxide (ITO) coated glass slide. The effect of concentration and composition of precursor solution on the electrochemical behaviour of the composited material were investigated. The PPy/PP3C/GO composite thin film synthesized under the optimized experimental conditions was characterized by cyclic voltammetry (CV). In addition, the electrochemical behavior and doping/dedoping properties of the obtained composite thin film in a neutral phosphate-buffered saline (PBS) solution were also studied. Finally, the PPy/PP3C/GO composite was used to detect ascorbic acid (AA). It was found that PPy/PP3C/GO showed good electroactivity property in neutral PBS solution and could be applied for the detection of AA. Therefore, it can be concluded that an electrochemically fabricated PPy/PP3C/GO composite material is a promising candidate as smart material for biosensing applications.

Keywords: graphene oxide, polypyrrole, pyrrole-3-carboxylic acid, biosensor

INTRODUCTION

Conducting polymers (CPs) such as polythiophene, polyaniline, poly(phenylene vinylene) and polypyrrole (PPy) and their derivatives have received considerable attention because of their unique electrical, optical, chemical and biochemical properties (Vidal *et al.*, 2003; Guimard *et al.*, 2007; Peng *et al.*, 2009; Singh *et al.*, 2009; Yang *et al.*, 2015). In recent years, CPs have found potential applications in various fields such as fuel cells, electrochromic displays, field effect transistors (FETs) drug release system, affinity chromatography, chemical sensor and biosensors (Adhikari and Majumdar, 2004; Demos *et al.*, 2006; Baba *et al.*, 2010; Jiang *et al.*, 2012; Yue *et al.*, 2015). Nowadays, CPs and their derivatives-based biological sensors have been extensively investigated to detect biomolecules for example glucose, urea, enzymes, hormones, neurotransmitters, antibodies and antigens (Sriwichai *et al.*, 2010; Janmanee *et al.*, 2011; Lin *et al.*, 2013; Chu *et al.*, 2015; Soares *et al.*, 2015). Among these CPs, polypyrrole (PPy) and their derivatives are especially promising as chemical and biochemical sensors due to their good electrical conductivity, environmental stability, good biocompatibility, facile

