Enzymatic polymerization of polythiophene by immobilized glucose oxidase

In this study 'green', environmentally friendly enzymatic reaction-based synthesis of conducting polymer polythiophene (PTP) is proposed. Glucose oxidase (GOx) was shown as an effective catalyst, which, in the presence of glucose, produces hydrogen peroxide suitable for the oxidative polymerization of PTP under ambient conditions at neutral pH. Enzymatically induced formation of the PTP layer over GOx-modified graphite rod electrode (GRE) was demonstrated and evaluated amperometrically and by attenuated total reflectance - Fourier transform infrared (ATR-FTIR) spectroscopy. Surface morphology of GOx- and PTP-modified GR electrodes was characterized by atomic force microscopy. It was clearly shown that the apparent kinetic Michaelis constant ($K_{M(\text{app.})}$) of GOx-PTP-modified GRE increased by increasing the duration of polymerization reaction. Therefore, enzymatic polymerization could be applied in adjustment and/or tuning of $K_{M(\text{app.})}$ and other kinetic parameters of GOx-based electrodes used in biosensor design. (C) 2014 Elsevier Ltd. All rights reserved.