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Polypyrolle/glucose oxidase electrode for electrochemical determination of glucose

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Abstract

A growing interest in biosensors for use in medical, environmental and food analysis has been recognized. Biosensors are devices that transform chemical information, usually the concentration of a specific sample component, into an analytically useful signal. Their selectivity depends on the characteristics of enzyme and biosensors' response rate and sensitivity on electroconducting polymer used.

Glucose oxidase (GOx) is the most widely used enzyme in the field of biosensors because of its high specificity for a commercially important analyte, high turnover number and high stability. On the other side, among the conducting polyheterocyclic polymers, polypyrolle (PPy) is of particular interest because the relatively low oxidation potential of the monomer enables films to be grown from aqueous solutions that are compatible with most of biological elements.

The aim of this study was to investigate the possibility of glucose determination using enzyme electrode obtained by immobilization of GOx into polypyrolle electrochemically polymerised on platinum electrode. Electrochemical synthesis was performed in 0.5 mol dm^{-3} HCl and 0.2 mol dm^{-3} pyrolle at constant current density of 2 mA cm^{-2}. Polypyrolle/enzyme electrode was formed by immobilization of glucose oxidase via glutaraldehyde into electrochemically synthesized polypyrolle on platinum electrode. Apparent Michaelis constant was determined and it was found to be 0.045 mmol dm^{-3}, which is much lower than that of free enzyme indicating enhanced enzyme efficiency when it is immobilized into polymer electroconducting matrix. PPy/enzyme electrode lost 5% and 18% of its initial signal after 5 and 20 days, respectively.