Abstract

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Title of thesis: Macroporous indium tin oxide as a potential platform for bioanalytical applications

Blood glucose monitoring is an essential tool in diabetes mellitus diagnosis. Therefore new strategies have been developed to improve the performance of glucose sensing devices. In this thesis the suitability of macroporous indium tin oxide (ITO) electrodes for construction of third-generation glucose biosensors was investigated. As a biosensing part in sensor cellobiose dehydrogenase from *Corynascus thermophilus* (CtCDH) immobilized onto ITO platform was used. Several immobilization strategies based on physical adsorption, electrostatic bindings of the enzyme to the surface functionalized with polythyleneimine (PEI) and cross-linking with glutaraldehyde (GA) were studied in order to achieve reasonable sensitivity and stability of the biosensor. The morphology/topography and elemental composition of the enzyme modified surface were examined by scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), X-ray photoelectron spectroscopy (XPS). The optimal working conditions for flow injection experiment were established as follows: pH of 7,2, working potential of 0,3 V, and flow-rate of 0,5 ml/min. The current response obtained from the electrode functionalized with PEI was about 10 times higher than the one modified with GA. CDH-GA modified electrode exhibited improved stability in flow-injection test for duration of 7 hours with relatively high concentration of glucose (10 mM). The decrease of the initial response was 15% and 72% for GA-CDH and PEI-CDH modified electrodes, respectively. The sensor showed linearity in the glucose concentration range from 1 to 20 mM with the limit of detection down to 0,03 mM for the PEI-CDH modified electrode and 0,37 mM for GA-CDH modified electrode.

Keywords: amperometric sensor, indium tin oxide, cellobiose dehydrogenase, glucose