Substrate Specificity and Interferences of a Direct-Electron-Transfer-Based Glucose Biosensor

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Abstract

Objective:
Electrochemical sensors for glucose monitoring employ different signal transduction strategies for electron transfer from the biorecognition element to the electrode surface. We present a biosensor that employs direct electron transfer and evaluate its response to various interfering substances known to affect glucose biosensors.

Methods:
The enzyme cellobiose dehydrogenase (CDH) was adsorbed on the surface of a carbon working electrode and covalently bound by cross linking. The response of CDH-modified electrodes to glucose and possible interfering compounds was measured by flow-injection analysis, linear sweep, and chronoamperometry.

Results:
Chronoamperometry showed initial swelling/wetting of the electrode. After stabilization, the signal was stable and a sensitivity of 0.21 µA mM⁻¹ cm⁻² was obtained. To investigate the influence of the interfering substances on the biorecognition element, the simplest possible sensor architecture was used. The biosensor showed little (<5% signal deviation) or no response to various reported electroactive or otherwise interfering substances.

Conclusions:
Direct electron transfer from the biorecognition element to the electrode is a new principle applied to glucose biosensors, which can be operated at a low polarization potential of -100 mV versus silver/silver chloride. The reduction of interferences by electrochemically active substances is an attractive feature of this promising technology for the development of continuous glucose biosensors.


Keywords: biosensors, cellobiose dehydrogenase, continuous glucose measurement, direct electron transfer, interference, selectivity

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