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ORIGINAL ARTICLE

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 $\mu A\ mM^{-1}\ cm^{-2}$ 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.

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Abbreviations: (Ag/AgCl) silver/silver chloride, (CDH) cellobiose dehydrogenase, (CGMS) continuous glucose monitoring system, (CLSI) Clinical and Laboratory Standards Institute, (DET) direct electron transfer, (FAD) flavin adenine dinucleotide, (GDH) glucose dehydrogenase, (GOx) glucose oxidase, (PBS) phosphate-buffered saline, (PQQ) pyrroloquinoline quinone

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

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