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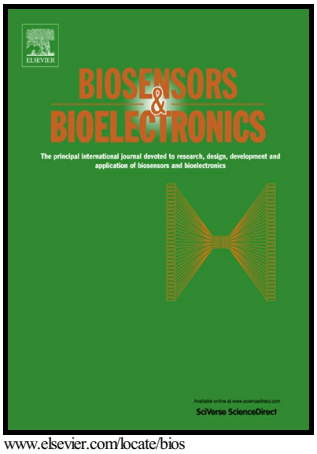

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A fine pointed glucose oxidase immobilized electrode for low-invasive amperometric glucose monitoring

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Abstract

A low invasive type glucose sensor, which has a sensing region at the tip of a fine pointed electrode, was developed for continuous glucose monitoring. Platinum-iridium alloy electrode with a surface area of 0.045 mm^2 was settled at the middle of pointed PEEK (Polyetheretherketone) tubing and was employed as sensing electrode. Electrodeposition of glucose oxidase in the presence of surfactant, Triton X-100, was performed for high-density enzyme immobilization followed by the electropolymerization of *o*-phenylenediamine for the formation of functional entrapping and permselective polymer membrane. Ag/AgCl film was coated on the surface of PEEK tubing as reference electrode. Amperometric responses of the prepared sensors to glucose were measured at a potential of 0.60 V (*vs.* Ag/AgCl). The prepared electrode showed the sensitivity of 2.55 mA/cm^2 mM with high linearity of 0.9986, within the glucose concentration range up to 21 mM. The detection limit (S/N = 3) was determined to be 0.11 mM. The glucose sensor properties were evaluated in phosphate buffer solution and in vivo monitoring by the implantation of the sensors in rabbit, while conventional needle type sensors as a reference were used. The results showed that change in output current of the proposed sensor fluctuated similar with one in output current of the conventional needle type sensors, which was also in similar accordance with actual blood sugar level measured by commercially glucose meter. One-point calibration method was used to calibrate the sensor output current.

Keywords: Continuous glucose monitoring; in vivo measurement; low-invasive device, glucose oxidase

1. Introduction

Diabetes is a leading cause of morbidity and mortality as well as a major health problem for most developed societies around the world. The incidence of diabetes is now estimated at 366 million people worldwide (2011) and is expected to reach 552 million by 2030 (Unwin et al., 2012). The biggest market for biosensors is a glucose sensor accounting for about 85% of