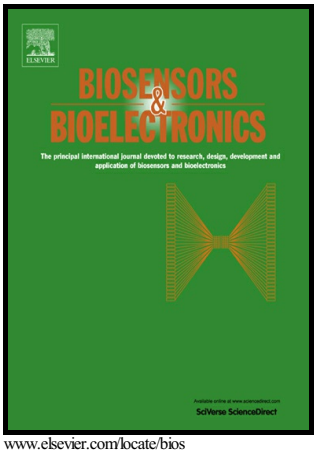

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Aqueous polythiophene electrosynthesis: A new route to an efficient coupling of PQQ-dependent glucose dehydrogenase for sensing and bioenergetic applications

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Abstract

In this study, polythiophene copolymers have been used as modifier for electrode surfaces in order to allow the immobilization of active pyrroloquinoline quinone dependent glucose dehydrogenase (PQQ-GDH) and to simultaneously improve the direct electrical connection of the enzyme with the electrode. Polymer films are electrosynthesized in aqueous solution without the need of surfactants onto carbon nanotubes modified gold electrodes from mixtures of 3-thiopheneacetic acid ($ThCH_2CO_2H$) and 3-methoxythiophene ($ThOCH_3$) using a potentiostatic pulse method. Polythiophene deposition significantly improves the bioelectrocatalysis of PQQ-GDH: the process starts at -200 mV vs. Ag/AgCl and allows well-defined glucose detection at 0 V vs. Ag/AgCl with high current density. Several parameters of the electro-polymerization method have been evaluated to maximize the anodic current output after enzyme coupling. The polymer deposited by this new procedure has been morphologically and chemically characterized by different methods (SEM, EDX, FT-IR, UV-Vis, XPS and Raman spectroscopy). The bioelectrocatalytic response towards increasing glucose concentrations exhibits a dynamic range extending from 1 μM to 2 mM. The low