CARBON NANOTUBES CHEMICALLY DERIVATIZED WITH REDOX SYSTEMS AS MEDIATORS FOR BIOFUEL CELL APPLICATIONS

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Abstract

The aim of this study was designing of nanostructured bioelectrodes and assembling them into a biofuel celi with no separating membrane. Carbon nanotubes (CNTs) chemically connected with residues of typical mediators, i.e. ferrocene (Fc) and 2,2'-azino-bis--(3-ethylbenzothiazoline)-6-sulfonic acid (ABTS) deposited on glassy carbon electrodes (GCE) were found useful as mediators for the enzyme catalyzed electrode processes. The electrodes were in turn covered with glucose oxidase from *Aspergillus niger* AM-11 and laccase from *Cerrena unicolor* C-139, respectively, incorporated in a liquid-crystalline matrix. The nanostructured electrode coating with the cubic phase film containing enzymes acted as the catalytic surface for the enzymatic reactions that is oxidation of glucose at anode and reduction of oxygen at cathode. For the system with mediators anchored to CNTs the catalysis was almost ten times more efficient than on bare GCE electrodes: catalytic current of glucose oxidation was l $mAcm^{-2}$ and oxygen reduction current exceeded 0.6 $mAcm^{-2}$. The open circuit voltage of the biofuel cell was 0.43 V. Application of the carbon nanotubes increased maximum power output of the constructed biofuel cell to 100 μWcm^{-2} without stirring the solution. It is ca. 100 times more efficient than using the same bioelectrodes without nanotubes on the electrode surface.

Keywords: biofuel cell, laccase, glucose oxidase, cubic phase, carbon nanotubes