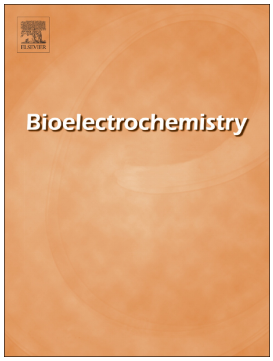

Effective immobilization of alcohol dehydrogenase on carbon nanoscaffolds for ethanol biofuel cell

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Effective immobilization of alcohol dehydrogenase on carbon nanoscaffolds for ethanol biofuel cell

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Abstract

An efficient approach for immobilizing alcohol dehydrogenase (ADH) while enhancing its electron transfer ability has been developed using poly(2-(trimethylamino)ethyl methacrylate) (MADQUAT) cationic polymer and carbon nanoscaffolds. The carbon nanoscaffolds were comprised of single-walled carbon nanotubes (SWCNTs) wrapped with reduced graphene oxide (rGO). The ADH entrapped within the MADQUAT that was present on the carbon nanoscaffolds exhibited a high electron exchange capability with the electrode through its cofactor β-nicotinamide adenine dinucleotide hydrate and β-nicotinamide adenine dinucleotide reduced disodium salt hydrate (NAD^+/NADH) redox reaction. The advantages of the carbon nanoscaffolds used as the support matrix and the MADQUAT employed for the entrapment of ADH versus physisorption were demonstrated via cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). Our experimental results showed a higher electron transfer, electrocatalytic activity, and rate constant for MADQUAT entrapped ADH on the carbon nanoscaffolds. The immobilization of ADH using both MADQUAT and carbon nanoscaffolds exhibited strong potential for the development of an efficient bio-anode for ethanol powered biofuel cells.

Keywords: alcohol dehydrogenase; bioanode; biofuel cell; MADQUAT; rGO; SWCNTs.