ELECTROCATALYTIC OXIDATION OF NADH USING A PENCIL GRAPHITE ELECTRODE MODIFIED WITH QUERCETIN

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The electrochemical oxidation of the reduced form of P-Nicotinamide Adenine Dinucleotide (NADH) has received considerable attention. Since it is an important coenzyme found in all living cells and participates in many important biosynthetic reactions and especially in the enzymatic catalysis of more than 250 dehydrogenases [1,2]. However, the direct oxidation of NADH is highly irreversible with a great overpotential at bare electrodes such as carbon, gold and platinum and is followed by the passivation of the electrode surface due to the adsorption of intermediate radicals and oxidation products. Therefore, modification of the electrode surface has been extensively used to be an effective method for reducing the overpotential of NADH oxidation [1,2]. In this study, electrocatalytic oxidation of NADH was investigated using a pencil graphite electrode modified with quercetin (PGE/QH2). In the modification of PGE surface with QH2, firstly the surface of PGE was pre-treated by applying a potential of +1.40 V for 60 s in the blank supporting electrolyte without stirring. Then, this pencil lead was immersed into a stock QH2 solution (1.0 mM in ethanol) for 60 s. After that, the electrocatalytic oxidation of NADH was investigated with this modified electrode. Cyclic voltammetric studies show that the peak potential of NADH oxidation shifts from +500 mV at bare PGE to +300 mV at PGE/QH2 (Figure 1). The electrocatalytic currents obtained from amperometric measurements at +500 mV vs. Ag/AgCl/KClsat. and at pH 7.0 phosphate buffer solution containing 0.1 M KCl were linearly related to the concentration of NADH. Linear calibration plots are obtained in the concentration range from 0.5 μM to 100 μM. The limit of detection was found to be 0.15 μM.

Figure 1. Cyclic voltammograms of PGE/QH2 (a) in the absence and (b) in the presence of 0.5 mM NADH. c) A cyclic voltammogram of 0.5 mM NADH at bare PGE. (Supporting electrolyte: 0.1 M phosphate buffer solution (pH 7.0) containing 0.1 M KCl; scan rate: 50 mV s⁻¹

References