Electropolymerization of Hematoxylin for Electrocatyltic Oxidation of NADH

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Reduced nicotinamide adenine dinucleotide (NADH) is an important cofactor in all living systems as it is required for the reactions of more than 250 oxidoreductase-denoted dehydrogenases(1). Due to the important functions of NADH, many researchers have been interested in its electrocatalytic oxidation.(1-2)

In this work, a derivative of catechol, Hematoxylin (HEMA), was used as redox mediator for electrocatalytic oxidation of NADH. Poly-HEMA modified Glassy Carbon Electrode(GCE) was prepared using cyclic voltmetry in optimized conditions (cyclic number: 20 times, Potential range: -0.8 to +2.3 V, scan rate: 100 mVs⁻¹, supporting electrolyte: 0.1 M H₂SO₄ containing 0.5 M NaNO₃, monomer concentration: 0.5 mM HEMA).

In order to check the electrocatalytic activity of the poly-HEMA modified GCE, cyclic voltammograms were recorded in the absence and presence of 2 mM NADH at 0.1 M Phospate buffer (pH:7) at 100 mVs⁻¹ (Figure 1). The anodic peak potential for oxidation of NADH at the poly-HEMA modified GCE is about 235 mV, while NADH is oxidized at about 554 mV at bare electrode. A decrease in overpotential of ca. 320 mV and an enhancement peak current on modified electrode reflect that HEMA exhibits a good electrocatalytic effect for NADH. On the other hand, the second order electrocatalytic rate constant (k_{obs, [NADH]=0}) was calculated from rotating disk electrode experiments at various concentrations of NADH and phosphate buffer with different pH values.

Figure 1. Cyclic voltammograms of a poly-HEMA modified GCE in the absence (a) and in the presence (b) of 2 mM NADH. (c) As (b) for an unmodified GCE (0.1 M phosphate buffer solution at pH 7.0; scan rate: 100 mV/s).

References

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