Preparation of a Novel Modified Electrode with a Complex Containing Phenanthroline Quinone for Electrocatalytic Oxidation of NADH

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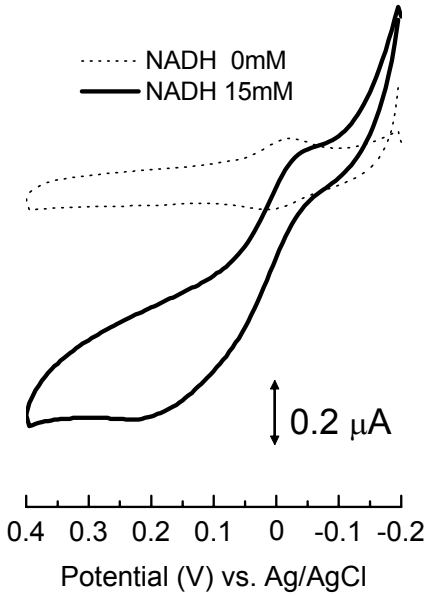
Nicotinamide-adenine dinucleotide (NADH, reduced form) is a coenzyme taking part in various biochemical redox reactions. The electrocatalytic oxidation of NADH has been a subject receiving great attention in views of development of biodevices. However, direct electrochemical oxidation of NADH requires a high overpotential. It is known that the transition-metal complexes with 1,10-phenanthroline-5,6-dione (phenanthroline quinone; pdon) show high electrocatalytic activity for the oxidation of NADH.[1] We prepared a novel pdon-containing ruthenium complex, $[Ru(aphen)(pdon)_2](ClO_4)_2$ (aphen = 5-amino-1,10'-phenanthroline) (**1**), and constructed an electrode modified with the self-assembled monolayer of **1**. The electrocatalytic oxidation of NADH using this modified electrode was investigated.

The formal potential of **1** modified on a gold electrode is -15 mV (*vs.* Ag/AgCl). This response can be assigned to the quinone / hydroquinone couple of **1**. The rate constant k_s for electron transfer between the electrode and the quinone moiety was calculated from CV peak separations and k_s value of 1.1 s^{-1} was evaluated at pH 7.0. In the presence of NADH, the cyclic voltammogram of the **1**-modified electrode taken at a slow potential scan rate exhibits a dramatic enhancement of the anodic current (Figure). This observation clearly demonstrates a catalytic effect in the oxidation of NADH.



1) Q. Wu, M. Maskus, F. Pariente, F. Tobalina, V. M. Fernández, E. Lorenzo, H. D. Abruña, Anal. Chem. 68 (1996) 3688.