Effect of Carboxyl Graphene on Direct Electrochemistry of Myoglobin and Electrocatalytic Investigation

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In this paper the effect of carboxyl graphene (G-COOH) on the electrochemical behavior of myoglobin (Mb) was investigated in detail. A Nafion, Mb and G-COOH modified carbon ionic liquid electrode (CILE) was constructed and applied to electrochemical biosensing. G-COOH with high conductivity and good biocompatibility could act as an electron transfer bridge for enhancing the electron transfer reactivity of Mb. In phosphate buffer solution (pH 6.0) Mb exhibited a pair of good-shape redox peaks on cyclic voltammogram with the formal peak potential (E^0) as -0.255 V (vs. SCE). Electrochemical studies of Mb were checked with electrochemical parameters calculated. Mb molecules on the electrode displayed excellent electrocatalytic reduction to trichloroacetic acid (TCA). The current showed a linear response to TCA concentrations from 5.0 to 57.0 mmol L⁻¹ with a low detection limit (1.0 mmol L⁻¹). The Michaelis–Menten constant (K_M^{app}) of the fabricated Mb bioelectrode for TCA was determined as 1.30 mmol L⁻¹. Therefore the usage of G-COOH established an effective platform for direct electrochemistry of redox enzymes in the field of third-generation electrochemical sensor.

Keywords: Carbon ionic liquid electrode; Carboxyl graphene; Myoglobin; Direct electrochemistry; Electrocatalysis.

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