Electrochemical Synthesis of a Binary Mn-Co Oxides Decorated Graphene Nanocomposites for Application in Nonenzymatic H₂O₂ Sensing

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doi: 10.20964/2017.07.55

Received: 12 April 2017 / Accepted: 11 May 2017 / Published: 12 June 2017

In this work, binary metallic oxides of MnO₂-Co₃O₄ nanocomposite was electrodeposited on graphene oxide (GO) modified electrode by a facile and one-step electrochemical method. The resultant MnO₂-Co₃O₄/graphene (MnO₂-Co₃O₄/GP) electrode was characterized by scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDX) to study its morphology and element composition. The as-prepared MnO₂-Co₃O₄/GP modified electrode was employed in fabricating a nonenzymatic H₂O₂ electrochemical sensor. The cyclic voltammetry (CV) and amperometric experiments demonstrated that the MnO₂-Co₃O₄/GP composites exhibited superior electrocatalytic activities toward oxidation of H₂O₂ to the monometallic oxide decorated graphene materials (MnO₂/GP and Co₃O₄/GP). The developed nonenzymatic H₂O₂ sensor showed a high sensitivity of 53.65 $\mu\text{A mM}^{-1} \text{cm}^{-2}$, a wide linear range of 5 μM -1.2 mM, and a detection limit of 0.8 μM (S/N = 3). In addition, good selectivity, high detection accuracy and acceptable stability were also obtained for the present sensor. Therefore, this work will open an avenue to construct high-performance electrode materials and expand their applications in various fields such as catalysis and biosensor.

Keywords: Electrochemical; Graphene; binary metallic oxides; Hydrogen peroxide

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