Electrodeposited ZnO@three-dimensional Graphene Composite Modified Electrode for Electrochemistry and Electrocatalysis of Myoglobin

Zuorui Wen¹, Wenshu Zhao¹, Xiaoyan Li¹, Xueliang Niu¹, Xiuli Wang², Lijun Yan¹, Xi Zhang¹, Guangjiu Li², Wei Sun^{1*}

¹ Key Laboratory of Tropical Medicinal Plant Chemistry of Ministry of Education, College of Chemistry and Chemical Engineering, Hainan Normal University, Haikou 571158, P R China

² College of Chemistry and Molecular Engineering, Qingdao University of Science and Technology, Qingdao 266042, P. R. China

*E-mail: swyy26@hotmail.com

doi: 10.20964/2017.03.09

Received: 24 November 2016 / Accepted: 4 January 2017 / Published: 12 February 2017

A three-dimensional graphene (3DGR) was electrodeposited on carbon ionic liquid electrode (CILE) and further decorated with electrodeposited zinc oxide (ZnO) to get a ZnO@3DGR hybrid composite. Then myoglobin (Mb) was immobilized on the surface of ZnO@3DGR modified electrode with Nafion to prepare the biosensor named as Nafion/Mb/ZnO@3DGR/CILE. On cyclic voltammogram a pair of well-defined redox responses resulted from the electron transfer of Mb with the working electrode was got, which could be ascribed to the specific characteristics of ZnO@3DGR including porous macrostructure, biocompatibility, high conductivity and big surface area. Electrochemical parameters including the electron transfer coefficient (α) and the apparent heterogeneous electron transfer rate constant (k_s) were got by electrochemical methods with the values as 0.31 and 0.76 s⁻¹. This biosensor showed excellent electrocatalysis to the electro reduction of trichloroacetic acid (TCA). A good linear relationship between the catalytic reduction peak current and TCA concentration was in the range from 0.5 to 30.0 mmol L⁻¹ and the detection limit was 0.167 mmol L⁻¹ (3 σ). The results indicated that a third-generation electrochemical Mb biosensor with ZnO@3DGR/CILE was prepared and exhibited good stability with reproducibility.

Keywords: Three-dimensional graphene; ZnO; Myoglobin; Carbon ionic liquid electrode; Electrochemistry; Electrocatalysis.

[FULL TEXT](#)

© 2017 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).