Electrochemical DNA Biosensor Based on Graphene Oxide-Chitosan Hybrid Nanocomposites for Detection of Escherichia Coli O157:H7

Shichao Xu1,2,3,*, Yiyi Zhang1, Kai Dong1, Junnan Wen1, Chunming Zheng1,2, Shihuai Zhao1,2

1 School of Environmental and Chemical Engineering, Tianjin Polytechnic University, 399 Binshui West Road, Tianjin 300387, China
2 State Key Laboratory of Hollow Fiber Membrane Materials and Membrane Process, Tianjin Polytechnic University, 399 Binshui West Road, Tianjin 300387, China
3 Tianjin Engineering Center for Safety Evaluation of Water Quality & Safeguards Technology, Tianjin Polytechnic University, 399 Binshui West Road, Tianjin, 300387, China
*E-mail: xushichao@tjpu.edu.cn

doi: 10.20964/2017.04.16

Received: 12 January 2017 / Accepted: 6 February 2017 / Published: 12 March 2017

In this article, we present a simple and sensitive electrochemical DNA biosensor based on graphene oxide (GO)/chitosan (CS) hybrid nanocomposites modified glassy carbon electrode (GCE) for detection of Escherichia coli O157:H7 (E.coli O157:H7). The morphology and composition of GO and hybrid nanocomposites were characterized by transmission electron microscope (TEM), X-ray powder diffraction (XRD), field emission scanning electron microscopy (FESEM), and Fourier transform infrared spectrum (FTIR). Cyclic voltammetry investigations indicated that the GO/CS/GCE showed excellent electron transfer ability and good linear relation. Under the optimal hybridization conditions, electrochemical impedance spectroscopy (EIS) responses of ssDNA/GO/CS/GCE biosensor were in linear with the target DNA in the concentration range from $1 \times 10^{-14}$ to $1 \times 10^{-8}$ M with the detection limit as $3.584 \times 10^{-15}$ M (3σ). Moreover, differential pulse voltammetry (DPV) studies revealed good specificity and excellent ability of ssDNA/GO/CS/GCE biosensor to distinguish complementary, 1-base mismatched DNA, 2-base mismatched DNA and multi-base mismatched DNA. The developed strategy in this research revealed that the GO/CS modified electrode possess excellent performance for detecting of Escherichia coli O157:H7 DNA.

Keywords: Graphene oxide, chitosan, nanocomposites, Electrochemical DNA biosensor, Escherichia coli

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/).