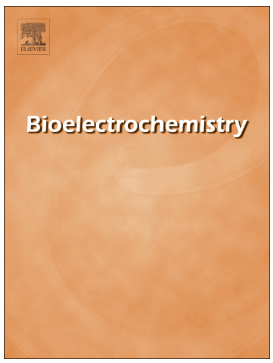

Double strand DNA-based determination of menadione using a Fe3O4 nanoparticle decorated reduced graphene oxide modified carbon paste electrode

Maryam Hosseini Ghalehno, Mohammad Mirzaei, Masoud Torkzadeh-Mahani

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Double strand DNA -based determination of menadione using a Fe_3O_4 nanoparticle decorated reduced graphene oxide modified carbon paste electrode

Maryam Hosseini Ghalehno[a,b], Mohammad Mirzaei[a], Masoud Torkzadeh-Mahani [c*]

[a]Department of Chemistry, Shahid Bahonar University of Kerman, Kerman, Iran.

[b]Young Research Society, Shahid Bahonar University of Kerman, Kerman, Iran.

[c]Department of Biotechnology, Institute of Science, High Technology and Environmental Sciences, Graduate University of Advanced Technology, Kerman, Iran.

*Corresponding author at Department of Biotechnology, Institute of Sciences, High Technology and Environmental Sciences, Graduate University of Advanced Technology, Kerman, Iran

Tel/fax: +98 3433776617 E-mail address: mtmahani@gmail.com

Abstract

In this work an electrochemical label free DNA biosensor (ds-DNA) for the determination of menadione (MD) was developed. The biosensor was constructed using a modified nanocomposite consisting of Fe_3O_4 nanoparticles decorated reduced graphene oxide (Gr) on a carbon paste electrode (CPE). Scanning electron microscope (SEM), energy dispersive X-ray (EDAX) and Fourier transform infrared (FT-IR) spectroscopy confirmed the structure of the synthesized nanocomposites (electrode composition). The Gr-Fe_3O_4 nanocomposites formed a sensitive layer with large surface area. Electrochemical studies revealed that modification of the electrode surface with ds-DNA and Gr- Fe_3O_4 nanocomposite significantly increases the oxidation peak currents and reduces the peak potentials of MD. Under the optimum conditions, calibration curve was linear in the range of 0.3 – 100.0 nM with a detection limit of 0.13 nM. The relative standard deviation for 50.0 nM was 3.90 % (n=5). The proposed biosensor was successfully applied to the determination of MD.

Keywords: DNA biosensor, Carbon paste electrode, Menadione, Nanocomposite

1. Introduction

Menadione (vitamin K_3, 2-methyl- 1,4-naphthoquinone, MD) is a synthetic pro-vitamin which has shown antihemorrhagic and anti-inflammatory activity because of the presence of the quinone function group in its structure [1]. Recently, much interest has been generated in MD due to its potential as a clinically useful antitumor agent.