A sensitive impedimetric aptasensor based on carbon nanodots modified electrode for detection of 17ß-Estradiol

ABSTRACT

A simple and sensitive aptasensor based on conductive carbon nanodots (CDs) was fabricated for the detection of 17ß-Estradiol (E2). In the present study, the hydrothermal synthesis of carbon nanodots was successfully electrodeposited on a screen-printed electrode (SPE) as a platform for immobilization of 76-mer aptamer probe. The morphology and structure of the nanomaterial were characterized by UV-visible absorption spectra, Fluorescence spectra, Transmission electron microscopy (TEM) and Fourier transform infrared spectroscopy (FTIR). Moreover, cyclic voltammetry and electrochemical impedance spectroscopy were used to investigate the electrochemical performance of the prepared electrodes. Subsequently, impedimetric (EIS) measurements were employed to investigate the relative impedances changes before and after E2 binding, which results in a linear relationship of E2 concentration in the range of $1.0 \times 10{-}7$ to $1.0 \times 10 {-}12$ M, with a detection limit of $0.5 \times 10{-}12$ M. Moreover, the developed biosensor showed high selectivity toward E2 and exhibited excellent discrimination against progesterone (PRG), estriol (E3) and bisphenol A (BPA), respectively. Moreover, the average recovery rate of spiked river water samples with E2 ranged from 98.2% to 103.8%, with relative standard deviations between 1.1% and 3.8%, revealing the potential application of the present biosensor for E2 detection in water samples.

Keyword: Carbon nanodots; Impedance analysis; Aptamer; 17ß-estradiol; Aptasensor