Ultrasensitive and Highly Selective Electrochemical Biosensor for HIV Gene Detection Based on Amino-Reduced Graphene Oxide and β -cyclodextrin Modified Glassy Carbon Electrode

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doi: 10.20964/2020.03.62

Received: 8 November 2019 / Accepted: 27 December 2019 / Published: 10 February 2020

A differential pulse voltammetry (DPV) platform for the sensing of human immunodeficiency virus (HIV) gene was described through the self-assembling of amino-reduced graphene oxide (NH₂-rGO) and β -cyclodextrin (β -CD) on the surface of glassy carbon electrode (GCE). It is making use of the single-stranded DNA (ssDNA) with sequence hybridized with HIV gene. The ssDNA was attached on NH₂-rGO/ β -CD modified GCE (NH₂-rGO/ β -CD/GCE) surface, then methylene blue (MB) was interacted with ssDNA to general obvious DPV signal. The HIV gene was then initiated to hybridize with ssDNA on NH₂-rGO/ β -CD/GCE surface, causing a dramatic decrease in DPV response of MB at potential of -0.25 V (vs. Ag/AgCl). Under optimal experimental conditions, response was linear in the 0.05 pM to 1 pM HIV gene concentration range. The electrochemical biosensor displayed an ultrahigh sensitivity with detection limit of 8.7 fM and excellent selectivity. The modified electrode displayed good reproducibility, ultra-high sensitivity, and terrific selectivity. This electrochemical biosensor was successfully used for the determination of HIV gene in human serum samples.

Keywords: HIV gene; Differential pulse voltammetry; Amino-reduced graphene oxide; Biosensor; β -Cyclodextrin

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