



Development of an electrochemical sensor for the determination of carbofuran in vegetable samples

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Carbofuran is one of carbamate pesticides that are toxic to human and environment. The determination level of carbofuran is important for good health. This research presents development of an electrochemical sensor for the determination of carbofuran. The proposed electrochemical sensor was prepared using a carbon paste electrode modified with graphene nanoplatelets and hemin. The current signal increased proportionally to the amount of carbofuran. The electrochemical sensor was characterized by cyclic voltammetry, differential pulse voltammetry, scanning electron microscopy, and electrochemical impedance spectroscopy. The optimal conditions and analytical performances were investigated by the differential pulse voltammetry. The results were shown of ratio of graphene nanoplatelets to hemin of 10:1, phosphate buffer solution at pH 7.0, scan rate at 10.0 mV/s, pulse amplitude and step potential at 12.5 and 10.0 mV versus Ag/AgCl, respectively. The electrochemical sensor was experimentally evaluated with respect to a linear response range from 2.50 - 50.0 μM carbofuran ($r^2=0.999$) with a sensitivity of $1.50 \text{ A}\cdot\mu\text{M}^{-1}\cdot\text{cm}^{-2}$, a limit of detection and quantification at 0.75 and 2.5 μM , respectively. Moreover, the proposed electrochemical sensor was successfully applied to the carbofuran determination in vegetable samples.

Keywords: Electrochemical sensor; Graphene nanoplatelets; Hemin; Carbofuran; Carbon paste electrode