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A novel Laccase Biosensor based on Laccase immobilized Graphene-Cellulose Microfiber Composite modified Screen-Printed Carbon Electrode for Sensitive Determination of Catechol

Selvakumar Palansamy, Sayee Kannan Ramaratnam, Shen-Ming Chen, Thomas C. K. Yang, Pan Yi Fan, Tse-Wei Chen, Vijayalakshmi Velusamy & Sonadevi Selvam

In the present work, we demonstrate the fabrication of laccase biosensor to detect the catechol (CC) using laccase immobilized on graphene-cellulose microfibers (GR-CMF) composite modified screen printed carbon electrode (SPCE). The direct electrochemical behavior of laccase was investigated using laccase immobilized different modified SPCEs, such as GR/SPCE, CMF/SPCE and GR-CMF/SPCE. Compared with laccase immobilized GR and CMF modified SPCEs, a well-defined redox couple of Cu(I)/Cu(II) for laccase was observed at laccase immobilized GR-CMF composite modified SPCE. Cyclic voltammetry results show that the as-prepared biosensor has 7 folds higher catalytic activity with lower oxidation potential towards CC than SPCE modified with GR-CMF composite. Under optimized conditions, amperometric i-t method was used for the quantification of CC, and the amperometric response of the biosensor was linear over the concentration of CC ranging from 0.2 to 209.7 μM. The sensitivity, response time and the detection limit of the biosensor for CC is 0.932 μA·M·cm⁻², 2 s and 0.085 μM, respectively. The biosensor has high selectivity towards CC in the presence of potentially active biomolecules and phenolic compounds. The biosensor also accessed for the detection of CC in different water samples and shows good practicality with an appropriate repea.
Determination of 4-nitrophenol in water by use of a screen-printed carbon electrode modified with chitosan-crafted ZnO nanoneedles

Balamurugan Thirumalraj, Chellakannu Rajkumar, Shen-Ming Chen*, Kuan-Yu Lin

Electroanalytical and Bioelectrochemistry Lab, Department of Chemical Engineering and Biotechnology, National Taipei University of Technology, No. 1, Section 3, Chung-Hsiao East Road, Taipei 106, Taiwan, ROC

ABSTRACT

The toxicity and environmental pollution by nitro aromatic compounds in water samples is the most recognized problem in worldwide. Hence, we have developed a simple and highly sensitive electrochemical method for the determination of 4-nitrophenol (4-NP) in water samples based on a chitosan (CHT) crafted zinc oxide nanoneedles (ZnO NDs) modified screen printed carbon electrode. The CHT/ZnO NDs were characterized by Field emission scanning electron microscope, Fourier transform infrared spectroscopy and X-ray diffraction technique. The CHT/ZnO NDs modified electrode showed an enhanced electrocatalytic activity and lower potential detection towards 4-NP, compared with other modified electrodes. Under optimum conditions, the differential pulse voltammetry (DPV) response of CHT/ZnO NDs modified electrode displayed a wide linear response range from 0.5 to 400.6 μM towards the detection of 4-NP with a detection limit (LOD) of 0.23 μM. The CHT/ZnO NDs modified electrode was used for specific and sensitive detection of 4-NP in presence of possible interfering species and common metal ions with long-term stability. In addition, the excellent analytical performance of the proposed sensor was successfully applied for determination of 4-NP in water samples.

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Development of electrochemical sensor for the determination of palladium ions (Pd^{2+}) using flexible screen printed un-modified carbon electrode

Murugan Velmurugan, Balamurugan Thirumalraj, Shen-Ming Chen, Fahad M.A. Al-Hemaid, M. Ajmal Ali, Mohamed S. Elshikh

Department of Chemical Engineering and Biotechnology, National Taipei University of Technology, Taipei 106, Taiwan, ROC

Department of Botany and Microbiology, College of Science, King Saud University, Riyadh 11451, Saudi Arabia

A B S T R A C T

To date, the development of different modified electrodes have received much attention in electrochemistry. The modified electrodes have some drawbacks such as high cost, difficult to handle and not eco friendly. Hence, we report an electrochemical sensor for the determination of palladium ions (Pd^{2+}) using an un-modified screen printed carbon electrode has been developed for the first time, which are characterized and studied via scanning electron microscope and cyclic voltammetry. Prior to determination of Pd^{2+} ions, the operational conditions of un-modified SPCE was optimized using cyclic voltammetry and showed excellent electro-analytical behavior towards the determination of Pd^{2+} ions. Electrochemical determination of Pd^{2+} ions reveal that the un-modified electrode showed lower detection limit of 1.32 μM with a linear ranging from 3 to 133.35 μM towards the Pd^{2+} ions concentration via differential pulse voltammetry. The developed sensor also applied to the successfully determination of trace level Pd^{2+} ions in spiked water samples. In addition, the advantage of this type of electrode is simple, disposable and cost effective in electrochemical sensors.

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Scheme 1. Electrochemical pathway for the determination of Pd^{2+} ions via CV.
Studies on the influence of β-cyclodextrin on graphene oxide and its synergistic activity to the electrochemical detection of nitrobenzene

Murugan Velmurugan, Natarajan Karikalan, Shen-Ming Chen, Zi-Chi Dai
Department of Chemical Engineering and Biotechnology, National Taipei University of Technology, Taipei 106, Taiwan, R.O.C.

ABSTRACT

The impact of the β-cyclodextrin (β-CD) on the graphene oxide (GO) was considerably altered the activity of electrochemical sensors. Hence, the present study, we scrutinized the electrocatalytic determination of nitrobenzene (NB) by changing the different loading level of β-CD on GO modified electrodes. The composites were prepared by the simple ultrasonication method and characterized by UV–Visible spectroscopy, infrared spectroscopy and scanning electron microscope. Interestingly, the synergistic electrocatalytic activity was appeared for the 1.2 mg β-CD loaded GO (β-CD$_{1.2mg}$/GO) to the determination of NB whereas bare SPCE, GO and other β-CD loaded GO/SPCE exhibited the lower electrocatalytic activity. The β-CD$_{1.2mg}$/GO composite modified SPCE was furnished the linear concentration range from 0.5–1000 μM and showed the lowest detection limit of 0.184 μM. Moreover, it exhibited high sensitivity, acceptable reproducibility and good stability. Besides, the proposed sensor was demonstrated its practicability in real water samples.

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Synthesis and characterization of polypyrrole decorated graphene/β-cyclodextrin composite for low level electrochemical detection of mercury (II) in water


A B S T R A C T

Mercury (Hg(II)) is considered as one of the most toxic element that directly affects the human health and the environment. Therefore, in this study, we propose a sensitive and disposable electrochemical sensor for the detection of Hg(II) in various water samples using polypyrrole (PPy) decorated graphene/β-cyclodextrin (GR-CD) composite modified screen-printed carbon electrode (SPCE). The GR-CD/PPy composite was synthesized by chemical oxidation of PPy monomer in GR-CD solution using FeCl3. Differential pulse voltammetry (DPV) is used for the detection of Hg(II) and the DPV results reveal that GR-CD/PPy composite modified SPCE has high sensitivity towards Hg(II) than bare, GR, GR-CD and PPy modified SPCES. The optimization studies such as effect of pH, accumulating time and effect of scanning potential towards the detection of Hg(II) were investigated. The GR-CD/PPy composite modified SPCE could detect the Hg(II) up to 51.56 μM L⁻¹ with the limit of detection (LOD) of 0.47 nM L⁻¹. The obtained LOD was well below the guideline level of Hg(II) set by the World's Health Organization (WHO) and U.S. Environmental Protection Agency (EPA). In addition, the fabricated GR-CD/PPy composite modified SPCE selectively detected the Hg(II) in the presence of potentially interfering metal cations.

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