

NEWS

Reference Papers (2015~2017)



Tyramine detection using PEDOT:PSS/AuNPs/1-methyl-4-mercaptopyridine modified screen-printed carbon electrode with molecularly imprinted polymer solid phase extraction

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ABSTRACT

Tyramine (4-hydroxyphenethylamine), which is a monoamine metabolized by monoamine oxidase (MAO), exists widely in plants, animals, fermented foods, and salted foods. The incidence of hypertension, or “cheese effect”, which is associated with a large dietary intake of tyramine while taking MAO inhibitors has been reported; therefore, the measurement of tyramine is an urgent concern. Herein, an efficient approach that integrates a molecular imprinting polymer for solid phase extraction (MISPE) technique with a sensitive electrochemical sensing platform (SPCE/PEDOT: PSS/AuNP/1-m-4-MP) for the quantification of tyramine is presented. Enhanced electrode conductivity was achieved sequentially by constructing a conductive polymer (PEDOT: PSS) on a screen-printed carbon electrode (SPCE), followed by electrodeposition with gold nanoparticles (AuNPs) and, finally, by modification with positively charged 1-methyl-4-mercaptopyridine (1-m-4-MP) using an Au-S bond. Tyramine was isolated selectively and pre-concentrated by the MISPE technique; electroanalysis that used differential pulse voltammetry (DPV) in NaOH (0.1 M, pH 13) was conducted successively. Experimental parameters (such as modes of electrode modification, ratio of PEDOT: PSS, pH of electrolyte, time required for AuNP deposition, and 1-m-4-MP concentrations) that were associated with optimal detection conditions were evaluated also. We obtained a linear concentration range (5–100 nM, $R^2=0.9939$) with LOD and sensitivity at 2.31 nM, and $3.11 \mu\text{A nM}^{-1} \text{cm}^{-2}$, respectively. The applicability of our technique was demonstrated by analyzing tyramine in spiked serum and milk. The feature of our newly developed analytical methods that coupled sample pre-treatment (sample clean-up and pre-concentration) with sensitive detection makes it a promising tool for quantifying of tyramine.

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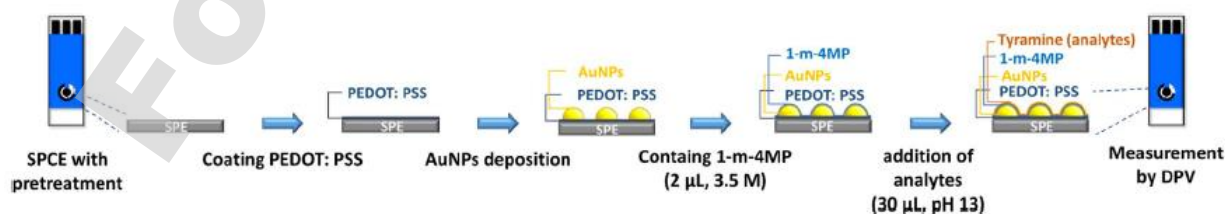


Fig. 1. Schematic diagram of the modification of screen-printed carbon electrodes (SPCE) and detection of tyramine.



Methyl parathion detection in vegetables and fruits using silver@graphene nanoribbons nanocomposite modified screen printed electrode

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We have developed a sensitive electrochemical sensor for Organophosphorus pesticide methyl parathion (MP) using silver particles supported graphene nanoribbons (Ag@GNRs). The Ag@GNRs nanocomposite was prepared through facile wet chemical strategy and characterized by TEM, EDX, XRD, Raman, UV-visible, electrochemical and impedance spectroscopies. The Ag@GNRs film modified screen printed carbon electrode (SPCE) delivers excellent electrocatalytic ability to the reduction of MP. The Ag@GNRs/SPCE detects sub-nanomolar concentrations of MP with excellent selectivity. The synergic effects between special electrocatalytic ability of Ag and excellent physicochemical properties of GNRs (large surface area, high conductivity, high area-normalized edge-plane structures and abundant catalytic sites) make the composite highly suitable for MP sensing. Most importantly, the method is successfully demonstrated in vegetables and fruits which revealed its potential real-time applicability in food analysis.

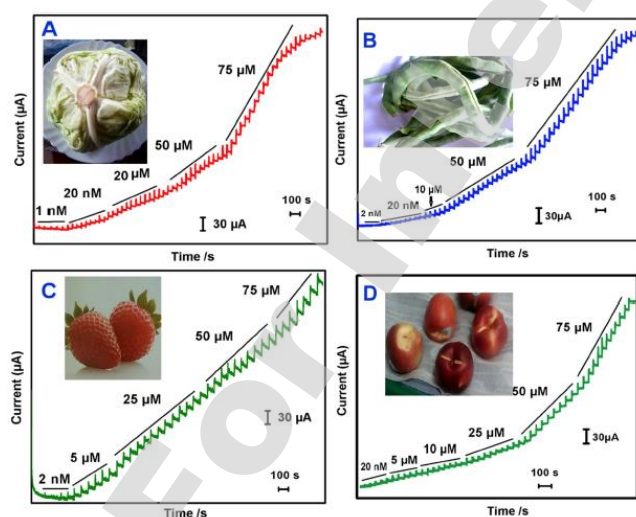
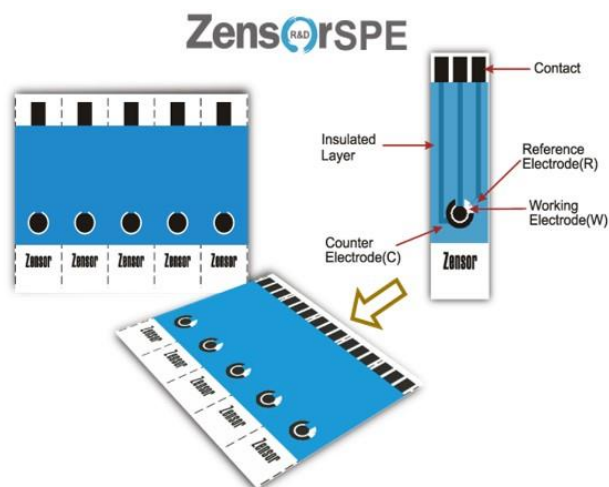


Figure 6. Real sample analysis: Amperometric responses of Ag@GNRs/SPCE for each sequential addition of real samples containing MP into continuously stirred phosphate buffer (pH 7). (A) cabbage, (B) Green beans, (C) Strawberry and (D) nectarine fruit. Amperometric experiments are performed using Ag@GNRs/SPCE towards each sequential addition of real samples into phosphate buffer (pH 7). The rotation speed = 1500 RPM and electrode potential = -0.18 V.



Cite this: *RSC Adv.*, 2016, 6, 24698**RSC Advances****Acetylcholinesterase biosensor based on the mesoporous carbon/ferroferic oxide modified electrode for detecting organophosphorus pesticides**

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In this paper a biosensor modified by ordered mesoporous carbon–chitosan (OMC–CS)/ferroferic oxide–chitosan (Fe_3O_4 –CS) was developed on the surface of screen-printed carbon electrodes (SPCEs). The acetylcholinesterase (AChE) was modified onto the film to prepare an AChE biosensor. Chitosan was used as a dispersant to disperse OMC and Fe_3O_4 . The OMC and Fe_3O_4 were used to enhance the electrochemical response. Before the detection of organophosphorus (OP) pesticides, the electrochemical behaviour of AChE/OMC–CS/ Fe_3O_4 –CS/SPCE was studied with cyclic voltammetry, and the results showed that the chitosan can disperse OMC and Fe_3O_4 evenly and fix them on the electrode surface firmly. OMC and Fe_3O_4 have a significant synergistic effect towards electron transfer. The parameters affecting performance, such as the pH of the test solution, the amount of AChE and the time of inhibition have been optimized. Under optimum conditions, using methamidophos and chlorpyrifos as model compounds, this biosensor showed a wide range, low detection limit, good reproducibility and high stability. Moreover, the AChE/OMC–CS/ Fe_3O_4 –CS/SPCE biosensor can be used for the detection of real samples, and is suitable for field testing of OP pesticide residues.

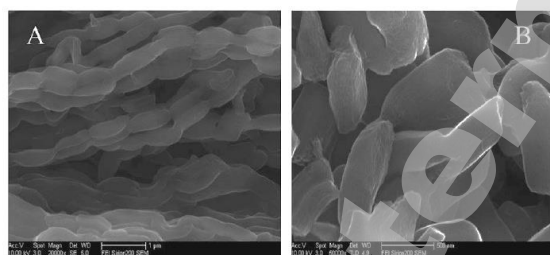


Fig. 1 SEM characterizations of OMC–CS (A) scale bar = 1 μm ; (B) scale bar = 500 nm.

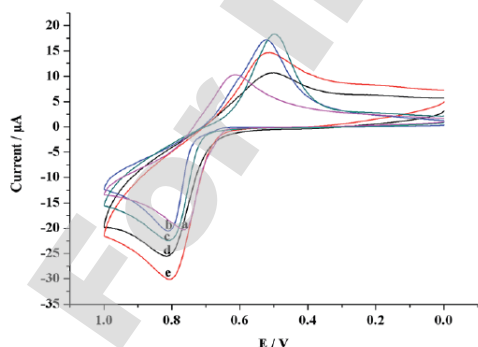


Fig. 3 CVs of modified SPCEs recorded in pH 7.5 PBS solution containing 1.0 mM ATCl: (a) bare SPCE; (b) Fe_3O_4 –CS/SPCE; (c) OMC–CS/

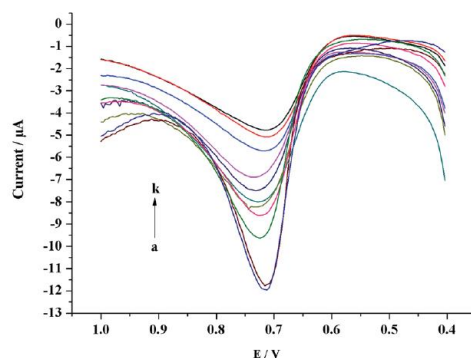
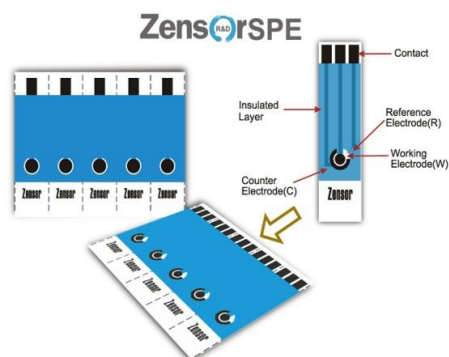


Fig. 7 DPV of AChE/OMC–CS/ Fe_3O_4 –CS/SPCE in pH 8.0 PBS solution containing 10 mM ATCl after inhibition with methamidophos for 12 min. Methamidophos concentration: (a–k) 0 $\mu\text{g L}^{-1}$; 1 $\mu\text{g L}^{-1}$; 10 $\mu\text{g L}^{-1}$; 20 $\mu\text{g L}^{-1}$; 30 $\mu\text{g L}^{-1}$; 40 $\mu\text{g L}^{-1}$; 50 $\mu\text{g L}^{-1}$; 100 $\mu\text{g L}^{-1}$; 200 $\mu\text{g L}^{-1}$; 400 $\mu\text{g L}^{-1}$; 600 $\mu\text{g L}^{-1}$.





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Sensitive and selective determination of gallic acid in green tea samples based on an electrochemical platform of poly(melamine) film



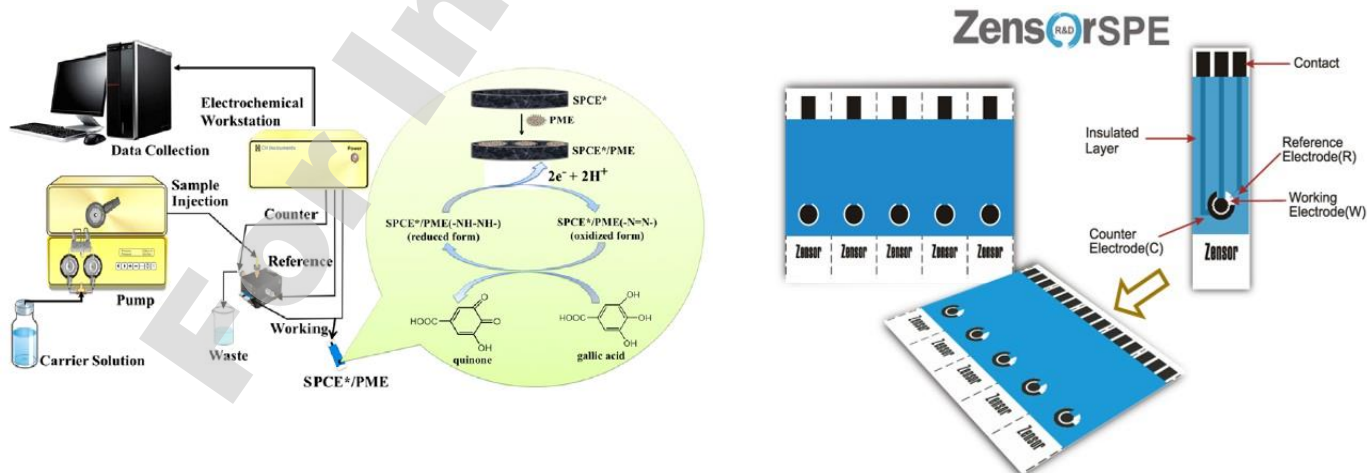
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ABSTRACT

In this work, an electrochemical sensor coupled with an effective flow-injection amperometry (FIA) system is developed, targeting the determination of gallic acid (GA) in a mild neutral condition, in contrast to the existing electrochemical methods. The sensor is based on a thin electroactive poly(-melamine) film immobilized on a pre-anodized screen-printed carbon electrode (SPCE*/PME). The characteristics of the sensing surface are well-characterized by field emission scanning electron microscopy (FE-SEM), X-ray photoelectron spectroscopy (XPS) and surface water contact angle experiments. The proposed assay exhibits a wide linear response to GA in both pH 3 and pH 7.0 phosphate buffer solutions (PBS) under the optimized flow-injection amperometry. The detection limit ($S/N = 3$) is $0.076 \mu\text{M}$ and $0.21 \mu\text{M}$ in the pH 3 and pH 7 solutions, respectively. A relative standard deviation (RSD) of 3.9% is obtained for 57 successive measurements of $50 \mu\text{M}$ GA in pH 7 solutions. Interference studies indicate that some inorganic salts, catechol, caffeine and ascorbic acid do not interfere with the GA assay. The interference effects from some orthodiphenolic compounds are also investigated. The proposed method and a conventional Folin–Ciocalteu method are applied to detect GA in green tea samples using the standard addition method, and satisfactory spiked recoveries are obtained.

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Biomolecule-free, selective detection of clenbuterol based on disposable screen-printed carbon electrode



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A B S T R A C T

We report here the development of a selective clenbuterol sensor made of disposable screen-printed carbon electrode (SPCE) without the need of adding any biorecognition element. Good analytical performance was achieved through the proper function of both the oxygen functionalities and edge plane sites on the “preanodized” SPCE (SPCE*). It is the amino group of clenbuterol to effectively form hydrogen bond with the SPCE* to induce the adsorption of clenbuterol. The edge plane sites enhance the electron transfer process and further help the dimer formation of clenbuterol to generate electroactivity for analysis. Square wave voltammetry was applied to increase the detection sensitivity with a linear response in the range of 7–1000 ppb and a detection limit of 0.51 ppb ($S/N = 3$). In the real sample analysis, results observed were satisfactory with meat, human blood, and human urine. High reproducibility in sensor fabrication further favors the disposable purpose of applications.

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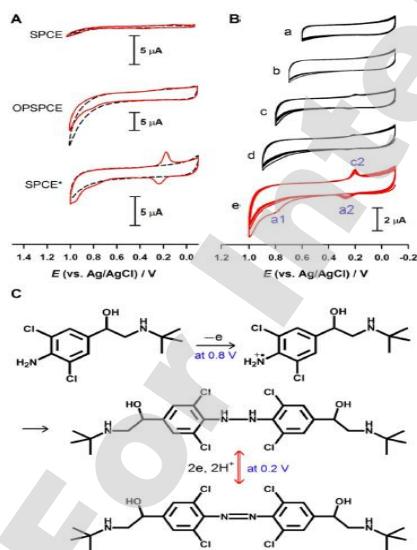


Fig. 1. (A) Cyclic voltammetric responses at SPCE, OPSPCE, and SPCE* in the presence (solid line)/absence (dashed line) of 1 ppm clenbuterol in 0.1 M, pH 7.0 PBS at a scan rate of 50 mV/s. (B) Potential segment experiments of 1 ppm clenbuterol at SPCE* in the range of -0.1 V to (a) 0.6, (b) 0.7, (c) 0.8, (d) 0.9, and (e) 1.0 V in 0.1 M, pH 7.0 PBS. (C) Schematic representation for the formation of clenbuterol dimer through an ECE mechanism.

