A reduced graphene oxide modified electrode for ciclopirox olamine amperometric determination in flowing solutions

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Abstract

A reduced graphene oxide modified electrode was prepared for amperometric determination of ciclopirox olamine in flowing solutions.

Introduction

Ciclopirox olamine (CPO), 6-ciclohexil-1-hidroxi-4metil-2(1H)-piridona is a fungicide which destroys pathogenetic fungi[1]. It is found in shampoo, ointment, lotions and nail polish. The electrochemical determination of CPO has been performed with different working electrodes including mercury drop[2], glassy carbon[3] and boron-doped diamond electrode[4]. In this work a new modified electrode based on electrochemical reduction of graphene oxide (GO) on glassy carbon subtract is proposed for CPO determination.

Results and Discussion

Cyclic voltammetry measurements were performed with a microAutolab Potentiostat by using a platinum wire and Ag/AgCl as auxiliary and reference electrode, respectively. GO synthetized by modified Hummers method was dispersed in acetate buffer solution (1mg/mL) pH 4.8. An aliquot of 4 µL of this dispersion was placed on glassy carbon electrode (GCE) by drop casting. The GO deposited on GCE was electrochemically reduced between 0.0 to -1.5V vs Ag/AgCl in acetate buffer solution, pH 4.7 by performing 30 cycles. Figure 1 shows the voltammetric response of CPO at bare GCE (A) and at reduced GO (rGO) modified electrode (B).

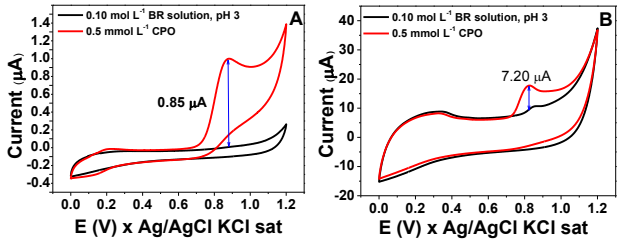

Figure 1: Cyclic voltammograms of 0.5 mmol L^{-1} CPO recorded with bare GCE (A) and reduced graphene oxide electrode (B) in 100 mmol L^{-1} Britton-Robinson buffer solution, pH 3.0. Scan rate: 20 mV s^{-1}.

A significant increase on current peak signal (~8 times) was observed for modified electrode. Based on this result, the rGO modified electrode was used as detector in a flow injection analysis (FIA) system for CPO determination at +0.85 V vs Ag/AgCl. The flow injection procedure shows linear response for CPO between 0.5 µmol L^{-1} and 100 µmol L^{-1}. Sequential injections of 50 µL of 20 µmol L^{-1} CPO shows a RSD of 3.1% (n=15). At 1.0 mL min^{-1} flow rate, an analytical throughput of 250 injections per hour can be attained. The method was applied for CPO analysis in two pharmaceutical samples by using standard addition method. Typical i-t signals obtained for CPO analysis in a pharmaceutical sample is shown in Fig. 2.

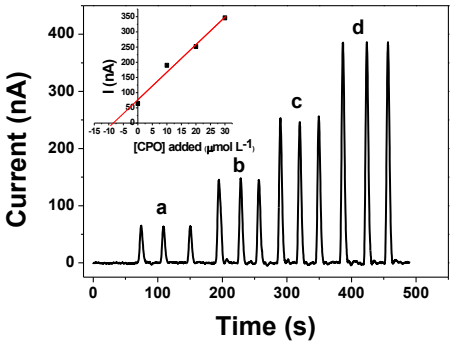

Figure 2: I-t signals obtained for CPO determination in a pharmaceutical sample using the standard addition method. The current peaks correspond to the sample (a) and to CPO standard additions: b) 10 c) 20 and d) 30 µmol L^{-1}.

The result obtained (8.56 ± 0.82 mg mL^{1}) by the proposed method showed good agreement with CPO amount indicated in the label.

Conclusions

The method proposed for the GCE modification with rGO is simple and very attractive for CPO determination.

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