Reduced graphene oxide modified electrode for simultaneous determination of naringenin and quercetin.

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Abstract

Simultaneous determination of naringenin and quercetin was made by cyclic voltammetry using a reduced graphene oxide modified electrode.

Introduction

Electrodes modified with graphene oxide (GO) or reduced graphene oxide (rGO) have been used in order to enhance the analytical signals in electrochemical and biological sensing applications[1]. Flavonoids are natural's polyphenolic compounds known by their antioxidant properties, which can be evaluated by electrochemical methods[2]. These compounds are found in plants and extracted by solvents. This work aims to investigate the simultaneous determination of two flavonoids by using a reduced graphene oxide modified electrode. A practical application of the procedure was carried out in a plant extract.

Results and Discussion

Cyclic voltammetry measurements were carried out with an Autolab Potentiostat PGSTAT 302N using a platinum wire and Ag/AgCl as auxiliary and reference electrode, respectively. A GO dispersion prepared in deionized water (2mg/mL) was diluted (0,5mg/mL) in phosphate buffer solution, pH 6.5 and 60µL of this new solution was placed on glassy carbon working electrode (GCE) by drop casting. The GO deposited on the electrode was electrochemically reduced between 0.0 to -1.5V vs Ag/AgCl in acetate buffer solution, pH 4.7 by performing 30 cycles (Fig. 1).

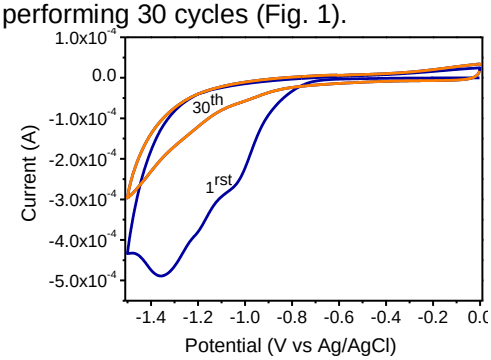

Figura1. Cyclic voltammograms depicting electrochemical reduction (1rst cycle and 30th cycle) of GO on a GCE in 0.10 mol L^{-1} acetate buffer electrolyte solution, pH 4.7 at 50 mV s^{-1}.

In the voltammogram of a mixture of flavonoids using bare GCE (Fig. 2a), the quercetin and naringenin show anodic peaks at 0.16 V and around 0.90V, respectively. Using the electrode modified with rGO, the peaks shifted to less positive potential values and the current intensity increased (Fig. 2b).
A sample containing 30mg of the butanolic extract of a plant, *Ludwigia repens,* in 1.5mL de DMSO was added to 13.5mL of acetate buffer solution and the voltammogram (Fig. 2c) was obtained using rGO modified electrode. A large peak can be observed around 0.35V indicating that neither quercetin nor naringenin is the major component of this extract. The presence of polyphenolic compounds in the extract was indicated by test with DPPH.

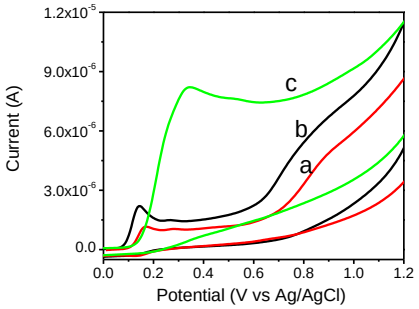

Figura 2. Cyclic voltammograms of quercetin (0.18 mmol/L) + naringenin (0.18 mmol/L) obtained in phosphate buffer solution, pH 6.5 and DMSO (1:1) with bare GCE (a) and rGO modified electrode (b) at 25 mV s^{-1}, and of the plant extract (c).

Conclusion

As quercetin and naringenin have distinct oxidation potential they can be identified in a mixture. The cyclic voltammograms with rGO modified electrode present better sensitivity and a significant increase on the analytical signal. Analysis of a plant extract showed a signal around 0.35V indicating that neither quercetin nor naringenin is the main component of the extract.

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