Redox activation of biologically active hybrid quinones: electrochemistry contributing to medicinal chemistry

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Abstract

Hybrid quinones (antitumor activity) were studied electrochemically in order to obtain data regarding its redox mechanism.

Introduction

The molecular pathways related to the bioactivity of quinones include: oxidative stress, bioreductive alkylation, Michael addition and also through metal complexation[1]. In this study, we investigated the electrochemical behavior of hybrid quinones in protic and aprotic media in order to obtain data regarding its reduction mechanism, reactivity with oxygen, the analysis of the stability of the electrogenerated intermediate and interactions with biological targets, like DNA.

Results e Discussion

The measurements were taken in an electrochemical cell with three electrodes. The working electrode was a glassy carbon electrode, the counter electrode was a Pt wire, and the reference electrode was an Ag|AgCl|Cl^- (saturated) and spectroelectrochemical measurements were carried out in a modified quartz cell (optical path 1 cm) fitted with a platinum grid as the working electrode. The compounds in the case 1 showed complex redox behavior, with evidence of additional waves related to structural changes (Figure 1).

Case 1:

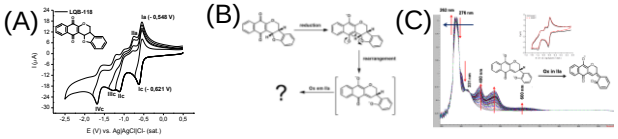

Figure 1. (A) CV of LQB-118 (c= 1 mmol L^{-1}) in DMF/$TBAPF_6$ (0.1 mol L^{-1}). GCE, v = 100 mV s^{-1}. **(B)** Possible mechanism of cleavage of the heterocyclic rings, after reduction, generating a new redox system[2].**(C)** Reduction of LQB-118: spectroelectrochemistry.

The products of the electroreduction of pterocarpanquinones have been shown to react with oxygen, indicative of ROS generation and explaining, in part, the reported cytotoxic effect (Figure 2, A). Additionally, the interaction with DNA of the most promising derivative, LQB-118, was investigated and showed to be negative (Figure 2, B and C).

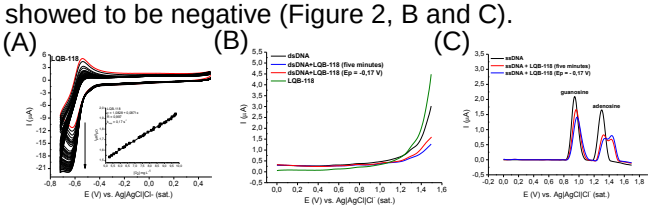

Figure 2. (A) CV, DMF/TBAP (0.1 mol L^{-1}) in the presence of different concentrations of oxygen, v = 50 mV s^{-1}. (B) and (C) Studies with dsDNA and ssDNA biosensor.

Case 2:

The CV for selenoquinone in an aprotic medium is shown in figure 3, A.

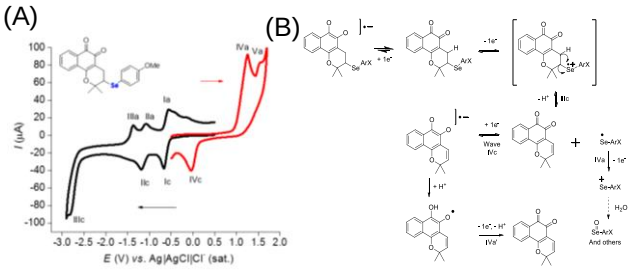

Figure 3. **(A)** CV for selenoquinone (c = 1 mmol L^{-1}) in DMF/$TBAPF_6$ (0.1 mol L^{-1}). GCE, v = 100 mV s^{-1}. **(B)** Possible redox mechanism of selenoquinone.

Conclusions

The electrochemical is an important tool in the elucidation of the redox mechanism action of promising prototypes in the development of anticancer drugs.

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