

ELECTROCHEMICAL OXIDATION OF BENTAZON

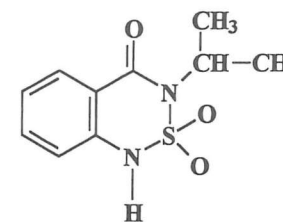
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Electroanalytical techniques have for long proved to be of great interest for the quantification of environmental hazard compounds either by themselves or in conjunction with HPLC separation using an electrochemical detector. The herbicide bentazon (3-isopropyl-1H-2,1,3-benzothiadiazin-4-(3H)-one-2,2-dioxide)



is used to control broadleaf weeds in most grains and many large-seed leguminous plants, its activity being short-lived. In Portugal it is mainly used for application in rice and corn crops.

The electrochemical oxidation of bentazon was studied using cyclic, differential pulse and square wave voltammetry. As with most of this type of compounds severe

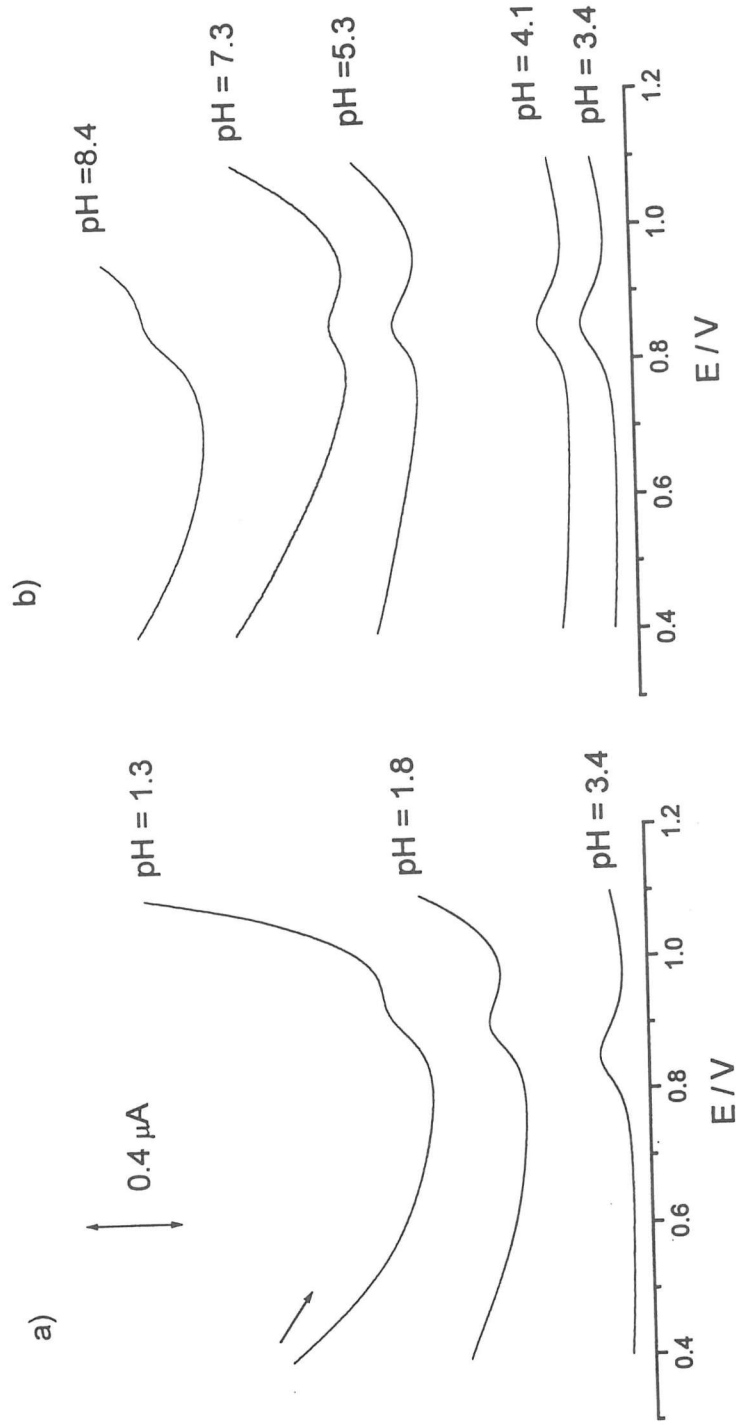


Fig. 1 Differential pulse voltammograms of bentazon, 2×10^{-5} M, in different buffer solutions. Pulse amplitude 50 mV, scan rate 5 mV s^{-1} .

problems of adsorption on the electrode surface were found. The effect of pH and of addition of a surfactant was studied.

Bentazon was from Riedel-Aldrich, all other reagents were analytical grade and the solutions were prepared using purified water from a Millipore Milli-Q system. All experiments were performed using a 663 VA Metrohm system containing a glassy carbon working electrode, a carbon rod counter electrode and a Ag/AgCl reference electrode attached to a Autolab PSTAT 10 potentiostat/galvanostat running with model GPES version 3 software, from Eco-Chemie, Netherlands. The potential range studied was from +0.2 to +1.2 V over the pH range 1.2 to 12.8.

The differential pulse voltammograms in Fig.1 show that the peak potential decreases slightly up to pH = 3.4 and then remains constant. For pH values higher than 8 the peak begins to disappear.

The oxidation of bentazon is an irreversible process, shown by cyclic voltammetry and the products of oxidation adsorb very strongly on the electrode surface causing irreproducibility. In order to be able to obtain good reproducibility an electrochemical as well as a mechanical cleaning procedure of the electrode was developed and a surfactant added to the supporting electrolyte solution. The surfactant used was Triton which could be used in high concentrations; problems of foam formation do not occur since there is no need to degas the solution for oxidation studies. The surfactant acts by preventing adsorption of the oxidation products. The effect of the addition of different percentages of Triton is depicted in Fig. 2. At low percentages of Triton, adsorption effects are manifested by curvature in the peak current vs. concentration plots and at high percentages the increased blocking of the electrode surface causes the peak current to diminish, even for low bentazon concentrations. It can be seen that the best results were obtained for the addition of 1% Triton to the solution. For the addition of 0.1% Triton a decrease in the peak

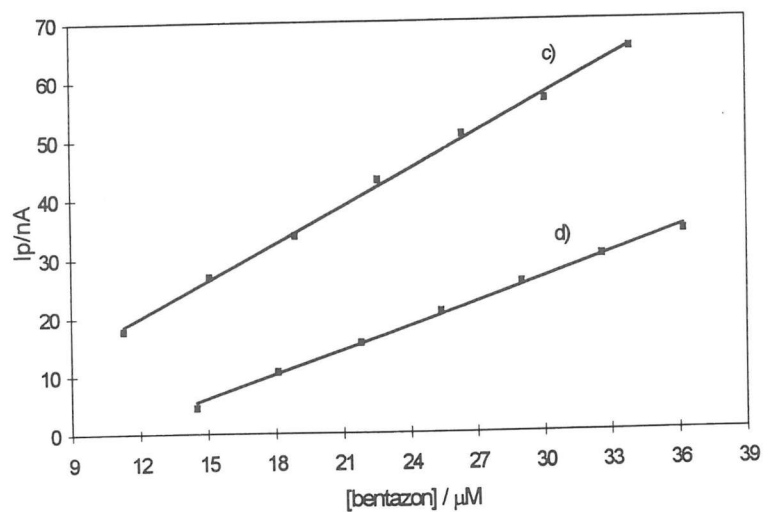
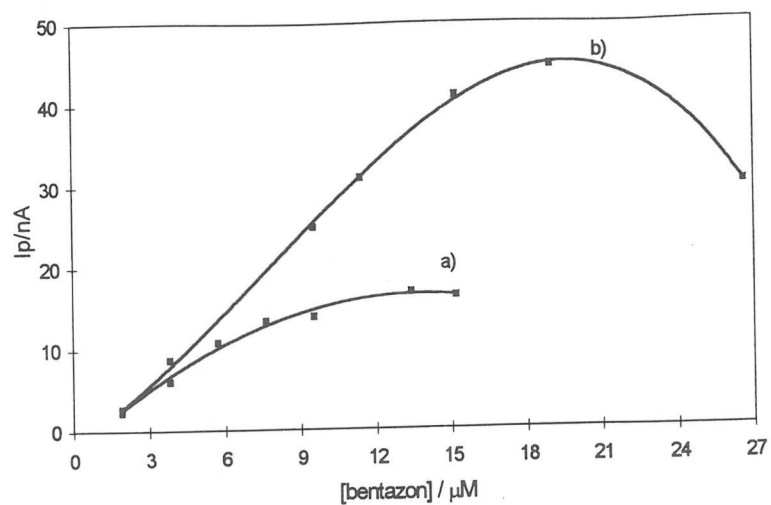


Fig. 2 Effect of concentration of Triton on the peak current of bentazon, by square wave voltammetry, frequency 50 Hz and amplitude 50 mV, supporting electrolyte pH=3.4 acetate buffer: a) 0; b) 0.1 %; c) 1 %; d) 5%.

current for higher concentrations of bentazon was still observed. With 5% Triton, despite the greater adsorption of the surfactant itself on the electrode surface and diminution of the peak current good reproducibility was obtained. In the optimized conditions of pH 3.4 acetate buffer with 1% Triton the detection limit was 1.5×10^{-5} M.

ACKNOWLEDGMENT

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