DIFFERENTIAL PULSE POLAROGRAPHIC DETERMINATION OF PIPEMIDIC ACID

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SUMMARY

A simple differential pulse polarographic (DPP) method has been developed for the determination of pipemidic acid. The Britton Robinson (BR) buffer of pH 2.07 was used as supporting electrolyte. The peak potential occurs at -0.809 V (SCE). The differential pulse polarographic peak height varies linearly with the concentration of pipemidic acid over the range 8.26×10^{-8} - 7.41×10^{-5} M. The precision of the proposed method is excellent with relative standard deviation around 0.83 % at a concentration of 6.54×10^{-6} M.

Key words : Pipemidic acid, differential pulse polarography, analysis.

INTRODUCTION

Pipemidic acid (I) [8-ethyl-5,8-dihyro-5-oxo-2-(1-piperazinyl)pyrido [2,3 d] pyrimidine-6-carboxylic acid] (1) has become an important chemotherapeutic agent with a broad-spectrum activity (2-4). The antibacterial activity of pipemidic acid proved to be higher than that of piromidic acid (II) and

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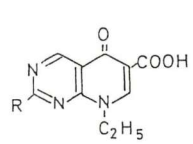
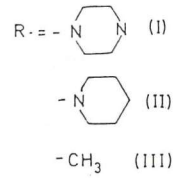
nalidixic acid (III) (5-7).





Various methods have been proposed for the investigation of pipemidic acid including densitometric (8). spectrofluorimetric (9), spectrophotometric (10). electroanalytical (11), GLC (12), HPLC (13.14) and microbiological methods (15-17).

The aim of this work was to apply the electroanalytical method developed by using differential pulse polarography to the pipemidic acid.

Since polarographic techniques are very precise and rapid, when used with pulse technique, the limit of detection is lowered to 10^{-7} M.

EXPERIMENTAL

Polarographic curves were recorded using a Princeton Applied Research (PAR) Model 174A Polarographic Analyzer with a Model 174/70 Drop Knocker and Houston Omnigraphic Model 2000 x-y recorder.

A three-electrode-cell-system was used. A saturated calomel electrode (SCE) and a platinum wire were used as reference and auxiliary electrodes. The working electrode was a dropping mercury electrode (DME) which had an out-flow velocity of

0.806 mg /s in BR buffer at pH 2.07, 0.00 V vs SCE and a mercury pressure of 90 cm. Drop-times were regulated by a drop-knoker as 1 drop/s.

Polarographic studies were carried out on solutions that had previously been deaerated with oxygen free nitrogen for 10 min. The solution was blanketted with an atmosphere of nitrogen during analysis. The drop knocker and cell-system were put in a Faraday cage. All experiments were performed in a jacketed polarographic cell at a temperature of 20 ± 1°C.

For pH measurements a Corning Research Model 12 pH meter was used.

Reagents and Solutions

A sample of pipemidic acid three hydrate was obtained from the Danippon Pharmaceutical Co.,Ltd. All chemicals were of analytical-grade purity and used without further purification. All solutions were prepared with triple-distilled water with a conductivity of < 1 μmho.

An aqueous stock solution (10^{-3} M) for polarographic investigation was prepared from pipemidic acid. This solution was stable for over a month at room temperature. Diluted solutions were repared from the stock solution by appropriate dilution.

A stock Britton -Robinson buffer solution was prepared from analytical-grade reagents and used as supporting electrolyte. The BR buffers with different pH values were prepared by adding appropriate volumes of 0.1 M sodium hydroxide .

RESULT and DISCUSSION

The changes of peak currents with pH for pipemidic acid were examined by differential pulse polarography in different acidic, basic and buffer solutions. The height of the peak decreased with increasing pH. The maximum peak was found in the Britton-Robinson buffer at pH 2.07. Therefore the buffer of this pH was selected as the best supporting electrolyte for the determination of pipemidic acid.

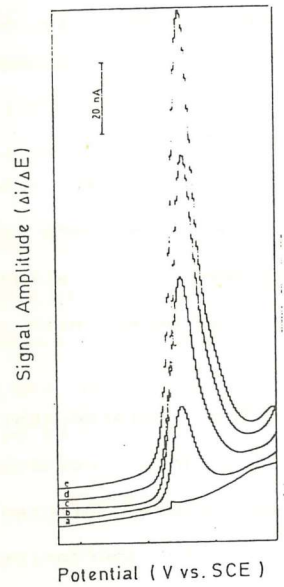


Fig.1: Differential pulse polarograms of pipemidic acid in the BR buffer (pH=2.07). a)0,b)9.90×10^{-6} M,c)2.91×10^{-5} M, d)4.76×10^{-5} M,e)6.5×10^{-5} M pipemidic acid.

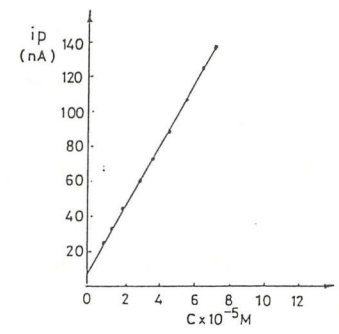


Fig.2: Calibration curve obtained polarography for pipemidic acid in BR buffer pH 2.07

In differential pulse polarography. 8.26×10^{-8} M or more concentrated solution of pipemidic acid give one well-defined reduction peak in the Britton-Robinson buffer (pH=2.07) with a peak potential at -0.809 volt versus saturated calomel electrode in the investigated potential range. Differential pulse polarograms for various concentrations of pipemidic acid are shown in Fig 1.

The optimum conditions for the analytical determination of pipemidic acid in an aqueous solution were found to be in BR buffer pH 2.07 with pulse amplitude 25 mV, scan rate 5 mV/s and droptime 1 s for the concentration range between 8.26×10^{-8} M and 7.41×10^{-5} M (Fig. 2). The equation of the standard curve for pipemidic acid is $y = 4.39 + 1.82 \times 10^{6} X$ with r=0.9982 for 12 determination.

The precision of diferential pulse polarographic determination for pipemidic acid is exellent . For measurements and a concentration level of 6.54×10^{-6} M the relative standard deviation is 0.83 % for pipemidic acid.

On the basis of the results of this investigation, the differential pulse polarographic method described is sensitive. rapid, reliable and simple for the determination of pipemidic acid.

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