

## **CYCLIC VOLTAMMETRIC STUDY OF COLCHICINE**

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### **ABSTRACT**

Cyclic Voltammetry reveals the reversible electrode processes during the cyclic oxidation-reduction of the colchicine in 0.1 M H<sub>2</sub>SO<sub>4</sub>. The behaviour of Peak potential with pH was studied to investigate the acid base reaction of the species, involved in the electrochemical reaction.

### **INTRODUCTION**

The alkaloid colchicine remains the drug of choice for treatment of acute attacks of gout. Gout is associated with painful inflammation which is believed to be a consequence of phagocytosis of urate crystals by leucocytes that invade the area. Colchicine inhibits the migration of leucocytes to the inflammatory area and reduces the increase in lactic acid production associated with phagocytosis and hence interrupts the cycle of urate crystal deposition and inflammatory response that sustain the acute attack. It impairs the release of enzyme from lysosomes and thus retards the development of inflammation. It has also been used in polyarthritis associated with sarcoidosis as an antitumour and in neoplastic disease. It is not analgesic. It is readily absorbed from the gastro intestinal tract and is partially metabolised in the liver and its metabolites are excreted in the urine and faeces. It frequently causes nausea, vomiting and abdominal pain. Large doses may cause profused diarrhea, skin rashes, renal damage and dehydration.

Previous quantitative studies of colchicine have shown the interest in polarography in which a single one electron cathodic wave is mentioned (Schaar, 1979). Anodic Study at Platinum and Gold rotating disc electrode showed one anodic wave at 1.4V in concentrated solution and additional wave at 1.2V vs SCE at lower concentration (Bishop, 1984).

### **EXPERIMENTAL**

Calibrated "A" grade glassware was used in conjunction with mettler electric balance model No.509327 Type 10. All glasswares were cleaned with analytical grade nitric acid and rinsed thoroughly with distilled water. Analytical grade reagents were employed throughout together with previously out gasses distilled water. Solids and solutions were protected from light by wrapping the container in aluminium foil. All working solutions were prepared freshly.

Cyclic Voltammetry was performed using a BAS. Electroanalytical instrument, 2701Kent Ave. West Lafayette Indiana USA with X-Y recorder. Platinum disc working electrode area 0.011 cm<sup>2</sup>, reference electrode Ag/AgCl E<sup>0</sup>=0.224V. Each scan is recorded after cleaning the electrode surface or remove adsorbate by immersion in nitric acid for 1 min. and rinse with pure water.

Before the measurement is performed on a sample, a set is run on a supporting electrolyte of the same composition and volume, to serve as a blank and as a check on electrode performance.

The specimen solution is placed in the cell being deoxygenated for 30 min. with purified nitrogen. The instrumentation operational amplifiers are checked for offset; X and Y zeros, calibrations and scale lengths are checked; start and terminate potential and scan rate are set.

## RESULT AND DISCUSSION

### Cyclic Voltammetry

The cyclic voltammetric behaviour of colchicine was studied over a range of sweep rate to elucidate the reversibility of the compound. Typical voltammogram recorded at different scan rates in 0.1M H<sub>2</sub>SO<sub>4</sub> show an anodic peak. On the reverse scan this peak shown companion reduction peak, fig.1. To evaluate the nature of reaction recorded in voltammogram, the scan rate was altered from 50mV/sec to 800 mV/sec. The difference in potential of cathodic and anodic peaks ( $\Delta E_p$ ) for lower scan rate (upto 500 mV/sec.) is 57 mV. A criterion for the reversible charge transfer (Nicholson and Shain, 1964, 1965). The shift of both peak potentials  $E_{pc}$  and  $E_{pa}$  with the change in scan rate indicates a departure from the reversible behaviour i.e. the degree of irreversibility increases with the increase in scan rate (Nicholson, 1964).

The values of the peak current also change with the change in scan rate. The ratio of anodic to cathodic peak currents ( $I_a/I_c$ ) increases with  $\log V$ , fig.2, but never approach to unity. The fact that the ratio  $I_a/I_c$  gives lower value at lower scan rate and increases with the increase in scan rate

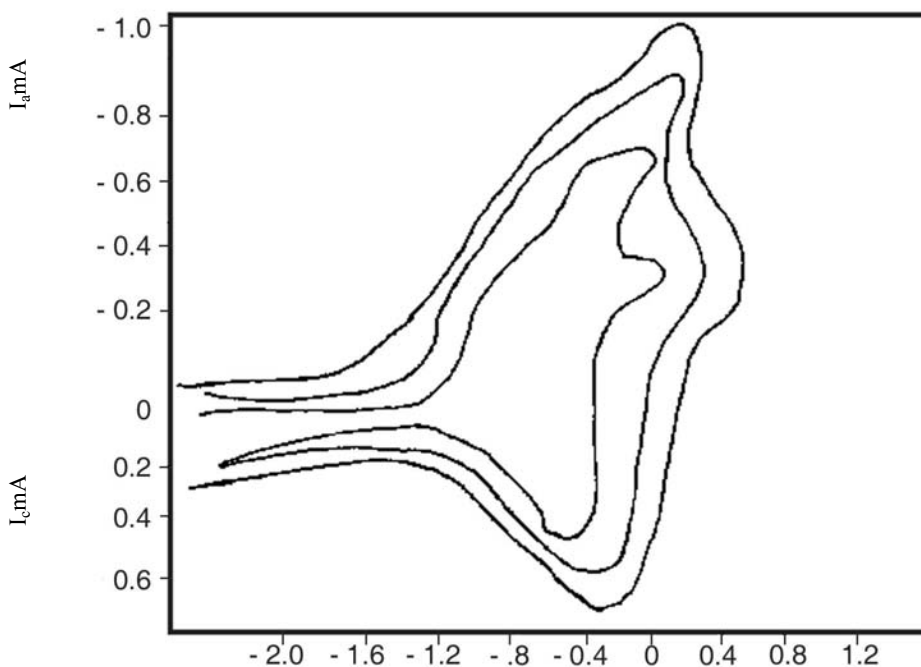


Fig. 1: Cyclic voltammetry of  $5 \times 10^{-3}$  mol l<sup>-1</sup> colchicine in 0.1 mol l<sup>-1</sup> sulphuric acid at platinum electrode. Nominal scan rate for curve 1-3 are 50,100,350 on Vs<sup>-1</sup> respectively.

might indicate that a chemical reaction is interfering with charge transfer (Wopschall, 1967). If it is assumed that the chemical reactions are slow compared to charge transfer reactions, the observed effects on the ratio of peak current at higher scan rate are understandable. This type of reaction has been proposed for amines (Mizoguchi and Adam, 1962, Nicholson and Shain, 1964).

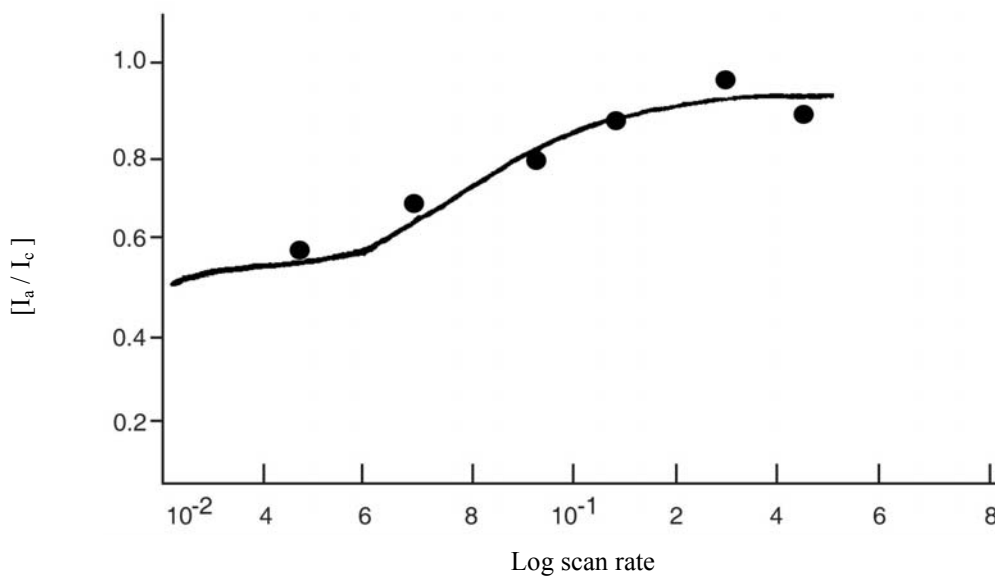


Fig. 2: Change in ratio of anodic to cathodic, peak currents  $I_a/I_c$  with the change in scan rate for the solution of colchicinic in  $0.1\text{M H}_2\text{SO}_4$  mol  $\text{l}^{-1}$ .

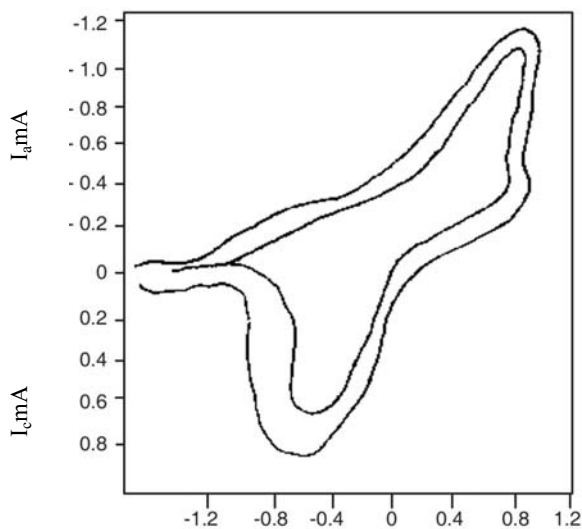


Fig. 3: Cyclic voltammogram of  $5 \times 10^{-3}$  mol  $\text{l}^{-1}$  colchicinic in citrate phosphate buffer adjusted to exact pH unit curve in pH 3.5 scan rate  $300\text{ V s}^{-1}$  curve 2 pH 9.5 scan rate  $400\text{ mV s}^{-1}$ .

**Cyclic Voltammetry in Buffer Media**

The citrate-phosphate buffers (Dien, 1975) exerted no specific influence on the electrodes and the electrode processes. The peak potential, are little affected by change of pH. The behaviour of colchicine is exemplified in fig. 3 and table 1. The poorly pronounced post peak following the anodic charge transfer appears in pH 4 and 8.4. In the reverse scan there is no extra peak indicated. The cyclic voltammogram shows no change in successive scan that shows there is no adsorption on the surface of electrode.

Table 1  
Cyclic Voltammetry of Colchicine Concentration  $5 \times 10^{-3} \text{ mol l}^{-1}$  in  $0.1 \text{ mol l}^{-1}$   
Sulphuric Acid Platinum Electrode Temperature  $25^{\circ}\text{C}$ ; Potential vs S.C.E.

Scan rate (v)/mVS <sup>-1</sup>	Anodic I <sub>pa</sub> /mA	E <sub>pa</sub> /mV	Cathodic I <sub>pc</sub> /mA	E <sub>pc</sub> /mV
50	0.157	- 0.50	0.65	0.750
100	0.254	- 0.65	0.88	0.725
200	0.550	- 1.15	1.15	0.700
250	0.725	- 1.70	1.75	0.685
300	0.958	- 1.95	2.00	0.550
400	1.255	- 2.60	2.67	0.445
500	1.956	- 2.95	2.90	0.375

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