INCLUSION COMPLEX OF HISTIDINE- CYCLIC VOLTAMETRY

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Abstract

The reaction mixture of [β-cyclodextrin], [sodium acetate] and buffer. With the addition of histidine in the presence of Cu (II) ions the peak potential decreased. The decrease in the current potential is due to the formation of inclusion complex. Cyclic voltametry was used to confirm the formation of inclusion complex

Keywords— copper (II), Histidine peroxomonosulphate (PMS), β-cyclodextrin (β-CD) catalyst, inclusion complex, Cyclic voltametry

1. Introduction

Cyclodextrin modified electrodes and their applications as electrochemical sensors in pharmaceutical analysis based on the self-assembly of CD derivatives on metal electrodes and nanoparticles, (i). The interactions between rutin or the inclusion complex of rutin--cyclodextrin and DNA were investigated by cyclic voltammetry [2]. Voltammetric responsive sensors based on organized self-assembled -cyclodextrin derivative monolayers on a gold electrode (-CD-SME) for electroinactive ursodeoxycholic and dehydrocholic acids have been studied [3]. The special characteristic of cyclodextrins is the ability to form an inclusion complex with various organic molecules through host-guest interaction with the interior cavity that provides hydrophobic environment to trap a polar pollutant (4). Kinetic data for the permanganate—β-cyclodextrin redox system are reported for the first time. Conventional spectroscopic method was used to monitor the progress of the reaction (5). Cyclodextrins were amongst the first chiral selectors employed in CE and their successful application has followed their use as chiral stationary phases in GC, TLC, and HPLC, and as mobile phase additives in TLC and HPLC (6). Kinetics and mechanistic study of β-cyclodextrin catalyzed oxidation of glutamine by peroxomonosulphate was investigated(7). EPR studies about interaction of CDs with flexible bi radicals were also reported [8-9].

The electrochemical studies were carried out using (CHI 760C – CH Instrument Inc., USA), three electrodes single compartment cell setup were employed for the electrochemical experiments. Here, glassy carbon, platinum wire, and Ag/AgCl electrode were used as working electrode,

counter electrode and reference electrode, respectively.(8) All potentials were reported with respect to Ag/AgCl electrode. Cyclic voltammetric was used to confirm the formation of inclusion complex. The reaction mixture of β-cyclodextrin in acetic acid - sodium acetate buffered medium by adding amino acid in presence and absence of Cu (II) ions.(9).

2. Experimental method

Cyclic Voltammetric Studies

The electrochemical studies were carried out using (CHI 760C – CH Instrument Inc., USA), three electrodes single compartment cell setup were employed for the electrochemical experiments. Here, glassy carbon, platinum wire, and Ag/AgCl electrode were used as working electrode, counter electrode and reference electrode, respectively. All potentials were reported with respect to Ag/AgCl electrode.

The concentrations of β-cyclodextrin were maintained as 500 mg and concentrations of histidine were maintained as 50 mg. The electrode potential of 4.30V was obtained for the reaction mixture of [β-cyclodextrin], [sodium acetate] and buffer. With the addition of histidine to the reaction mixture, the peak potential decreased (figure 2). The decrease in the current potential is due to the formation of inclusion complex. The above reaction mixture is followed by the successive addition of [histidine] (0,5ml,1.0ml,1.5ml,2.0ml) and the current intensity linearly decreased. Figure (3) and Figure (6).

Table 2.1Potential (Volts) values of the different reaction mixtures

Description	'E' (Potential in Volts)
	Peak I
Buffer + β-CD [β-Cyclodextrin in acetate buffer medium]	4.30V
Buffer + β-CD +histidine [β-Cyclodextrin in acetate buffer medium with histidine]	2.216V
Buffer + β-CD+ histidine + PMS[β-Cyclodextrin in acetate buffer medium with histidine by PMS]	2.557V

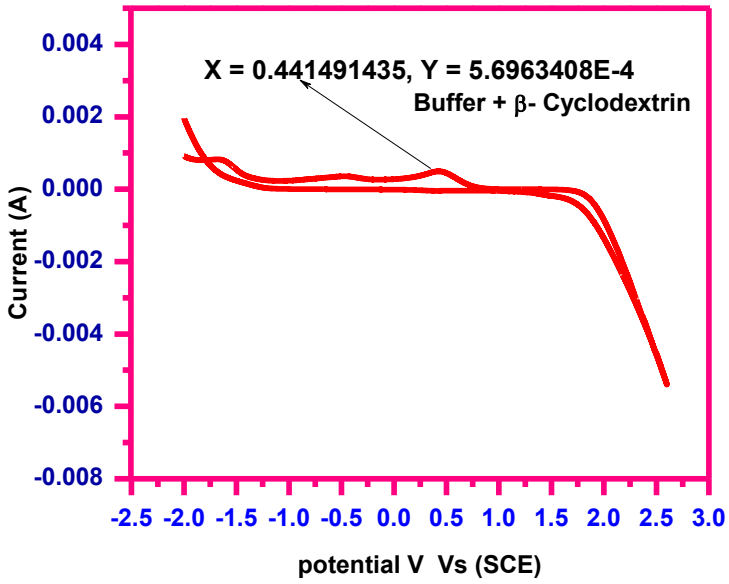


Figure 2.1 Cyclic voltammogram of the reaction mixtures of Buffer + β-CD
$[H^+]$ = 5 x 10^{-1} M; [sodium acetate] = 8.5 x 10^{-2} M ; [β-cyclodextrin] = 50mg

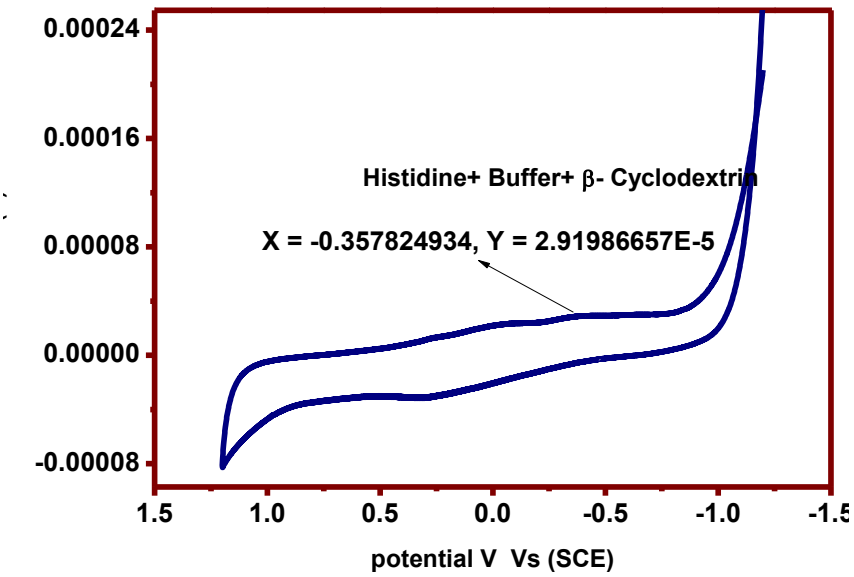


Figure 2.2 Cyclic voltammogram of the reaction mixtures of Buffer + histidine + β-CD $[H^+]$ = 5 x 10^{-1} M; [sodium acetate] = 8.5 x 10^{-2} M ; [β-cyclodextrin] = 50mg:[histidine] =500mg

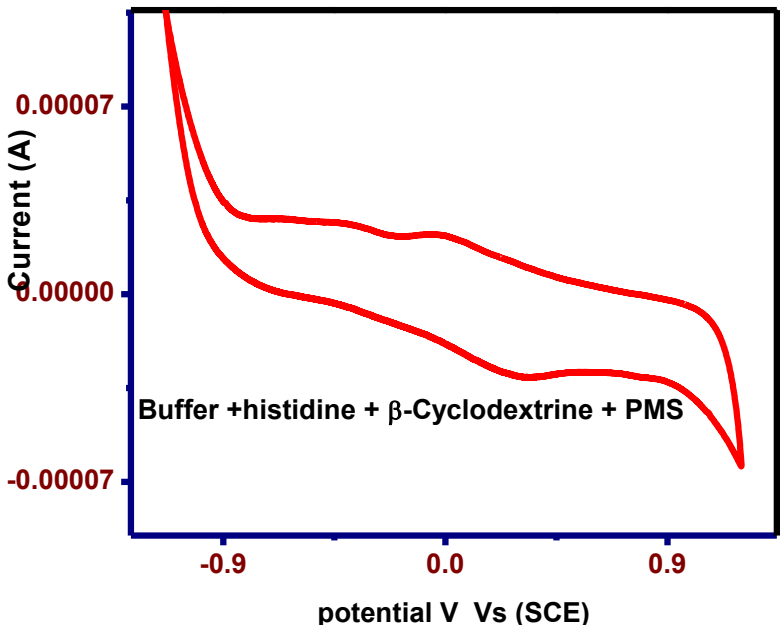


Figure 2.3 Cyclic voltammogram of the reaction mixtures of Buffer + histidine + β-CD $[H^+]$ = 5 x 10^{-1} M; [sodium acetate] = 8.5 x 10^{-2} M ; [β-cyclodextrin] = 50mg: [histidine] =500mg ; [PMS] = 3.90 x 10^{-3} M

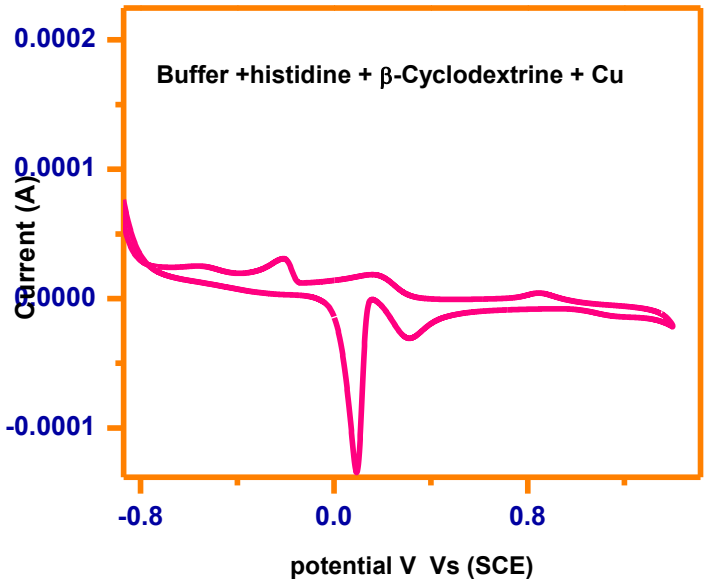


Figure 2.4 Cyclic voltammogram of the reaction mixtures of Buffer + histidine + β-CD + Cu $[H^+]$ = 5 x 10^{-1} M; [sodium acetate] = 8.5 x 10^{-2} M ; [β-cyclodextrin] = 50mg: [histidine] =500mg ; [copper(II)] = 2.5 x 10^{-3} M;

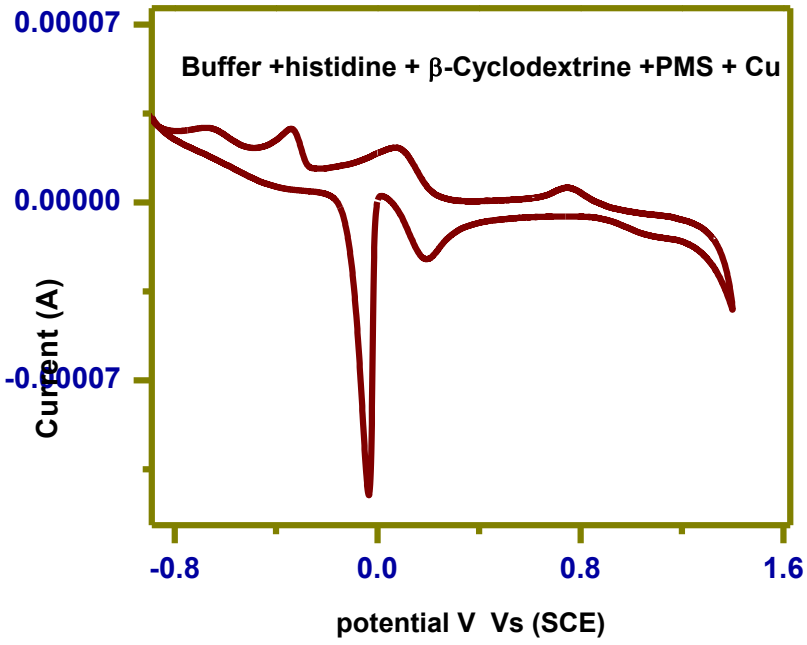
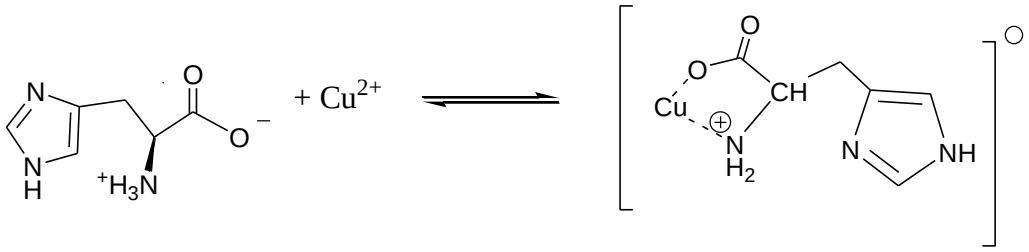
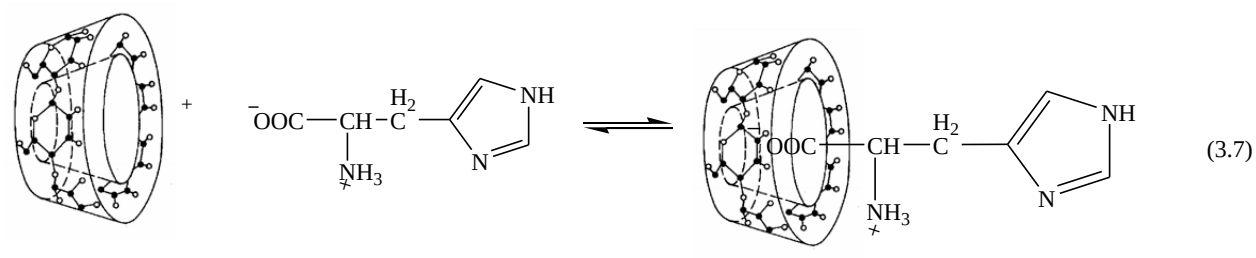


Figure 2.5 Cyclic voltammogram of the reaction mixtures of Buffer + histidine + β-CD + Cu+ PMS
$[H^+]$ = 5 x 10^{-1} M; [sodium acetate] = 8.5 x 10^{-2} M ; [β-cyclodextrin] = 50mg: [histidine] =500mg ; [copper(II)] = 2.5 x 10^{-3} M; [PMS] = 3.86 x 10^{-3} M

ZWITTERIONS OF HISTIDINE IN THE PRESENCE OF CU (II) CATALYST

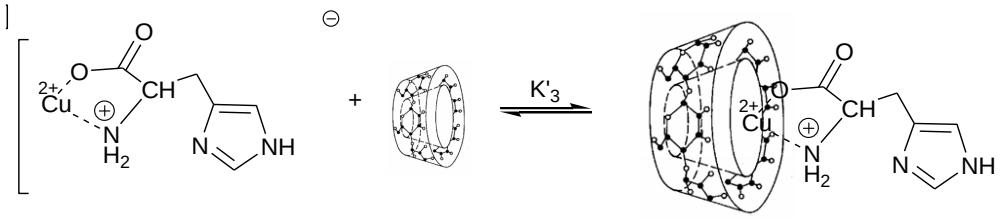
Histidine exists as a dipolar ion in aqueous solutions. The dissociation of histidine depends on the pH of the medium. The pKa value was suggested that in acidic medium, it exists both in the protonated form and as zwitterions as shown below



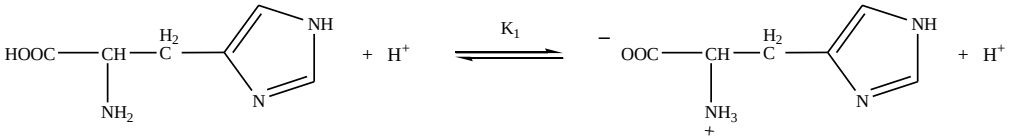


(3.7)

INCLUSION COMPLEX OF HISTIDINE IN THE PRESENCE OF CU (II) CATALYST.



Equation for Zwitterions of histidine



Conclusion

Cyclic voltometry was studied by the reaction mixture of histidine, acetic acid and sodium acetate the current peak potential was 2.216V. .. The following reaction mixture with the

addition of β- CD, the peak current potential is 2.557V .. so the peak current potential is decreased by the addition β- CD . Cyclic voltammetric was used to confirm the formation of inclusion complex.. The decrease in the current potential is due to the formation of inclusion complex.

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