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Cyclic Voltammetric Study of Isoniazid

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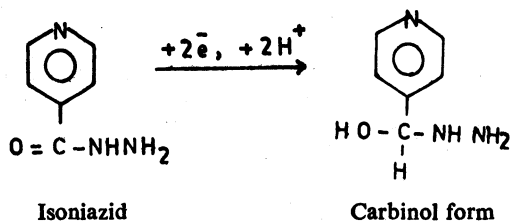
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The electrochemical reduction behaviour of Isoniazid has been studied employing cyclic voltammetric technique in ethanol-water medium in a suitable pH range. The effect of solvent on the reduction of keto group is discussed. The kinetic parameters such as transfer coefficient and diffusion coefficient values have been evaluated. A possible reduction mechanism is proposed.

Isoniazid, a pyridine derivative, is used as antituberculosis drug. Oxidation of isoniazid was studied by Ameta et al¹. An attempt is made to study the electrochemical reduction behaviour of isoniazid under hanging mercury drop electrode in 20% (v/v) ethanol-water medium covering a pH range from 1.8 to 10.0.

Isoniazid (BDH) was purified by recrystallisation from ethanol. AR grade chemicals were used for the preparation of the supporting electrolytes. All experiments were carried out at 301 K. Cyclic voltammograms were obtained by Polarographic Analyzer model 264A and SMDE 303 (PARC) coupled with an X-Y Recorder model RE 0150. The HMDE of area 0.0096 cm² was used as working electrode and Ag/AgCl(s).Cl⁻ as reference electrode. Elico Digital pH meter was used for pH measurements.

One cathodic peak was obtained for the reduction of isoniazid under HMDE in all the supporting electrolytes of pH 1.8 to 9.1. This peak is attributed to the reduction of carbonyl group present in the title compound. The reduction process was noticed to be absorption free as evidenced by the i_p vs. $v^{1/2}$ plots being linear and passing through the origin. It was also observed that the reduction process is irreversible as seen from the absence of anodic peak in the reverse scan. The E_p values are found to shift to more negative values with increase of the pH indicating participation of protons in the rate determining step. This was also confirmed from the linear plots of E_p vs. pH. By employing millicoulometric technique², the number of electrons involved in the reduction process was found to be two. With increase of solvent composition, the peak potential is found to shift to more negative side. This is due to the adsorption of solvent molecules on the surface of the electrodes³. Basing on the above results, the possible reduction mechanism at HMDE may be proposed as follows:



Typical kinetic parameters such as transfer coefficient (α_{na}) and diffusion coefficient (D) values have been evaluated and reported (Table 1) using the equations^{4,5}

$$E_p - E_{p/2} = \frac{0.048}{\alpha_{na}} V \text{ and } i_p = 3.01 \times 10^5 n A C v^{1/2} (\alpha_{na})^{1/2} D^{1/2}$$

where E_p and $E_{p/2}$ are peak and half peak potentials respectively, i_p is the peak current and A is the area of HMDE. Diffusion coefficient values are found to be constant in all the media studied as expected.

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TABLE 1

TYPICAL CYCLIC VOLTAMMETRIC DATA OF ISONIAZID

Conc. (C) : 0.2 mM

Solvent : 20% Ethanol

Scan rate (v) : 50 mVs⁻¹

Sl. No.	Supporting Electrolyte	$-E_p/V$	$i_p/\mu A$	α_{na}	$\frac{D \times 10^{-5}}{\text{cm}^2 \text{ s}^{-2}}$
1.	Clarks & Lubbs duffer of pH 1.8	0.88	2.6	1.60	7.23
2.	Acetate buffer of pH 4.0	0.95	2.5	1.20	8.92
3.	Acetate buffer of pH 6.0	1.17	1.8	0.96	5.78
4.	Diammonium hydrogen phosphate solution of pH 7.0	1.22	1.7	0.96	5.15
5.	Ammonia buffer of pH 8.2	1.22	1.95	1.20	5.43
6.	Borax buffer of pH 9.1	1.35	1.9	0.68	9.09
7.	Carbonate buffer of pH 10.0	ill-defined peaks			

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