Polarographic Study of Meta-Hydroxyacetanilide and its Determination

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Abstract
Present paper deals with polarographic study of effect of maxima suppressors and supporting electrolytes on anodic waves of meta-hydroxyacetanilide and polarographic determination of meta-hydroxyacetanilide under optimum concentration of maxima suppressors and supporting electrolytes.

Methodology
All chemicals were of A.R. grade. Polarograms of all system were recorded on D.C. Recording Polarograph using Omniscrile recorder between 200 to 1300 mV using Rotating Platinum micro Electrode (RPE) as anode and Saturated Calomel Electrode (S.C.E.) as cathode. Detail procedure is given under each heading.

Effect of maxima suppressors and supporting electrolytes on polarographic waves of meta-hydroxyacetanilide

The maxima suppressor capacity of fuchsin on the anodic wave of meta-hydroxyacetanilide in presence of 0.1 M HNO3 was studied by preparing three systems containing 0.6 ml of 5 x 10-3 M meta-hydroxyacetanilide, 1 ml 5 M HNO3 solution and different amount of fuchsin, viz., 0, 2.5 x 10-9, 1.25 x 10-5 g and diluted to 50 ml with distilled water. Polarograms of each system were recorded between 500 to 1300 mV by using Rotating Platinum micro Electrode (RPE) as anode and Saturated Calomel Electrode (S.C.E.) as cathode. Similar experiments were carried out using various concentrations of nitric acid.

Polarographic determination of meta - hydroxyacetanilide (calibration method)

Polarograms of system containing varying concentrations of meta-
Observations

Effect of maxima suppressors and supporting electrolytes on polarographic waves of meta-hydroxyacetanilide

Effect of fuchsin concentration on the oxidation wave of meta-hydroxyacetanilide in 0.1 M HNO₃ is given in Figure 1. Fuchsin suppresses the wave but does not improve the shape of wave thereby anodic wave is not well defined. Decomposition potential is found to be +950 mV. Similarly HNO₃ concentration exerts pronounced effect on current-potential wave of meta-hydroxyacetanilide (Figure 2). As concentration of HNO₃ varies from 0.1 M to 3 M initial current shifts to higher values for same applied potential, at the same time increase in wave height is observed.

Polarographic determination of meta-hydroxyacetanilide (calibration method)

Polarograms obtained for different amount of meta-hydroxyacetanilide in 0.1 M HNO₃ are shown in Figure 3.

Results and Discussion

There is not much literature review on the approaches used for meta-hydroxyacetanilide detection. The advantages of the application of polarography in the analysis of metha-hydroxyacetanilide are speed, sensitivity, which enables trace analysis to be carried out, and to follow changes in the composition of the preparation, the small sample requirements and selectivity. It is possible to carry out a polarographic analysis even in the presence of colouring matters and comparable amounts of other ingredients.

Effect of maxima suppressors and supporting electrolytes on polarographic waves of meta-hydroxyacetanilide

The polarographic method has been used to study qualitatively the effect of maxima suppressor (fuchsin) and supporting electrolyte (nitric acid) on oxidation wave of meta-hydroxyacetanilide. It shows a similar behavior to that observed for paracetamol [16-19]. Figures 1 and 2 represents effect of various concentrations of fuchsin (in 0.1 M HNO₃) and nitric acid on the anodic wave of 6.0 × 10⁻⁵ M meta-hydroxyacetanilide. It was found that fuchsin suppressed the wave (Figure 1) while increasing concentrations of nitric acid was found to increase residual as well as diffusion current values at the same time making the limiting current plateau much defined (Figure 2).

Polarographic determination of meta–hydroxyacetanilide (calibration method)

The log plots of the C-V curves of meta-hydroxyacetanilide in 0.1 and 3.0 M HNO₃ is given in Figure 4. The polarographic method has been used to identify the products of oxidation of meta-hydroxyacetanilide. In this connection the half-wave potentials (1025 mV and 1090 mV vs S.C.E.) and values of n are determined in 0.1 M and 3.0 M nitric acid (Table 1) and is found to agree with the values obtained for the oxidized product. A good agreement between experimental and theoretical value is shown by the log plots of the C-V curves of meta-hydroxyacetanilide in 0.1 and 3.0 M HNO₃ (Figure 4).

The experimental points of the log plots gave good straight lines with slopes of 0.0656 and 0.0770 V, in close agreement with the theoretical values which is 0.0591 V. Hence the value of n, the number of electrons taking part in the reversible reaction is found to be 0.9 and 0.8 (~1).

Thus meta-hydroxyacetanilide produces anodic wave at the rotating platinum electrode. The oxidation yields the 3-N-acetylaminosemiquinone and represents a reversible reaction. Polarographically a value of 900 mV is found for decomposition potential of meta-hydroxyacetanilide. Wave analysis point to a 1-electron step for each of the waves. Meta-hydroxyacetanilide is oxidized in the following manner:
While carrying out determination of meta-hydroxyacetanilide it is observed that waves of meta-hydroxyacetanilide are only proportional to concentration at low concentrations (below approximately $2 \times 10^{-4}$ M). Moreover meta-hydroxyacetanilide gives no reproducible wave and the nature of it changes as concentration of meta-hydroxyacetanilide varies from $6.0 \times 10^{-5}$ M to $1.0 \times 10^{-3}$ M as shown in Figure 3. At $6.0 \times 10^{-5}$ M meta-hydroxyacetanilide, limiting current plateau is not well defined; at $2.0 \times 10^{-4}$ M meta-hydroxyacetanilide, limiting current region become well developed; at $4.0 \times 10^{-4}$ M meta-hydroxyacetanilide round streaming maxima appears which become more pronounced with further increase in its concentration.

**Conclusion**

The polarographic method has been used to study qualitatively the effect of maxima suppressor (fuchsin) and supporting electrolyte (nitric acid) on oxidation wave of meta-hydroxyacetanilide an analogue of paracetamol. It shows a similar behavior to that observed for paracetamol. It produces anodic wave at the rotating platinum electrode. The oxidation yields the 3-N-acetylaminosemiquinone and represents a reversible reaction. Polarographically a value of 900 mV is found for decomposition potential of meta-hydroxyacetanilide. Wave analysis point to a 1-electron step for each of the waves. Waves of meta-hydroxyacetanilide are only proportional to concentration at low concentrations.

**References**

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