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Research Article

POLAROGRAPHIC STUDIES OF RIBOFLAVIN AND ESTIMATION IN PHARMACEUTICAL FORMULATIONS

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ABSTRACT

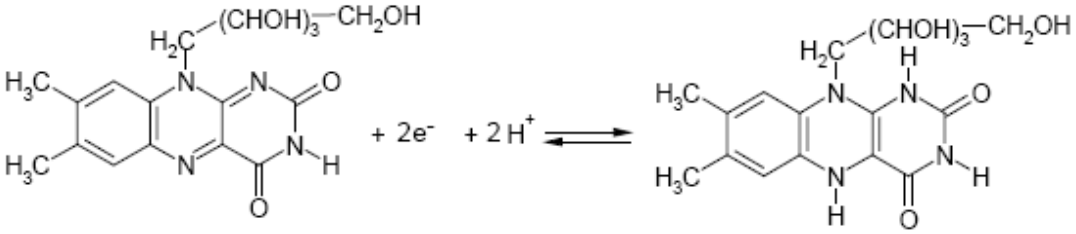
DC polarographic method was developed for estimation of riboflavin (Vitamin B_2) in pharmaceutical formulations. Parameters like concentration of supporting electrolyte, maximum suppressor, pH, mercury flow rate and drop time were optimized. Under optimum conditions, a well-defined sigmoid curve was observed with diffusion current proportional to the concentration of riboflavin. Analytical quality control was carried out with determination of relative mean deviation, standard deviation and regression studies. The method was found to be simple, rapid and reproducible. The optimized method was applied to various pharmaceutical formulations especially B-complex tablets and multivitamin tablets available in local market. The results obtained were found to be in agreement with the certified values.

Keywords: Riboflavin, Polarography, Pharmaceutical formulations.

INTRODUCTION

Riboflavin is well known as Vitamin B_2 and plays a key role in biological reduction and oxidation processes. It participates in metabolism of carbohydrates, lipids and proteins. Riboflavin derivatives act as member of cellular redox systems. The redox potential of riboflavin depends on the 9th substituent in the molecule.

Common analytical techniques being used for the determination of riboflavin include spectrophotometry[1], photochemical spectrophotometry[2], fluorometry[3], HPLC[4] and chromatography[5]. Various workers have carried out polarographic[6], cathodic voltammetric[7] as well as cyclic voltammetric[8] studies of riboflavin. The reduction wave of riboflavin is due to two-electron reduction to dihydroriboflavin as:



Riboflavin Dihydroriboflavin

This paper describes the polarographic investigations of riboflavin and its estimation in various marketed formulations.

MATERIALS AND METHODS

Apparatus

Polarographic studies have been carried out using Elico polarograph CL 25D attached with Elico XY-recorder. The electrode system consisted of dropping mercury electrode (DME) as working electrode and saturated calomel electrode (SCE) as a reference electrode. Saturated KCl salt bridge has been used for connecting the electrode systems. Height of mercury column was adjusted to get a flow rate of about 20 drops per minute. Nitrogen gas was used for deaeration and micropipette was used for addition of riboflavin solution. Mercury was purified by aeration method and then distilled under reduced pressure. The pH of the solutions were measured with the help of ELICO (Model LI-10) pH meter operating on 220 V stabilized AC mains. The electrode assembly was a glass-calomel supplied by the manufacturer. The pH meter was standardized every time before use with potassium hydrogen phthalate buffer (pH 4.0). Suitable temperature compensation adjustments were made. An electrically operated single pan balance, Mettler model H51AR, with least count of 0.01 mg was used for weighing purposes.

Reagents and Solutions

All the chemicals used were of AR grade and the solutions were prepared in double distilled water. Stock solution riboflavin was prepared by dissolving appropriate weight and desired dilutions were made as per the requirements. Stock solutions of maximum suppressor and various buffers were prepared by dissolving required amounts in double distilled water.

General procedure

In each determination, 25 mL of buffer solution was taken and 1 ml maximum suppressor was added. pH was adjusted using dilute NaOH and HCl solutions. Desired volume of riboflavin solution was added and deaerated with nitrogen gas for 15 minutes. Polarograms were recorded using optimized conditions.

RESULTS AND DISCUSSION

Studies were carried out in 0.02N acetate buffer changing the pH of solution using dil. NaOH solution. The polarograms were recorded and it was observed that the half wave potential ($E_{1/2}$) shifts towards more negative values with increase in pH. A well-defined

sigmoid wave with $E_{1/2}$= - 0.511 V was obtained at pH 7.65. The diffusion current (I_d) was found to increase with increase in pH upto 7.65 and decreased above this pH. Hence, this pH was selected for further studies.

Effect of various maxima supressors like gelatin, triton-X 100, bromocresol green, methyl thymol blue, methyl red etc was studied. It was observed that the current wave is highly reproducible when a mixture of 1 ml each of 3 x 10^{-5} % bromocresol green and 2 x 10^{-4} % methyl red is used as a maximum suppressor.

Instrumental conditions like mercury flow rate, scan rate etc were adjusted to get a sharp single wave with high reproducibility. Under optimum conditions of pH, maxima suppressor, mercury flow rate and scan rate, the diffusion current was found to be directly proportional to the concentration of riboflavin. The regression coefficient was found to be 0.9982 over a concentration range of 10 to 100 µg ml^{-1} with equation of regression line $\boldsymbol{y}_{(\mu A)} = 0.131\boldsymbol{x}_{(mg/L)} - 1.543$. The 3σ detection limit was found to be 2 µg ml^{-1}.

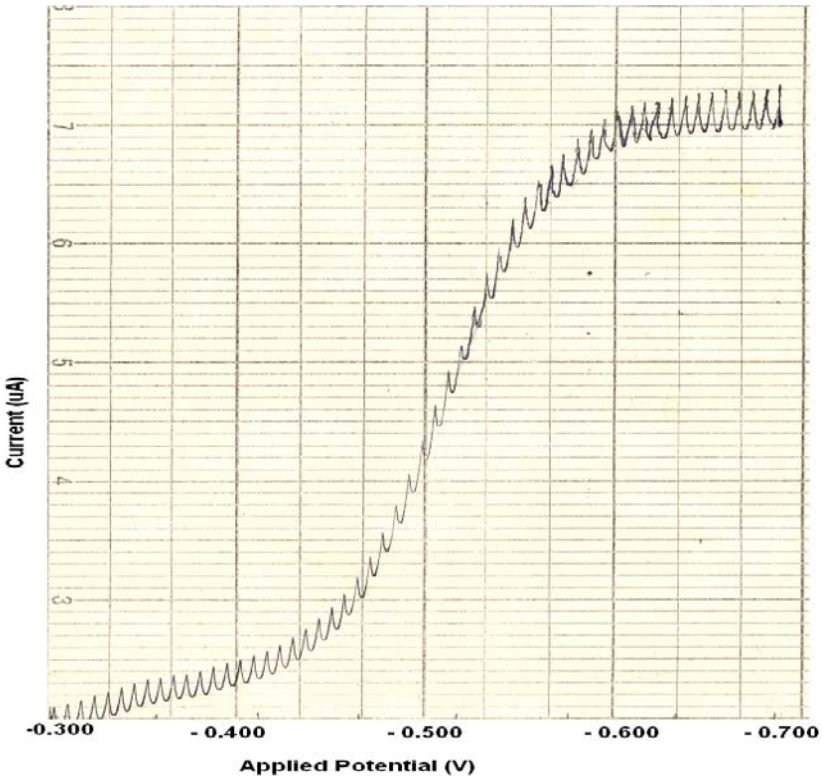


Fig. 1: Typical polarogram of 30 mg L^{-1} riboflavin in 0.02M acetate buffer of pH=7.65

APPLICATIONS

The developed method was applied to the determination of riboflavin in various pharmaceutical formulations in the local market. The quoted and observed values have been shown in table 1. The observed values agree with the reported values in most of the samples. Also, presence of other components does not interfere with estimation of riboflavin.

Table 1: Determination of Riboflavin in pharmaceutical formulations

Medicinal sample	Amount of Riboflavin (mg) Reported value	Observed value*
B-Complex		
Optineuron tablet	5.0	4.10 ± 0.38
Neurobion tablet	10.0	9.38 ± 0.30
B-complex with ascorbic acid and folic acid		
Polybion Tablet	10.0	9.38 ± 0.22
Basiton Forte Tablet	10.0	10.16 ± 0.88
Beplex Forte Tablet	10.0	7.71 ± 0.20
Becosule Capsule	10.0	10.16 ± 1.02
Betomin Capsule	10.0	10.16 ± 0.86
Becelac Capsule	3.0	2.25 ± 0.38
Cobadex Forte Capsule	10.0	9.84 ± 0.33
Vibetan Forte Capsule	10.0	9.38 ± 0.45
Becosule-Z Capsule	10.0	9.84 ± 0.55
Beplex Forte Tablet (with biotin)	10.0	7.71 ± 0.31
Becozym-C- Forte Capsule	10.0	10.16 ± 0.81
B-complex containing minerals		
B-Fact Tablet	10.0	8.55 ± 0.48
Eldervit-Z Capsule	10.0	10.16 ± 0.91
Zevit Capsule	10.0	9.38 ± 0.33
Zuvinal Capsule	10.0	8.55 ± 0.37

*(Avg±SD) of 3 values

CONCLUSION

The developed method was rapid, simple, reproducible and accurate. It could be applied to various pharmaceutical formulations. The Standard deviation, relative mean deviation and coefficient of variation are found to be 0.77, 5.2% and 4.5% respectively. An important advantage of the method is that it is possible to determine concentration of riboflavin in pharmaceutical formulations in the presence of other commonly occurring ingredients.

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REFERENCES

1. Hashmi MH, Ajmal AI, Qureshi T, Rashid A: Microchim Acta 1969; 30 (1969).
2. T. Perez-Ruiz, C.Martínez-Lozano, V. Tomas and O. Val; Analyst, 119, 1199 (1994).
3. L.F. Russell, J. T. Vanderslicea; Food Chemistry, 43, 79 (1992).
4. S.M. Fernando, P.A. Murphy; J. Agric. Food Chem., 38, 163 (1990).
5. G.Swiglo, A.Koziolowa; J. Chromatogr., A, 881, 285 (2000).
6. J.Lingane, J.Davis; *J. Biol. Chem*., 137, 567 (1994).
7. W.Hussein, D.Waqar; *Pak. J. Pharm. Sci.;* 5, 69 (1992).
8. W.Hussein, D.Waqar; *Pak. J. Pharm. Sci.;* 5, 139 (1992).