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SPECTROPHOTOMETRIC ESTIMATION OF PANTOPRAZOLE IN TABLET DOSAGE FORM

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ABSTRACT

Three simple, precise and economical UV methods have been developed for the estimation of pantoprazole in bulk and pharmaceutical formulations. Pantoprazole has the absorbance maxima at 290 nm (Method A) and in the first order derivative spectra, showed zero crossing at 290 nm, with a sharp peak at 282 nm when n=1 (Method B), Method C applied was Area Under Curve (AUC) for analysis of pantoprazole in the wavelength range of 286-296 nm. Drug followed the Beer's Lamberts range of 5-35, 10-100, 5-40 µg/mL for the Method A, B and C, respectively. Results of analysis were validated statistically and by recovery studies and were found to be satisfactory.

Key words : Pantoprazole, UV Spectophotometry, Derivative spectroscopy, Area Under Curve.

INTRODUCTION

pantoprazole is a proton pump inhibitor drug used for short-term treatment of erosion and ulceration of the esophagus caused by gastroesophageal reflux disease. Chemically, pantoprazole is 6-(difluoromethoxy)-2-[(3, 4-dimethoxypyridin-2-yl)methylsulfinyl]-1H-benzimidazole. It is listed in Merck index and Martindale-The complete drug reference[1, 2]. Literature survey reveals HPLC method for the determination of pantoprazole in human plasma[4-6]. Also method of simultaneous estimation for pantoprazole by spectrophotometry has been reported[7]. No single UV method for pantoprazole is reported till date using derivative spectroscopy and AUC method. Hence an attempt has been made to develop new UV method for its estimation in bulk and pharmaceutical formulations with good accuracy, simplicity, precision and economy.

EXPERIMENTAL

Pure sample of pantoprazole was obtained from Alkem Laboratories Limited

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(H.P.), Solan (Dist. Baddi) as a gift sample. A Shimadzu UV-1700 UV/VIS Spectrophotometer was used with 1 cm matches quartz cell. Tablets of 40 mg and 20 mg were procured from local pharmacy.

Preparation of standard solution

The pure drug accurately about 5 mg was weighed and dissolved in 100 mL methanol to give the standard stock solution of concentration 50 µg/mL. Aliquots of standard stock solution were pipetted out and suitably diluted with distilled water to get the final concentration of standard solutions.

Zero order spectroscopic method

The solutions were scanned in the range from 400-200 nm (method A) and the peaks were observed at 216 nm and 290 nm. The wavelength selected for the analysis of the drug was 290 nm (Fig. 1). The drug followed the Beers-Lambert's law in the range of 5-35 µg/mL. Using the calibration curve, the concentration of the sample solution can be determined.

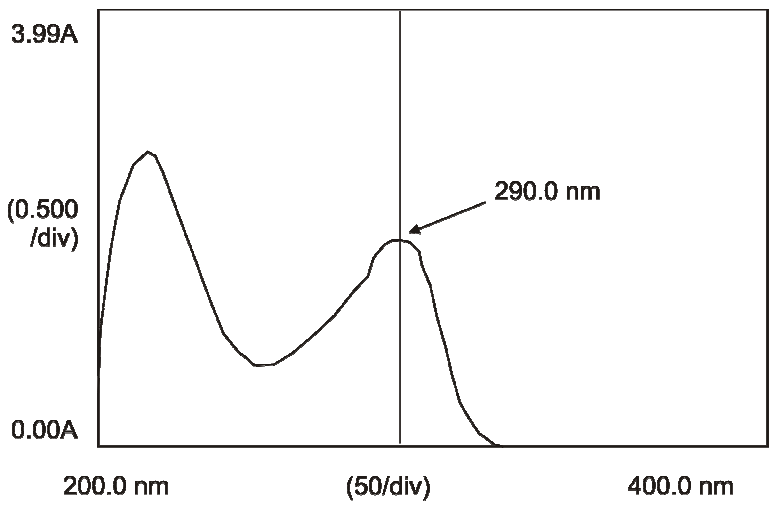

Fig. 1 : Zero order spectra of pantoprazole

First order derivative spectroscopic method

The first order derivative spectra at n = 1 (method B), showed a sharp peak at 282.0 nm (Fig. 2). The absorbance difference at n = 1 ($dA/d\lambda$) is calculated by the inbuilt software of the instrument, which was directly proportional to the concentration of the

standard solution. The standard drug solution was diluted so as to get the final concentration in the range of 5-90 µg/mL and scanned in the first order derivative spectra. The calibration curve of dA/dλ against concentration of the drug showed linearity.

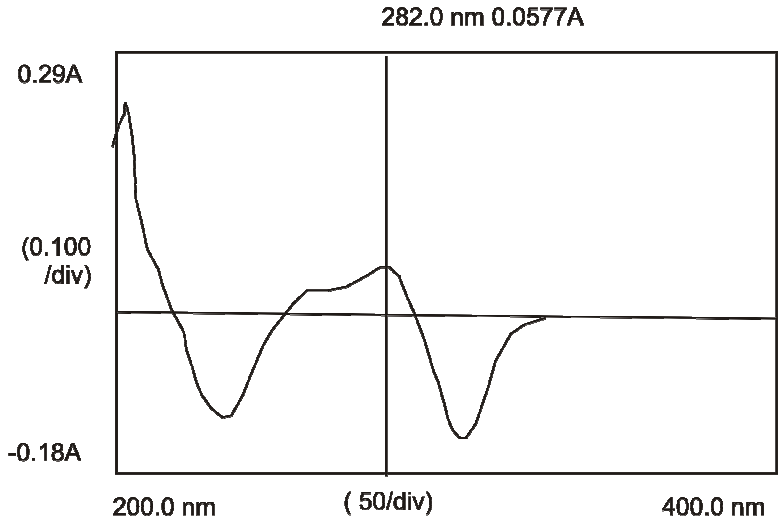

Fig. 2 : First order derivative spectrum of pantoprazole with n = 1

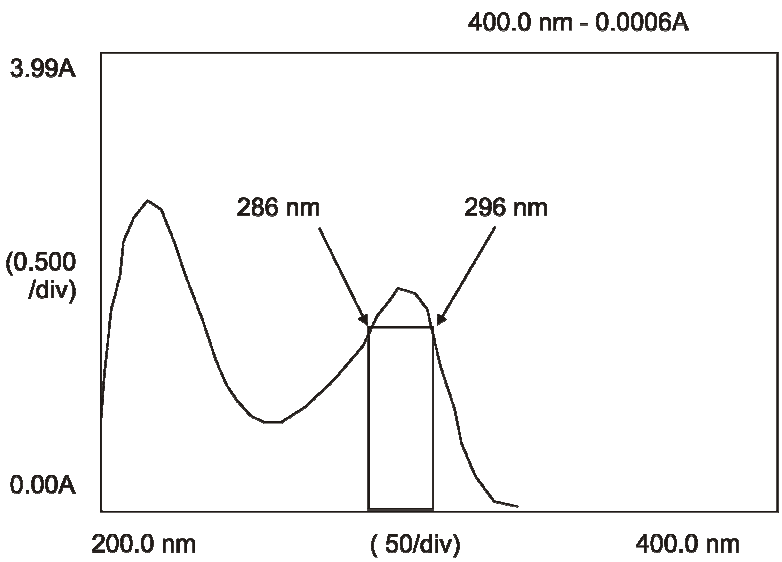

Fig. 3 : Wavelength range selected for AUC method of pantoprazole

Area under curve method (AUC)

The AUC (Area Under Curve) method involves the calculation of integrated value of absorbance with respect to the wavelength between two selected wavelength 286 nm and 296 nm. Area calculation processing item calculates the area bound by the curve and the horizontal axis. The horizontal axis is selected by entering the wavelength range over which the area has to be calculated. The wavelength range is selected on the basis of repeated observations so as to get the linearity between area under curve and concentration. Suitable dilutions of standard stock solution (50 µg/mL) of the drug were prepared and scanned in the spectrum mode from the wavelength range 400-200 nm (Fig. 2) and the calibration curve was plotted. All the three method were checked by analyzing the samples with known concentrations. As the result obtained were satisfactory, the method was applied for the pharmaceutical formulations.

Table 1 : Optical characteristics and other parameters

Parameters	Method A	Method B	Method C
λ_{max} (nm) / wavelength range (nm)	290	282	286-296
Beers-Lambert's range (µg/mL)	5-35	10-100	5-40
Coefficient of correlation	0.999934	0.. 999973	0.99996
Regression equation Y = mx + c			
Slope (m)	0.040436	0.011958	0.499375
Intercept (c)	-0.001	0.004533	-0.080652
LOD (µg/mL)	0.15	0.35	0.1
LOQ (µg/mL)	0.45	1.05	0.30

Where,
A is zero order derivative spectrum method with n = 0.
B is first order derivative method with n = 1.
C is AUC method.

Analysis of the tablet formulation

For the estimation of pantoprazole in tablet formulation by three methods, 10 tablets of brand were weighed and triturate to fine powder. Tablet powder equivalent to 5 mg of pantoprazole was weighed and it is the dissolved and further diluted with quantity

sufficient with methanol. It was kept for ultrasonication for 30 min. This was filtered through Whatman filter paper No. 41 to get the stock solution of 50 µg/mL. Various dilutions of the tablet solution were prepared and analyzed for six times and the concentration was calculated by using the calibration curve for three methods.

Validation of the method

All these methods were validated according to ICH guidelines by carrying out analysis of six replicate sample of tablet (tablet 2). Recovery studies were carried out at three different levels i. e. 50%, 100%, 150% by adding the pure drug to previously analyzed tablet powder sample. From the amount of drug found, percentage recovery was calculated (Table 2).

Table 2. Result of analysis of pantoprazole in tablet and recovery studies

Method	Tablet	Label Claim	% estimated	% recovery	S. D.	% RSD	S. E.	% COV
A	T1	40	100.00	99.42	0.76	0.76	0.44	0.76
	T2	20	100.45	98.43	0.55	0.55	0.32	0.47
B	T1	40	100.30	101.61	0.37	0.36	0.21	0.37
	T2	20	99.17	100.35	0.36	0.37	0.21	0.36
C	T1	40	100.85	98.80	0.47	0.46	0.27	0.27
	T2	20	99.76	99.31	0.05	0.02	0.01	0.01

Where, A is zero order derivative spectrum method with n = 0; B is first order derivative method with n = 1; C is AUC method; T1 is Pantru40; T2 is Pantab20

Table 3 : One way ANOVA (Tukey -Kramer multiple comparison test)

Comparison	Mean difference	q value	p Value
Method A Vs Method B	-0.1698	0.8354	ns p > 0.05
Method A Vs Method C	-0.7340	3.608	ns p > 0.05
Method B Vs Method C	-0.5642	2.774	ns p > 0.05

The ANOVA test i. e. Tukey-Kramer Multiple comparison test was applied to determine whether there is no significant difference between the results of analysis by three different analysis methods (Table 3).

RESULTS AND DISCUSSION

All the methods A, B and C for the estimation of pantoprazole in tablet dosage were found to be simple, accurate and reproducible. Beer-Lambert's law was obeyed in the concentration range of 5-35 µg/mL in all these methods. The accuracy of the method was assessed by recovery studies at three different levels i. e. 50%, 100%, 150%. The values of standard deviation were satisfactory and the recovery studies were close to 100%. The % RSD value is less than 2 indicative of accuracy of the method. The developed method was statistically compared using one way ANOVA. The p value was found to be 0.0953 and was greater than 0.05. The results of the ANOVA indicates no significant difference between three methods. Hence, these methods can be useful in routine analysis of pantoprazole in bulk drug and formulations.

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