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Reversed Phase HPLC Estimation of Lansoprazole in Pure and Pharmaceutical Formulations

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A simple, rapid and sensitive high performance liquid chromatographic method for the determination of lansoprazole in pharmaceutical formulations. The separation was achieved by using column Partisil, ODS, C18 (150 × 4.6, 5 μ) and a mobile phase consisting of methanol : KH_2PO_4 (pH 2.5), (60 : 40, v/v), a flow rate of 1.0 mL/min and UV detection at 240 nm. The detection and quantitative limits were 0.05 μg/mL and 0.15 μg/mL respectively, while the linear range of detection was between 0.1 and 100 mg/mL. The method has been applied successfully to the determination of Lansoprazole in pharmaceutical formulations.

Key Words: RP-HPLC, Determination, Lansoprazole, Dosage forms.

INTRODUCTION

Lansoprazole (LAN) is a substituted benzimidazole, chemically, 2-[[[3-methyl-4-(2,2,2-trifluroethoxy)-2-pyridyl]methyl]sulfinyl] benzimidazole. It inhibits gastric acid secretion. Lansoprazole belongs to a class of antisecretory compounds, the substituted benzimidazoles, that do not exhibit anticholinergic or histamine H_2-receptor antagonist properties, but that suppress gastric acid secretion by specific inhibition of the (H^+, K^+)-ATPase enzyme system at the secretory surface of the gastric parietal cell. This enzyme system is regarded as the acid (proton) pump within the parietal cell, lansoprazole has been characterized as a gastric acid-pump inhibitor, in that it blocks the final step of acid production. This effect is dose-related and leads to inhibition of both basal and stimulated gastric acid secretion irrespective of the stimulus.

Literature survey reveals that few HPLC[1–14] spectrophotometric methods[15–18], GCMS[19], LCMS[20], capillary electrophoresis[21, 22] and HPTLC[23, 24] were reported for its analytical monitoring in either biological fluids or formulations. The authors have made attempts in this direction and succeeded in developing a sensitive and precise HPLC method for the determination of LAN in bulk samples

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and pharmaceutical formulations by using Partisil, ODS, C18 (150 × 4.6, 5 μm) column as stationary phase, solvent combination methanol : KH_2PO_4 (60 : 40 v/v).

EXPERIMENTAL

All chemicals used were of analytical or HPLC grade. Dihydrogen potassium orthophosphate buffer (AR grade) (S.D. Fine Chem., Ltd.), methanol (HPLC grade) (Qualigens) and orthophosphoric acid (Merck) were used.

Quantitative HPLC was performed on a gradient HPLC water with Shimadzu 10AT vp series HPLC pump, SIL 10AD vp series auto sampler equipped with a 20 μL sample loop and SPD 10A vp dual absorbance detector. The output signal was monitored and integrated using Shimadzu CLASS-VP Version 6.12 SP1 software. Partisil, ODS, C18 (150 × 4.6 mm, 5 μm) column was used for the separation.

Preparation of standard drug solution

Stock solution of the drug was prepared by dissolving 100 mg of lansoprazole in 100 mL volumetric flasks containing 70 mL of methanol (AR grade, Qualigens), sonicated for about 15 min and then made up to volume with methanol. Daily working standard solutions of LAN were prepared by suitable dilution of the stock solution with appropriate mobile phase.

Chromatographic conditions: The separation was performed on a Partisil, ODS, C18 (150 × 4.6 mm, 5 μm) column; a mixture of methanol and KH_2PO_4 buffer (pH 2.5) [60 : 40, v/v] was used as a mobile phase at a flow rate of 1.0 mL/ min with a column based pressure 1540 (psi). Detection was performed at 240 nm. The mobile phase was filtered through a 0.45 μm millipole membrane filter and degassed. The separation was carried out at room temperature.

Recommended procedure: After systematic and detailed study of the various parameters involved, as described under results and discussion in this paper, the following procedure and conditions were recommended for the determination of lansoprazole in bulk samples and pharmaceutical formulations.

Method development: Composition and flow rate of the mobile phase was programmed from motor pump and the mobile phase consisting of methanol : KH_2PO_4 in the ratio of 60 : 40 was passed through the 0.45 μm membrane filter using Millipore HPLC solvent filtration assembly and delivered at 1.0 mL/min for column stabilization. During this period, the baseline was continuously monitrored. The wavelength of detection was selected at 240 nm. The prepared dilutions containing concentrations of lansoprazole in the range 0.1–100 μg/mL were injected into the chromatograph. The peak areas were recorded for all the chromatograms. Calibration curve was constructed by plotting peak areas (Y-axis) against the amount of drug in μg/mL (X-axis) and the linear relationship was evaluated by calculation of regression line by the method of least squares.

Assay procedure: In a 100 mL calibrated flask an accurately weighed amount from the mixed and powdered contents of 20 capsules of 100 mg LAN was dissolved in 70 mL of mobile phase and the contents were thoroughly shaken for 10 min. Then the volume was diluted up to the mark with the mobile phase, mixed well and filtered using quantitative filter paper. Working standard solution of LAN was further diluted with mobile phase. 20 µL of working standard solution were injected into the column. The peak areas of LAN were calculated. The amount of drug was assayed from the calibration graph, which was constructed using a standard solution of LAN.

RESULTS AND DISCUSSION

Optimization of the method: To develop a HPLC method for the determination of LAN, different mobile phases wre employed. Initially a mobile phase consisting of methanol : KH_2PO_4 in the ratio of 50 : 50 was tried. Partisil, ODS, C18 (150 × 4.6 mm, 5 micron) column 240 nm was used. Early elution with tailing of peaks was observed in the above condition. Then the composition of mobile phase was changed in the ratio of 30 : 70. Under these conditions broad peak shape and pronounced tailing was observed. For the same mobile phase, the ratio of methanol and KH_2PO_4 was changed to 60 : 40 and used as eluent. LAN was eluted at around 3.73 min with symmetric peak shape (Fig. 1).

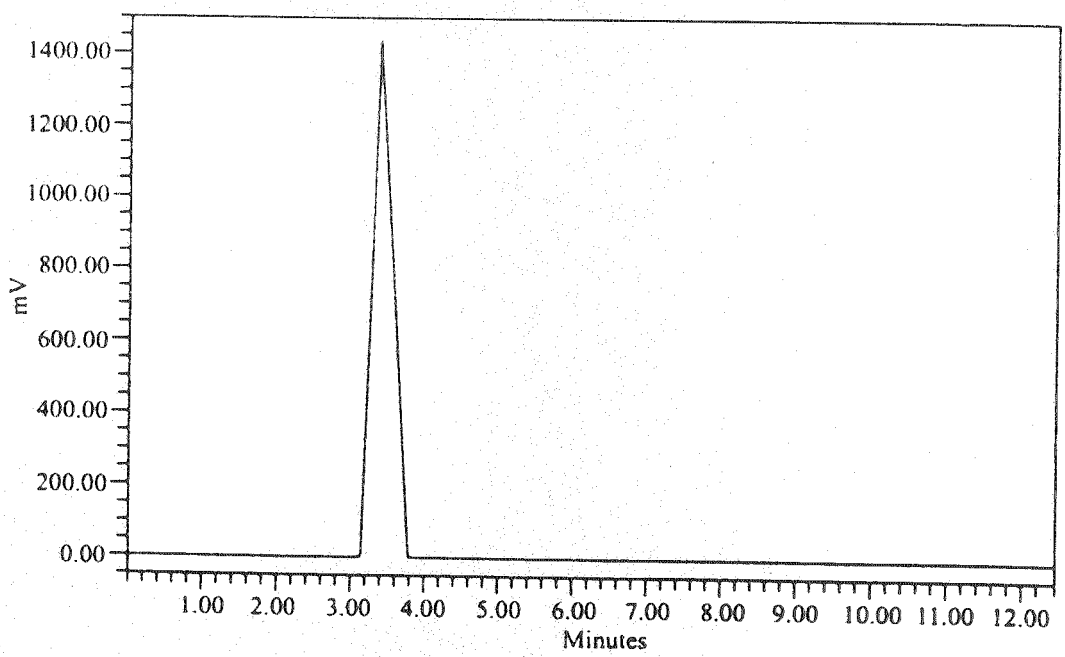

Fig. 1. Model chromatogram for lansoprazole (LAN)

The chromatogram of lansoprazole in methanol : KH_2PO_4 (60 : 40) is shown in Fig. 1. The λ_{max} of detection was fixed at 240 nm so that there was less interference from mobile phase with highet sensitivity according to UV analysis.

The peak areas were found to be linear. Values obtained for the calibration curve points and their standard deviation, coefficient of variance and standard error are presented in Table-1.

TABLE-1
OPTICAL AND REGRESSION CHARACTERISTICS OF THE PROPOSED HPLC METHOD FOR LAN

Parameter	Method
Detection wavelength (nm)	240
Linearity range (μg/mL)	0.1–100
Detection limits (μg/mL)	0.03883×10^5
Regression equation (Y = a + bC)	
Slope (b)	0.57502×10^5
Standard deviation of slope (S_b)	0.01223×10^5
Intercept (a)	–0.00235
Standard deviation of intercept (S_a)	0.06744×10^5
Standard error of estimation (S_e)	0.00948×10^5
Correlation coefficient	0.9993

The linear regression equations obtained for the proposed methods were $Y = -0.00235 + 0.57502 \times 10^4 X$ ($r = 0.9993$) where Y is the peak area ratio to the internal standard and X is the concentration of lansoprazole.

Precision and accuracy: The precision of the proposed method was evaluated by repeated analysis of samples containing LAN at three different concentrations (low, medium and high).

The within day precision showed a RSD of 0.60 or 0.14% at the low concentration (5 μg/mL). The between day precision evaluated for a period of five days showed a RSD of 0.61 or 0.11% at the low concentration. The low value of both the within and between day R.S.D. at the low concentration reflects the high precision of the method. At the high concentration (25 μg/mL) both the within and between day RSD were very low, which further indicates that the method is highly precise; the results are presented in Tables 2 and 3.

TABLE-2
VALIDATION REPORT FOR THE DETERMINATION OF LANSOPRAZOLE IN STANDARD SOLUTIONS BY HPLC METHOD

Preparation	I			II		
	Analyte taken ($\mu g\ mL^{-1}$)	Analyte found* ($\mu g\ mL^{-1}$) ± SD	RSD (%)	Analyte taken ($\mu g/mL^{-1}$)	Analyte found* ($\mu g\ mL^{-1}$) ±SD	RSD (%)
LAN pure form	5	4.98 ± 0.03	0.60	5	4.04 ± 0.03	0.61
	15	14.98 ± 0.2	0.17	15	14.91 ± 0.02	0.13
	25	25.19 ± 0.04	0.14	25	25.92 ± 0.03	0.10
Lanzap capsule	5	4.97 ± 0.02	0.40	5	4.92 ± 0.02	0.45
	15	14.93 ± 0.03	0.20	15	14.98 ± 0.01	0.06
	25	25.91 ± 0.02	0.08	25	25.98 ± 0.02	0.08
Lanzol capsule	5	4.96 ± 0.03	0.50	5	4.92 ± 0.02	0.45
	15	14.99 ± 0.02	0.40	15	14.98 ± 0.01	0.06
	25	24.89 ± 0.06	0.25	25	24.98 ± 0.02	0.08

*Relative standard deviation

TABLE-3
ASSAY AND RECOVERY OF LANSOPRAZOLE CAPSULES

Pharmaceutical formulation	Labeled amount (mg)	Amount obtained by proposed method	Recovery of proposed method (%)
Capsule	15	14.98	99.86
Capsule	15	14.99	99.93
Capsule	30	29.97	99.9
Capsule	30	30.02	100

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