AMERICAN JOURNAL OF PHARMTECH RESEARCH

Journal home page: http://www.ajptr.com/

Development and Validation of UV Spectrophotometric Area Under Curve Method for Estimation of Loratadine in Bulk and Tablet Dosage Form

Hemant Kumar Jain*[1], Khushbu H. Patel[1]

1. STES's Sinhgad College of Pharmacy, Vadgaon (Bk.), Off. Sinhgad Road, Pune - 411041, Maharashtra, India.

ABSTRACT

The aim of present work was to develop an accurate, precise, reproducible and economical UV spectrophotometric method for estimation of Loratadine. This method was based on area under curve of UV spectrum between 241 to 251 nm and validated as per ICH guideline Q2 (R1). The method has followed linearity in the range of 5-30µg/ml. The value of correlation coefficient was 0.999. Satisfactory values of Percent relative standard deviation for the intra-day and inter-day precision indicated that method is precise. Results of the recovery studies (99.66 % to 99.95 %) showed accuracy of the method. LOD and LOQ were calculated as 0.581 µg/ml and 1.935 µg/ml, respectively. The developed method can be used for routine estimation of Loratadine in bulk and tablet dosage forms.

Keywords: Loratadine, Estimation, UV spectrophotometry, Area under curve, Validation.

*Corresponding Author Email: hemantkjain2001@yahoo.co.in

Received 25 June 2013, Accepted 1 July 2013

Please cite this article in press as: Jain Hemant. *et al.*, Development and Validation of UV Spectrophotometric Area Under Curve Method for Estimation of Loratadine In Bulk and Tablet Dosage Form. American Journal of PharmTech Research 2013.

INTRODUCTION

Loratadine is used in the treatment of Urticaria, atopic dermatitis and allergic rhinitis[1,2]. Loratadine is a second-generation H1 receptor antagonist that does not produce sedation and anticholinergic side effects[3]. Loratadine is chemically known as 1-Piperidine carboxylic acid, 4-(8-chloro-5, 6-dihydro-11H-benzo [5,6]cyclohepta[1,2-b]pyridine-11-ylidene)-ethyl ester (Figure 1). This drug is official in British Pharmacopoeia (BP) and United State Pharmacopoeia (USP), where potentiometry[4] and High performance liquid chromatography (HPLC)[5] have been utilized for assay. Literature survey revealed some HPLC[6,7,8] methods have been reported for estimation of this drug. Only few papers have been available in the literature using spectrophotometry for estimation of Loratadine as single drug & combined dosage forms. These techniques were Colorimetry[9] and simultaneous equation method[10] but none of these methods have utilized integration technique so far. In this context, we wish to further explore UV spectrophotometry using area under curve for estimation of Loratadine in bulk & tablet dosage form.

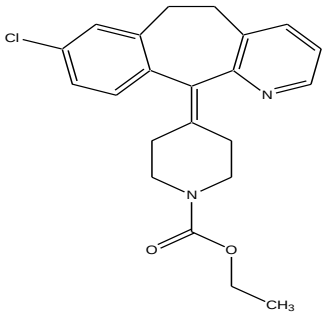

Figure 1: Chemical Structure of Loratadine

MATERIALS AND METHODS

Apparatus and Instrumentation

Shimadzu UV 1800 (Japan) with matched quartz cells, connected to computer loaded with UV Prob Software, was employed for this work. Single pan electronic balance (Shimadzu, AX 200, Japan) was used for weighing purpose. Sonication of the solutions was carried out using an Ultrasonic Cleaning Bath (Spectra lab UCB 40, India). Calibrated volumetric glasswares (Borosil) were used in this study.

Materials

Active pharmaceutical ingredient (API) of Loratadine was supplied as a gift sample from Cadila Pharmaceuticals Ltd., Dholka, (Gujarat, India). Commercially available tablets (Loridin containing 10 mg of Loratadine) were obtained from local pharmacy. AR-grade of Methanol (as a solvent) was purchased from Merck India Ltd., Mumbai.

Method development

Preparation of standard solution

The standard stock solution of Loratadine was prepared by transferring, accurately weighed, 10 mg of API to 100 mL of volumetric flask. The drug was dissolved with sonication in 50 ml of methanol and volume was made up to the mark by using methanol. The standard stock solution (100 µg/ml) was further diluted with methanol to get the concentration of 10 µg/ml.

Selection of wavelength range

The standard solution of 10µg/ml was scanned between 400 nm to 200 nm in UV spectrophotometer against methanol as blank after baseline correction. Wavelength range was selected around wavelength maxima (246 nm). Different working standards were prepared between 5-30 µg/ml. Various wavelength range were tried and final range between 241-251 nm was selected on the basis of linear relationship between area and corresponding concentration (Figure 2).

Area under curve (Area calculation)

This method involves calculation of integrated value of absorbance with respect to wavelength in indicated range. Area calculation processing item calculates the area bounded by the curve and horizontal axis[11]. Here horizontal axis represents baseline.

Area calculation (α+β) = $\int_{\lambda 2}^{\lambda 1} A d\lambda$

Whereas, α is area of portion bounded by curve data and a straight line connecting the start and end point, β is area of portion bounded by a straight line connecting the start and end point on curve data and horizontal axis, λ_1 and λ_2 are wavelenghts representing start and end point of curve region. In this study area was integrated between wavelength ranges from 241 to 251 nm.

Preparation of calibration curve

Working solutions were prepared from standard stock solution by further dilution with methanol to obtain the concentration of 5, 10, 15, 20, 25 and 30 µg/ml, respectively. These solutions were scanned from 400 to 200 nm and area under curve (AUC) was integrated[12] in the range of 241-251 nm. The calibration curve was plotted between area under curve against concentration (Figure 3).

Assay of tablet formulation

Twenty tablets were weighed and average weight was calculated. These tablets were crushed and powdered in a glass mortar. The tablet powder equivalent to 10 mg of Loratadine was accurately weighed, transferred to a 100 mL of volumetric flask and diluted up to mark with methanol. The

solution was filtered with Whatmann filter paper No. 41 and the first 5 ml of filtrate was discarded. This solution was further diluted to obtain 10µg/mL solution with same solvent and subjected for UV analysis. This procedure was repeated in triplicate (Table 1).

Method validation

The objective of validation of an analytical procedure is to demonstrate whether the procedure is suitable for its intended purpose. The proposed method was validated for various parameters such as Linearity, Accuracy, Precision, Limit of detection (LOD) and Limit of Quantitation (LOQ) according to ICH Q2 (R1) guideline[13].

Linearity and Range

The linearity was determined by using working standard solutions between 5-30 µg/ml. The spectrums of these solutions were recorded and area under curve was integrated in wavelength range 241-251 nm. Calibration curve of Area under curve vs. Concentration was plotted after suitable calculation and simple linear regression was performed (Figure 3). Regression equation and correlation coefficient were obtained. The range of solution has been decided according to statistical parameters of generated equation.

Method Precision

Repeatability

The precision of the method was checked by repeatedly injecting (n = 6) standard solutions of Loratadine (10 µg/mL). Area under curve of each of these solutions was measured in the range of 241-251 nm. Percentage relative standard deviation (RSD) was calculated (Table 2).

Intermediate Precision (Reproducibility)

The intra-day and inter-day precision of the proposed method was determined by analyzing the corresponding responses 3 times on the same day and on 3 different days over a period of 1 week for 3 different concentrations of standard solutions of Loratadine (5, 10 and 15 µg/mL). The results were reported in terms of relative standard deviation (RSD). The results were tabulated in Table 3.

Accuracy

The accuracy for the analytical procedure was determined at 80 %, 100 % and 120 % levels of standard solution. Area under curve was measured in the range of 241-251 nm and results were expressed in terms of % recoveries. Three determinations at each level were performed and % RSD was calculated. The results were tabulated in Table 4.

Limit of Detection (LOD) and Limit of Quantitation (LOQ)

Six sets of known concentrations (5-30 µg/ml) were prepared. Calibration curves were plotted

for each set. LOD and LOQ were calculated using the formulae as

$$LOD = 3.3\frac{SD}{S}$$

$$LOQ = 10\frac{SD}{S}$$

Where, SD is standard deviation of y-intercept of the calibration curves, S is mean slope of six calibration curves.

RESULTS AND DISCUSSION

An attempt was made to develop a simple and specific AUC spectrophotometric method for the determination of Loratadine in tablet dosage form. The generated regression equation was $\int_{241}^{251} A\,d\lambda = 0.0062C + 0.005$ (R^2 = 0.999). Where, $\int_{241}^{251} A\,d\lambda$ is area under curve between 241 to 251 nm, C is concentration and R is correlation coefficient. The R^2 value as 0.999 indicate that developed method was linear. The proposed method was found to be precise as % R.S.D values for intraday as well interday precision were satisfactory. The drug at each of the 80 %, 100 % and 120 % levels showed good recoveries (99.66 % to 99.95 %). Hence, it can be said that this method was accurate. The LOD and LOQ were calculated as 0.581 µg/ml and 1.935 µg/ml, respectively. The result of the analysis of pharmaceutical formulation by the developed method was consistent with the label claim, highly reproducible and reliable. The method can be used for the routine analysis of the Loratadine in tablet dosage form. The validation parameters are summarized in Table 5.

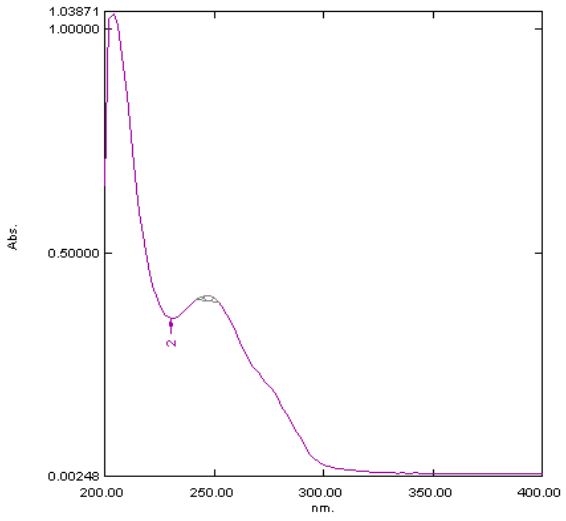

Figure 2: UV spectrum of Loratadine (10 µg/ml) in methanol.

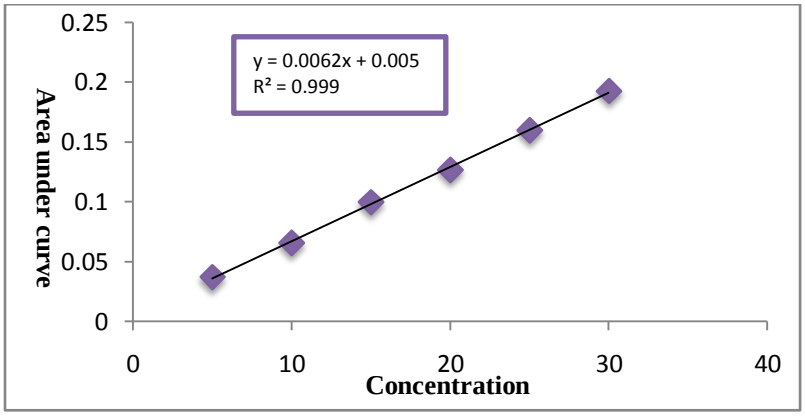

Figure 3: Calibration Curve of Loratadine (5-30 µg/ml)

Table 1. Assay of Tablet Dosage Form.

Sr. No.	Sample solution concentration (µg/ml)	Amount Found (%)	Mean Amount Found (%)	% RSD*
1	10	98.9		
2	10	99.5	99.4	0.47
3	10	99.8		

*n=3, % RSD = % Relative Standard Deviation

Table 2. Repeatability Results for Loratadine.

Drug	Concentration drug (µg/ml)	% RSD* Repeatability
Loratadine	10	0.678

*n=6

Table 3. Precision Results for Loratadine.

Drug	Concentration drug (µg/ml)	% RSD* Intraday	Interday
Loratadine	5	0.562	0.404
	10	0.619	1.319
	15	0.661	0.708

*n=3

Table 4. Accuracy Results for Loratadine.

Accuracy Level	Amount added (µg/ml)	% Recovery	Mean % Recovery	% RSD*
I(80%)	8	99.79±0.5672	99.8	0.372
II(100%)	10	99.66±0.1228		
III(120%)	12	99.95±0.4249		

*n=3

Table 5. Summary of Validation Parameters.

Parameter	Results
λ max	246 nm
Linearity range	5-30 µg/ml

Regression Equation(y=mx+c)	y= 0.0062x+0.005
Slope (m) ± SD*	0.0062 ± 0.001
Intercept (c) ± SD*	0.005 ± 0.0012
Correlation Coefficient (R^2)	0.999
Precision (% R.S.D)	
Repeatability	0.678
Intraday	0.614
Interday	0.810
Accuracy (Mean % Recovery)	99.80 %
LOD	0.581 µg/ml
LOQ	1.935 µg/ml

*n=6, SD = Standard Deviation

CONCLUSION

It can be concluded from the results that the proposed method was accurate, precise and consistent for the determination of Loratadine in tablet dosage form. This method was validated as per ICH guidelines. Results suggest that this method can be used for routine estimation of Loratadine in bulk and pharmaceutical dosage forms.

ACKNOWLEDGEMENT

The authors are grateful to Cadila Pharmaceuticals Ltd., Dholka (Gujarat, India) for providing API of Loratadine as gift sample and Dr. K.N. Gujar, Principal, Sinhgad College of Pharmacy, Vadgaon (Bk.), Pune for providing necessary facilities for this project.

REFERENCES

1. Tripathi KD, Essentials of Medical Pharmacology, 6th ed., Jaypee Brothers Medical Publisers, New delhi, 2008, 156-158.
2. Drug monograph-Loratadine. Available fromhttp://www.drugbank.ca/drugs/DB00455
3. Monroe EW. Loratadine in the treatment of urticaria. Clinical Therapeutics 1997; 19(2): 232–242
4. British Pharmacopoeia 2009. Vol.-I. Published by The Stationery Office on behalf of the Medicines and Healthcare products Regulatory Agency (MHRA), London, 3545.
5. United States of Pharmacopoeia-30/ National Formulary-25. Asian ed. United States Pharmacopoeial Convention, Inc., Rockville MD; 2007; vol. II; 2492.
6. Ramulu G, Kumar YR, Vyas K, Suryanarayana MV, Mukkanti K. A New Validated Liquid Chromatographic Method for the Determination of Loratadine and its Impurities. Sci Pharm. 2011; 79(2): 277–291.
7. Katiyar PK. RP-HPLC method for the determination of Loratadine in tablet formulation. International Journal of Pharmaceutical World Research 2012; 3 (2): 145-152.

8. Ruperez FJ, Fernandez H, Barbas C. LC determination of Loratadine and Related Impurities. Journal of Pharmaceutical and Biomedical Analysis 2002; 29: 35–41.
9. Shingvi I. Visible Spectrophotometry method for the estimation of Loratadine from tablets. Indian Journal of Pharmaceutical Science 2003; 65(3): 291-293.
10. Ponnilavarasan I, Chebrolu SN, P. Asha . Simultaneous estimation of Ambroxol Hydrochloride and Loratadine in tablet dosage form by using UV Spectrophotometric method. Int J Pharma and Bio Sci 2011; 2 (2): 338-345.
11. Jain HK, Agrawal RK. Simultaneous Estimation of Gliclazide and Metformin hydrochloride in combined dosage form. Indian J PharmSci 2002; 64: 88-91.
12. Shimadzu Corporation-Kyoto Japan, Analytical & Measuring Instruments Division, Instruction Manual –Operation Guide-UV 1800, 2008; 13.21-13.25
13. ICH Harmonized-Tripartite Guidelines. Validation of Analytical Procedure: Text and Methodology Q2 (R1), November, 2005.