Journal of Comprehensive Pharmacy

Research ArticleAvailable Online at: www.jcponline.in

ISSN NO: 2349-5669

A new method development and validation of dual wavelength UV Spectro Photometric method for Simultaneous estimation of Atenolol and Amlodipine besylate in combined dosage form

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ARTICLE INFO

Article history:

Received 25 April 2015

Accepted 20 May 2015

Available online 25 June 2015

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ABSTRACT:

A simple, accurate, and precise dual wavelength UV spectrophotometric method was developed for simultaneous determination of Atenolol and Amlodipine besylate in combined pharmaceutical dosage forms. The absorbance difference between two points on the mixture spectra is directly proportional to the concentration of the component of interest. During selection of two wavelengths the interfering component shows same absorbance while the component of interest shows significant difference in absorbance with concentration. The literature review reveals that there is no dual wavelength method was developed for this combination of drugs, hence this method was developed. The wavelengths selected for determination of atenolol were 230nm & 242nm, whereas, the wavelengths selected for determination of amlodipine besylate were 263nm and 277nm. Methanol and distilled water were taken as the solvents. The Beer's law was obeyed in the concentration range of 5–30 µg/mL for atenolol and 1–6 µg/mL for amlodipine besylate. Correlation coefficient was found to be 0.9983 and 0.9987 for atenolol and amlodipine besylate, respectively for dual wavelength method. Accuracy of method was found between 98.0–102.0%. The precision (intra-day, inter-day and analyst to analyst) of method was found within limits (%CV<2). LOD was found to be 0.162 µg and 0.0825 µg for Atenolol and Amlodipine besylate respectively and LOQ was found to be 0.492 µg and 0.25 µg for Atenolol and Amlodipine besylate respectively. The proposed method was successfully applied to determination of these drugs in laboratory-prepared mixtures and commercial tablets.

Keywords: Atenolol, Amlodipine besylate, Dual wavelength method, UV spectrophotometric method.

INTRODUCTION

Atenolol(ATN)is chemically 4-(2-hydroxy-3-isopropyl aminopropoxy)-phenyl acetamide, is beta-blocker seem to be equally effective as an antihypertensive, anti-anginal and antiarrhythmic drug. It is widely used cardiovascular drug in combination with Amlodipine. Amlodipine Besylate (AMN) is chemically 3-ethyl-5-methyl-(4RS)-2-[(2-aminoethoxy) methyl]-4-(2-chlorophenyl)-6-methyl-1,4-dihydropyridine-3,5-dicarboxylatebenzene sulphonate, is calcium channel blocker used as potent coronary and peripheral vasodilator and in bradycardia.

Literature survey reveals that various analytical methods have been reported for the assay of atenolol and amlodipine besylate in pure form and in pharmaceutical formulations. Non aqueous titration method is specified in Indian Pharmacopoeia for the assay of atenolol. While British Pharmacopoeia described liquid chromatography method for the assay of amlodipine besylate. Other methods such as derivative spectroscopy^{2,3}, simultaneous spectroscopic estimation^{4,5}, HPLC⁶⁻¹¹, RP-HPLC^{12,13}, Colourimetry, gas chromatography, difference spectroscopy¹⁴, HP-TLC¹⁵ were reported for the estimation of atenolol and amlodipine in individual formulations and

combined dosage forms. An attempt was made to develop simple, accurate, precise, reproducible, economic and organic solvent free method for simultaneous estimation of both these drugs in combined dosage form.

Dual wavelength spectroscopy offers an efficient method for analyzing a component in presence of an interfering component. For elimination of interferences, dual analytical wavelengths were selected in a way to make the absorbance difference zero for one drug in order to analyze the other drug. The difference in absorbance at 230 nm (A1) and 242nm (A2) was zero for Amlodipine besylate, so A1 - A2 were used to analyze Atenolol whereas the difference in absorbance at 263 nm (A3) and 277 nm (A4) was zero for Atenolol and hence, A3 - A4 were used to analyze Amlodipine besylate [1, 2].

MATERIALS AND METHOD:

Apparatus

Instrument used was an UV-Visible double beam spectrophotometer, make: LABINDIA (model UVWIN-3000+) with a pair of 1 cm matched quartz cells. All weighing was done on Elico analytical balance (Model AU-220). Calibrated glassware's were used throughout the work.

Reagents and chemicals

Pure drug samples of ATN and AMN were obtained as gift samples from Hetero Labs, Hyderabad. Methanol from Merk, water was used as solvent.

Marketed formulation

The marketed formulation studied was AMLOKIND tablet manufactured by Cipla pvt limited. Each tablet contains 50 mg Atenolol and 5 mg Amlodipine besylate.

Method development

UV spectrophotometric method for estimation Atenolol and Amlodipine besylate was carried by the dual wavelength spectroscopic method [3-5].

Determination of solubility

Atenolol and Amlodipine besylate solubility were tested in different organic and aqueous solvents. Both are soluble in methanol and sparingly soluble in water [6].

Standard solutions and calibration graphs for UV measurement

Standard stock solution of Atenolol and Amlodipine besylate were prepared in methanol(1000µg/ml) (1⁰stock). From this solution 1 ml was taken and diluted to 10 ml with water(100µg/ml)(2⁰stock). Calibration standards at six levels were prepared by

diluting 2⁰stock standard solutions in the concentration range of 5-30 µg/ml and 1-6 µg/ml for Atenolol and Amlodipine besylate respectively. Samples in triplicates were made for each concentration. Calibration graph was plotted by taking concentration on x-axis and absorbance on y-axis [7, 8].

Dual wavelength method

The utility of dual wavelength data processing program is to calculate the unknown concentration of a component of interest present in a mixture containing both the components of interest and an unwanted interfering component by the mechanism of the absorbance difference between two points on the mixture spectra. This is directly proportional to the concentration of the component of interest, independent of the interfering components. The pre-requisite for dual wavelength method is the selection of two such wavelengths where the interfering component shows same absorbance whereas the component of interest shows significant difference in absorbance with concentration [9-12].

Study of overlain spectra and selection of wavelength

By appropriate dilutions from the working standard solutions of 100 µg/ml of ATN and 100 µg/ml of AMN, the solutions of ATN (5-30 µg/ml) and AMN (1-6 µg/ml) were prepared working standard solutions were scanned from 200 to 400 nm to select the wavelengths for estimation. The maximum absorbance at λ_{max} for Atenolol and Amlodipine besylate was 273 nm and 243 nm respectively in methanol. From the overlain spectrum shown in figure the wavelengths selected for estimation of Atenolol were 230 nm and 242 nm, where Amlodipine besylate has no absorbance difference at that wavelengths and for Amlodipine besylate they were 263 nm and 277 nm, where Atenolol has no absorbance difference. Different concentrations of Atenolol and Amlodipine besylate were prepared, and then run in entire range from 200 to 400 nm. The drugs obey the Beer's law in the concentration range of 1-60µg/ml, 1-60 µg/ml for Atenolol and Amlodipine besylate respectively [13, 14].

Assay of tablet formulation by dual wavelength Spectrophotometry

Twenty tablets of AMLOKIND were weighed and finely powdered and tablet powder equivalent to 10mg of both Atenolol and Amlodipine besylate is weighed and extracted with methanol in a 100 ml volumetric flask. The flask was sonicated for 15 min and volume was made up to the mark with methanol. 1ml was transferred into a 10ml volumetric flask and the volume was made upto the mark with water, and 1ml of above solution is added to 10ml volumetric flask and made up to the mark with water, finally the

Simultaneous Over line spectra of Atenolol and Amlodipine besylate

Simultaneous over line spectra of Atenolol, Amlodipine besylate and mixture

solution is filtered by using syringe filter to obtain 10 µg/ml of Atenolol and 1 µg/ml of Amlodipine besylate. The absorbance of the solution was measured under UV spectrophotometer. The assay procedure was made triplicate and weight of sample taken for assay was calculated. The percentage of drug found in formulation, mean and standard deviation in formulation were calculated [15, 16].

Simultaneous estimation is made by dual wavelength spectroscopic method

S.NO	Drug	Wavelength	Wavelength
1	Atenolol	230nm (λ_1)	242nm (λ_2)
2	Amlodipine besylate	263nm (λ_3)	277nm (λ_4)
3	Mixture	230 nm & 242 nm	263 nm & 277 nm

Method validation

Method validation was performed in terms of sensitivity, specificity, linearity, LOQ, LOD, precision, accuracy and robustness [17].

Linearity

The linearity of calibration curves in pure solution was checked over the concentration ranges of about range

of 5-30 µg/ml and 1-6 µg/ml for Atenolol and Amlodipine besylate respectively. The regression line relating standard concentrations of drug using regression analysis, the calibration curves were linear in the studied range and equations of the regression analysis were obtained: $Y=0.007x + 0.016$; $R^2=0.998$ for Atenolol at 273 nm and $Y=0.048x - 0.012$; $R^2=0.998$ at 243 nm for Amlodipine besylate respectively. The mean and correlation coefficient of standard curves ($N=3$) were calculated.

Precision

The precision of the developed method was assessed in terms of repeatability and intermediate precision by analyzing replicate QC standard sample of 2 µg/ml, 4 µg/ml, 6 µg/ml for Amlodipine besylate and 10 µg/ml, 20 µg/ml, 30 µg/ml for Atenolol. The % R.S.D values of the results corresponding to the absorption values were expressed for intraday precision and on 3 days for inter-day precision. The intra and inter-day accuracy and precision were calculated and results were presented in the table. Precision of the analytical method was found to be reliable based on %R.S.D.

Accuracy

The accuracy of the method was determined by recovery experiments. The recovery studies were carried out at spiking levels of 80%, 100% and 120%

of test concentration. Results of assay and recovery were presented in the table.

Specificity

For determining Specificity of the method, a tablet dosage form was analysed. These results demonstrate that there was no interference from other materials in the tablet formulation therefore, confirm the specificity of the method.

Limit of detection (LOD), Limit of Quantification (LOQ)

Limit of detection was found to be 0.237µg/ml for Atenolol at 273 nm and 0.04µg/ml for Amlodipine besylate at 243 nm respectively and Limit of Quantification was found to be 0.824µg/ml for Atenolol at 273 nm and 0.1212µg/ml for Amlodipine besylate at 243 nm respectively.

Optimized method parameters for Dual Wavelength Spectrophotometry Method parameters Optimized parameters

Solvent	Methanol
Scanning range	200 nm to 450 nm
Scan speed	Medium
Analytical wavelengths for the determination of ATN	230nm and 242nm
Analytical wavelengths for the determination of AMN	263 nm and 277 nm

RESULTS AND DISCUSSION

The selected drugs Atenolol and Amlodipine besylate were estimated by using simultaneous estimation by dual wavelength spectroscopic method as per ICH guidelines. The method was validated for all validation parameters as per ICH guidelines. The linearity range for Atenolol and Amlodipine besylate was 5-30 µg/ml and 1-6 µg/ml, with R^2 value of 0.9987 and 0.9983 respectively. The % RSD for intraday and interday precision and interday precision was <2%. The method has been validated in assay of tablet dosage forms. The accuracy of the method was validated by recovery studies and was found to be significant and under specification limits, with % recovery 98-102 (i.e., within acceptable range 98-102%). The assay results were found to be 99.13% and 98.01% (within acceptable limits).

CONCLUSION

An accurate and precise dual wavelength spectroscopic method has been developed and validated for the analysis of Atenolol and Amlodipine besylate in tablet dosage form. The percentage recovery and found concentration of active ingredient in pharmaceutical formulations showed that the amount of drug present is consistent with the label claim. Hence, this method is very useful simple and accurate for estimation of Atenolol and Amlodipine besylate in tablet dosage form.

Linearity of Atenolol and Amlodipine besylate by dual wavelength method

S.No	Atenolol		Amlodipine besylate	
	Concentration	Absorbance at 230nm -242nm	Concentration	Absorbance at 263nm-277nm
1	5	0.117	1	0.006
2	10	0.255	2	0.015
3	15	0.377	3	0.024
4	20	0.481	4	0.035
5	25	0.610	5	0.043
6	30	0.720	6	0.054
Regression Value R^2	0.9987		0.9983	
Regression equation	$Y = 0.023x + 0.008$		$Y = 0.009x - 0.004$	

Assay

Formulation	Drug	Label claim	Amount Found $\pm$ SD	Assay	%RSD
AMLOKIND	Atenolol	50 mg	49.565 $\pm$ 0.307591mg	99.13%	0.61
	Amlodipine besylate	5mg	4.855 $\pm$ 0.10253mg	98.01%	2.08

Linearity curve of Atenolol:

Linearity curve of Amlodipine besylate:

Precision studies

Sample	Intraday precision				Interday Precision			
	Atenolol at 273 nm		Amlodipine besylate at 243 nm		Atenolol at 273 nm		Amlodipine besylate at 243 nm	
	Conc. (µg/ml)	%RSD	Conc. (µg/ml)	%RSD	Conc. (µg/ml)	%RSD	Conc. (µg/ml)	%RSD
1	10	1.103	2	1.403	10	0.935	2	1.257
2	20	0.628	4	0.881	20	0.852	4	0.845
3	30	0.670	6	0.202	30	0.659	6	0.540

Recovery studies

S.No.	Name of the drug	Amount of sample (µg/ml)	Recovery level	Amount of drug added (µg/ml)	Amount found (µg/ml)	% Recovery
1	Atenolol	10	80%	8	17.913	99.05
			100%	10	20.152	101.07
			120%	12	22.240	101.09
2	Amlodipine besylate	1	80%	0.8	1.821	101.16
			100%	1.0	1.984	99.02
			120%	1.2	2.156	98.01

Summary of the present method

S.No.	Parameter	Atenolol	Amlodipine besylate
1	$\lambda_{\max}$	273 nm	243 nm
2	Beer's limit (µg/ml)	5-30	1-6
3	Regression equation	at 230nm-242nm	at 263nm-277nm
	Slope	0.023	0.009
	Intercept	0.008	0.004
	Co-relation coefficient	0.9987	0.9983
4	LOD (µg/ml)	0.272	0.040
5	LOQ (µg/ml)	0.824	0.121
6	Precision	<2%	<2%
7	% Recovery	99.05-101.09	98.01-101.16
8	Wavelengths selection	263 nm & 277 nm	230 nm & 242 nm
9	Sandal sensitivity	-0.3043µg/ml	0.5555µg/ml

LOD and LOQ

S.NO	Parameter	Atenolol	Amlodipine besylate
1	LOD (µg/ml)	0.272	0.040
2	LOQ (µg/ml)	0.824	0.121

REFERENCES

1. Beckett AH, Stenlake JB. Practical Pharmaceutical Chemistry, Fourth Edition, Part II, CBS Publications, pp. 286 -288.
2. Validation of Analytical Methods and Procedures. Zip / analytical method development for Pharmaceutical Formulations Pharmainfo_net.htm.
3. Bhargavi A, Chandana P, Lohita B, Ramalingam M, Theja P, Kumar DHH, Vinod K. UV-Visible Spectrophotometric Method for the estimation of Amlodipine Besylate in tablet dosage forms. *Journal of Pharmacy Research*. 2011;**4(11)**:4001.
4. Agarwal R, Fadnis AG. Kinetic spectrophotometric determination of atenolol in Perchloric acid medium. *Int J Pharm Pharm Sci*. 2012;**4(2)**:350-352.
5. Srivani A, Sujitha H, Swathi M. Development and validation of RP-HPLC Method of simultaneous estimation of atenolol and amlodipine in combined dosage form. *Int J Pharm*. 2014;**4(1)**:265-269
6. Chaudhari BG, Patel AB. Simultaneous spectrometric Estimation of atorvastatin calcium and Amlodipine Besylate in Tablet Dosage Forms. *Int J Chem Tech Res*. 2010;**2(1)**:633-639.
7. Rathee P, Rathee S, Thakur S, Kumar V. Simultaneous estimation of Amlodipine besylate and Atenolol as A.P.I in Tablet Dosage Forms by Vierodt's Method using U.V. Spectrophotometry. *Int J Chem Tech Res*. 2010;**2(1)**:62-68.
8. Patel VB, Sahu R, Patel BM. Simultaneous determination of Amlodipine besylate and Atorvastatin calcium in Pharmaceutical tablet formulation by High Performance Thin Layer Chromatographic method. *Int J Chem Tech Res* 2011;**3(2)**:695-698.
9. Brunton LL, Parker KL Editors. Goodman & Gilman's Manual of Pharmacology and Therapeutics. New York: McGraw-Hill; 1996.
10. Kasture AV, Ramteke M. Simultaneous UV-Spectrophotometric method for the estimation of atenolol and amlodipine besylate in combined dosage form. *Indian J Pharm Sci*. 2006;**68(3)**:394-396.
11. Prasad CV, Parihar C, Chowdhary TR. Simultaneous determination of Atenolol-amlodipine and haloperidol-trihexaphenidyl in combined tablet preparations by derivative spectroscopy. *Pharm Pharmacol Commun* 1998;**4(7)**:325-330.
12. Patil PR, Rakesh SU, Dhabale PN, Burade KB. Simultaneous UV spectrophotometric method for estimation of losartan Potassium and amlodipine besylate in tablet dosage form *Asian J Research Chem* 2009;**2(1)**:183-187.
13. Jain HK, Agrawal RK. Spectroscopic methods for simultaneous determination of amlodipine besylate and lisinopril in tablets. *Indian Drugs* 2000;**37**:196-199.
14. Rahman N, Najmul S, Azmi H. Spectrophotometric method for the determination of amlodipine besylate with ninhydrin in drug formulations. *Farmaco*, 2001;**56(10)**:731-735.
15. Patki RV, Tamhankar CP, Tipnis HP. Simple and rapid high performance liquid chromatographic estimation of amlodipine in pharmaceutical dosage forms. *Indian Drugs*. 1994;**31**:560-561.
16. Halkar UP, Bhandari NP, Rane SH. High performance liquid chromatographic simultaneous determination of amlodipine and enalapril maleate from pharmaceutical preparation. *Indian Drugs* 1998;**35(3)**:168-169.

Cite this article as: Avula S, Madhu S, Ummaraspatty UR. A new method development and validation of dual wavelength UV Spectro Photometric method for Simultaneous estimation of Atenolol and Amlodipine besylate in combined dosage form. *J Compr Phar* 2015;2(3):98-104.