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VALIDATION AND DEVELOPMENT OF NEW SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF AZELNIDIPINE IN BULK DRUG AND PHARMACEUTICAL DOSAGE FORM

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ABSTRACT

A simple, precise, and accurate zero-order derivative spectroscopic approach has been developed and validated for the estimating Azelnidipine in bulk and pharmaceutical dosage forms. The medication has a maximum absorption (λ max) at 254nm in acetonitrile solution and obeys Beer's law in the concentration range of 2-12µg/ml. The linearity parameter was carried out, and the regression coefficient was found to be 0.9986 and it has showed good linearity and precision within this concentration range. The percent recovery was found to be 98.59-100.8, these results are within the limit and it shows method followed was accurate. The limit of detection and limit of quantification were found to be 0.050 and 0.151µg/ml, respectively. The percentage relative standard deviation was found to be less than 2. According to ICH guidelines the technique has been validated for linearity, precision, accuracy, robustness, ruggedness, LOD, and LOQ. The developed and validated method can be successfully applied for routine quantification of Azelnidipine in bulk and pharmaceutical dosage form.

KEYWORDS: Azelnidipine, Zero order derivative spectroscopy, Validation, Pharmaceutical formulation.

INTRODUCTION

Azelnidipine is a lipophilic dihydropyridine calcium channel blocker. Selectively for L – type calcium channel that has been recently used for the treatment of patients with hypertension.[1] Azelnidipine is often used to reduce systemic vascular resistance and arterial pressure. Azelnidipine is inhibits trans membrane Ca^{+2} influx through the voltage dependent channels of smooth muscles. They enter the cells through cell membrane, lower peripheral vascular resistance and arterial pressure. It is used for the treatment of essential hypertension and angina pectoris.[2] It is classified as a class II drug according to the biopharmaceutical classification systems (BCS).

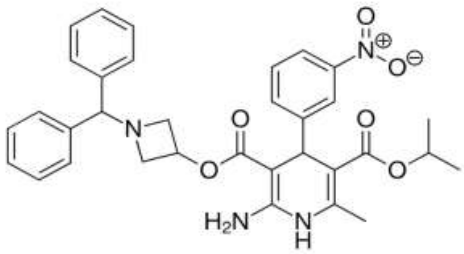

Figure 1: Structure of Azelnidipine.[3]

Extensive literature survey reveals that few spectrophotometric methods[5-9], RP-HPLC[10-17] and HPTLC[18] methods for the determination of the Azelnidipine alone or in combination in various pharmaceutical formulation and biological fluids including stability studies, this gives information related to the analyte is surveyed for the synthesis, physical and chemical properties, solubility and relavent analytical methods. Hence there is a need for the development of newer, simple, sensitive, rapid, accurate and reproducible spectrophotometric, visible and chromagraphical methods for the routine estimation of Azelnidipine in bulk and pharmaceutical dosage form.

MATERIALS AND METHODS

Instrument: UV-visible double beam spectrophotometer, SHIMADZU (model UV-1800) with UV probe software. All weitghts were taken in analytical balance.

Chemicals: Azelnidipine pure drug was obtained as a gift sample from 4Care Lifescience Pvt Ltd., Bagdol, and its pharmaceutical dosage Azelnidipine 20 tablets (Azovas–16) labelled claim 16mg from local pharmacy manifactured by Synokem Pharmaceuticals Ltd.

Solvent: Acetonitrile is used as a solvent.

Selection of analytical wavelength: Appropriate dilutions of Azelnidipine were prepared from standard stock solution and using spectrophotometer solution was scanned in the wavelenhgth range 200-400nm. The absorption spectra obtained and show maximum absorbance at 254nm, as the wavelength for detection.

Preparation of standard stock solution: 100mg of Azelnidipine was weighed accurately and transferred in to 100ml of volumetric flask and diluted in Acetonitrile up to mark. From this, the solution was further diluted into 100µg/ml and pipetted out 0.2, 0.4, 0.6, 0.8, 1.0 and 1.2ml into 10ml individual volumetric flask and diluted in acetonitrile up to mark, this gives 2, 4, 6, 8, 10, and 12µg/ml concentration.

Preparation of sample solution: 20 tablets of Azelnidipine marketed formulations was weighed and powdered. A quality of tablet powder equivalent to 100mg od Azelnidipine was transferred into a 100ml of volumetric flask then it was diluted with acetonitrile and made up to the mark.

METHOD AND VALIDATION

The method was validated according to the ICH guidelines.[19-21]

RESULTS AND DISCUSSION

METHOD: ZERO ORDER DERIVATIVE SPECTROSCOPY

Linearity: The linearity of an analytical method is its capacity to show the test results that are directly praportional to the concentration of the analyte in the sample with in the range. The linearity was established in the range od 2 - 12µg/ml was measered at 254nm and absorbence values shown in table-1. The calibration curve was prepared by plotting graph against the concentration and absorbance and there for the graph shown in figure 2. Statistical variables like slope, intercept, regression equation, corelation coefficient and sandell's sensitivity were determined and shown in tabel 2.

Precision: The precision of an analytical method expresses the closeness of a series of individual analyte measuerments obtained from multiple sampling of equivalent sample. Precision was established by intra-day and inter-day studies. Intra-day precision was determined by analysing the same concentration for six times in a same day. Inter-day precision was determined by analysing the same concentration daily for six days. Shown in table 3.

Accuracy: The accuracy of an analytical method says that closeness of test results obtained by that method to the true value. To assess the accuracy of the developed method, recovery

studies were carried out at three different levels as 50, 100, 150. In which the formulation concentration holds it constant and varied pure drug concentration. Shown in table 4.

Ruggedness: The ruggedness id defined as the reliability of results when the method is performed variation in conditions. This includes distinct analyst, laboratories, instruments, temperature ets. Rggedness was determined betwwen distinct analyst, the value of %RSD was found to be less than 2.(table-5)

LOD and LOQ: The limit of detection is an individual analytical method is the smallest amount of analyte in a samle which can be reliably detected by the analytical method. The limit of quantitation is a discrete analytical procedure is the smallest amount of analyte in a sample which can be quantitatively determined. LOD and LOQ were calculated by using following formula.

$$LOD = 3.3(SD)/S \text{ and } LOQ = 10(SD)/S$$

LOD and LOQ value of Azelnidipine were found to be 0.050µg/ml and 0.151µg/ml.

Table 1: Result of calibration curve at 254nm by zero order spectroscopy.

SL. NO	Concentration in µg/ml	Absorbance ± standard deviation*
1	0	0
+2	2	0.121±0.0013
3	4	0.221±0.0008
4	6	0.332±0.0017
5	8	0.422±0.0013
6	10	0.523±0.0010
7	12	0.620±0.0020

**Averege of six determinations*

Table 2: Regression parameter of Azelnidipine by zero order spectroscopy.

Regression parameter	Results
Range(µg/ml)	2-12
λ_{max} (nm)	254
Regression equation	Y=0.0512x+0.0129
Slope(b)	0.0512
Intercept(a)	0.0129
Correlation coefficient(r^2)	0.9986
Sandell's equation	0.018
Limit of detection(µg/ml)	0.050
Limit of quantification(µg/ml)	0.151

Table 3: Determination of precision results for Azelnidipine at 254nm by zero order spectroscopy.

Concentration (µg/ml)	Intra-day Absorbance±standard deviation*	%RSD**	Inter-day Absorbance±Standard deviation*	%RSD**
2	0.121±0.0016	1.341	0.121±0.0013	1.110
4	0.219±0.0012	0.552	0.221±0.0008	0.401
6	0.332±0.0019	0.584	0.332±0.0017	0.512
8	0.421±0.0026	0.623	0.422±0.0013	0.327
10	0.523±0.0017	0.340	0.523±0.0010	0.190
12	0.621±0.0013	0.212	0.620±0.0020	0.332

**Average of six determination, **% Relative standard deviation.*

Table 4: Determination of accuracy results for Azelnidipine at 254nm by zero order spectroscopy.

Spiked levels	Amount of sample (µg/ml)	Amount of Standard (µg/ml)	Amount recovered	% Recovery± Standard deviation*	%RSD**
50	6	3	9.03	100.3±0.314	0.313
100	6	6	11.8	98.5±0.413	0.318
150	6	9	15.0	100.8±0.361	0.358

**Average of six determination, **%Relative standard deviation.*

FIGURES

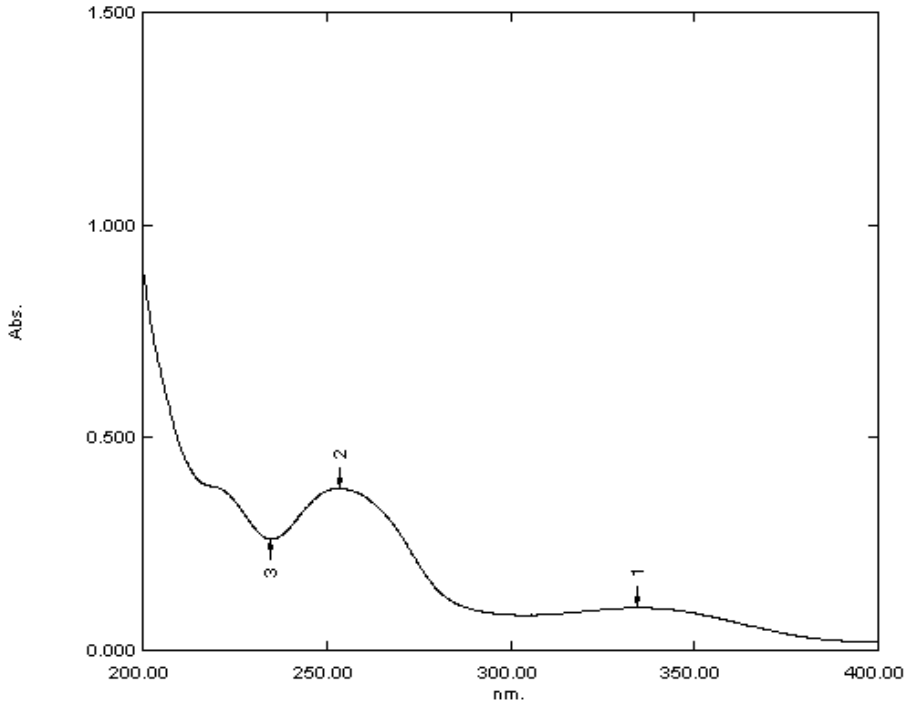

Figure 2: Zero order spectrum of Azelnidipine at 254nm.

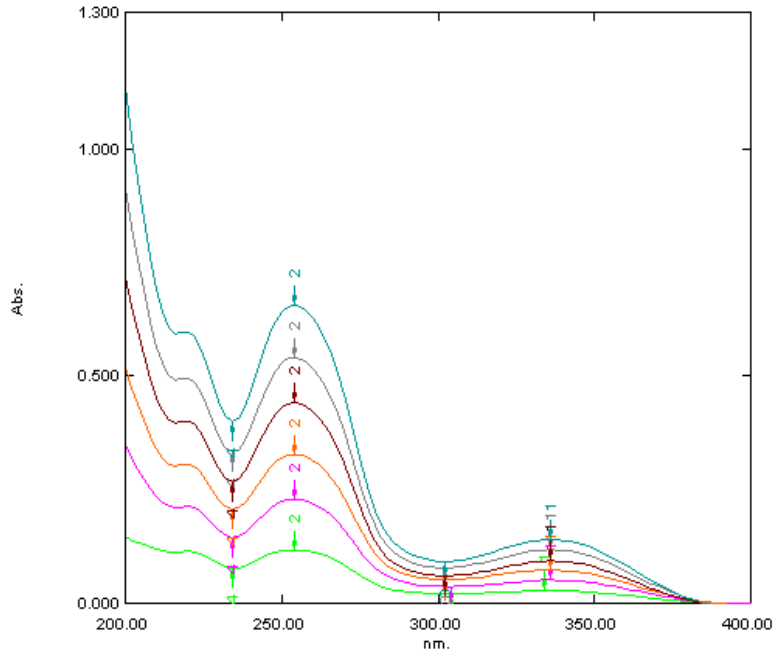

Figure 3: Zero order overlain spectra of Azelnidipine showing absorbance at 254nm.

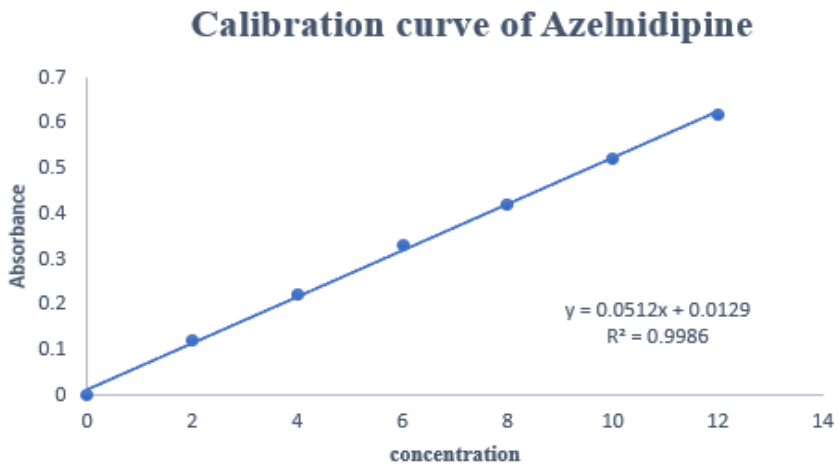

Figure 4: Calibration curve of Azelnidipine by zero order spectroscopy.

CONCLUSION

As per ICH guidelines, the present analytical work was carried out and meet the acceptance criteria. It was concluded that the developed analytical method was simple, specific, accurate, economical and sensitive and can be used for routine analysis of Azelnidipine in bulk drug and pharmaceutical dosage forms.

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REFERENCE

1. Mukeri IH, Kushwaha AK, Neupane NP, Kumar A, Sushant A, Nag A, Malairajan P. Analytical method development and validation of azelnidipine by UV-visible spectroscopy. World J Pharm Res., Jun. 6, 2021; 10(10): 858-72.
2. Sahoo S, Meyyanathan SN. Development and validation for the estimation of azelnidipine in its formulation by HPLC. J Pharm Negat, Dec. 22, 2022; 13(7): 3801-6.
3. Patel K, Mahida R. A review on analytical methods for estimation of azelnidipine and telmisartan in pharmaceutical dosage form. World J Pharm Res., Jan. 30, 2021; 10(4): 589-604.
4. Mandale D, Mistry R, Chauhan N. An analytical approach of azelnidipine: A review. World J Pharm Pharm Sci., Jan. 2, 2021; 10(3): 682-92.
5. Raskapur KD, Patel MM, Captain AD. UV-Spectrophotometric method development and validation for determination of azelnidipine in pharmaceutical dosage form. Int J Pharm Pharm Sci., 2012; 4(1): 238-240.
6. Prajapati dm, kadam a, mashru r. Analytical method development and validation for simultaneous estimation of azelnidipine and metoprolol succinate from the synthetic mixture by three different UV spectrophotometric methods. World J Pharm Res., 2022; 11(10): 785-798.
7. Suthar P, Mashru R. Advanced UV spectrophotometric method development and validation for simultaneous estimation of azelnidipine and telmisartan in pharmaceutical dosage form: Advanced UV spectrophotometric method development and validation. Indian J Pharm Drug Studies, Dec. 17, 2022: 128-34.
8. Dhasade PV, Kale S, Patil MS, Agawane SS, Gaikwad SP. Development and validation of an analytical method for simultaneous estimation of azelnidipine and chlorthalidone by UV in fixed-dose combination. Int J Pharm Res., Aug. 4, 2022; 7(4): 1265-1275.
9. Attimarad M, Chohan MS, Katharigatta Narayanaswamy V, Nair AB, Sreeharsha N, Shafi S, David M, Balgoname AA, Altaysan AI, Molina EI, Deb PK. Mathematically processed UV spectroscopic method for quantification of chlorthalidone and azelnidipine in bulk and formulation: evaluation of greenness and whiteness. J Spectrosc, 2022 May 20; 22.
10. Panda M, Dadi V, Yarraguntla SR, Rao KV. RP-HPLC method for determination of azelnidipine and telmisartan in pharmaceutical dosage form. Res J Pharm Technol, Feb. 1, 2023; 16(2): 509-13.

11. Patel JK, Patel NK. Validated stability-indicating RP-HPLC method for the simultaneous determination of azelnidipine and olmesartan in their combined dosage form. Sci pharm., Sep., 2014; 82(3): 541-54.
12. Bhosale A, Pingle A. Bioanalytical RP-HPLC method development and validation for estimation of azelnidipine and olmesartan medoxomil in human plasma. J Med Pharma allied sci., 2022; 11(5): 5235.
13. Chaitanya DB, Ajitha M. Stability Indicating RP-HPLC Method development and validation for simultaneous estimation of azelnidipine and telmisartan in bulk and pharmaceutical dosage form. World J Pharm Sci., Jan. 2, 2022; 10(01): 121-127.
14. Agrawal S, Nizami T. Method development and validation for the simultaneous determination of azelnidipine and telmisartan in tablet dosage form by RP-HPLC. Int J Pharm Sci Med., Oct., 2021; 6(10): 2519-9889.
15. Singh A, Rajput A, Kureshi G, Carpenter G, Vashi J. AN RP-HPLC method performance and validation for azelnidipine measurement and metoprolol succinate within a synthetic mixture. Pharmacophore, May1, 2023; 14(3): 2229-5402.
16. Modi J, Patel SK, Parikh N, Shah SR, Pradhan PK, Upadhyay UM. Stability indicating analytical method development and validation for estimation of azelnidipine. World J Pharm Res., 2016; 5(2): 831-47.
17. Dinakaran V, Unnissa SH. Development and validation of an RP-HPLC method for the simultaneous estimation of azelnidipine and telmisartan in pharmaceutical tablet dosage form. Res J Pharm Technol., Jun. 26, 2023; 16(6): 2638-2.
18. Rane AS, Mahajan SK. Validation and forced stability-indicating HPTLC method for determination of azelnidipine. World J Pharm Res., Jun. 5, 2016; 5(9): 1053-62.
19. ICH, Q2A Text on validation of analytical procedures, 1994. https://database.ich.org/sites/default/files/Q2%28R1%29%20Guideline.pdf
20. ICH, Q2B Validation of analytical methodology; 1996. https://www.fda.gov/regulatory-information/search-fda-guidance-documents/q2b-validation-analytical- procedures-methodology
21. ICH, Q2 (R1) Validation of analytical procedures: text and methodology; 2005. https://database.ich.org/sites/default/files/Q2%28R1%29%20Guideline.pdf