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UV SPECTROSCOPIC METHOD FOR THE ESTIMATION OF AZELNIDIPINE - A REVIEW

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ABSTRACT

Azelnidipine is a calcium channel antagonist that blocks lipopholic dihydropyridine calcium channels. Calcium channel blockers called dihydropyridine (DHP) are generated from the chemical dihydropyridine and are commonly used to lower systemic vascular resistance and arterial pressure. The focus of this review is on the azelnidipine uv spectroscopic analytical approach. The correlation coefficient of the calibration curve was found to be between 0.98 and 0.99, indicating that methanol is extensively utilised as a solvent solution in UV spectroscopy.

KEYWORDS: Lipopholic, Calcium channel blocker, Azelnidipine, and UV-spectroscopy.

INTRODUCTION

Chemically, azelnidipine (AZEL) is 3-*o*-(1-benzhydrylazetidin-3-yl)5-*o*-propan-2-yl 2-amino-6-methyl-4-(3- nitrophenyl)-1,4-dihydropyridine-3,5-dicarboxylate. It is a calcium channel blocker (CCB) of the dihydropyridine (DHP) class used to treat hypertension. Due to an asymmetric structure, AZEL contains two enantiomers.[1]

The DHP ring's 4-position contains carbon. The drug's pharmacological effect The (R)-enantiomer of AZEL is the active form. This contrasts sharply with additional CCBs where the (S)-enantiomer is the active ingredient biological function The three-dimensional structure of the object is unusual. The active enantiomer of AZEL might be linked to its one-of-a-kind structure. pharmacological characteristics that other DHPs don't have, such as a

long-term drop in blood pressure, a decrease in heart rate, and The drug has an anti-atherosclerotic action. AZEL has a diuretic impact as well. Increasing urine volume leads to a decrease in ion retention.[2]

Azelnidipine is a calcium antagonist dihydropyridine derivative that is novel and has a lengthy half-life. Azelnidipine blocks trans membrane Ca+2 influx through smooth muscle voltage-dependent channels in vascular walls. They enter cells through the cell membrane and reduce peripheral vascular resistance and blood pressure.[3,4]

It's used to treat angina pectoris and essential hypertension. Calcium channel blockers (CCBs) have been proven to inhibit the formation of early lesions in human coronary arteries and to slow down atherogenesis in animal models.[5,6]

Spectrophotometric determination[7,8]

The assay of an absorbing substance may be quickly carried out by preparing a solution in a solvent and measuring its absorbance at a suitable wavelength. UV-Visible spectrophotometry is one of the most frequently employed techniques in pharmaceutical analysis. It involves measuring the amount of ultraviolet radiation absorbed by a substance in solution. Instrument which measure the ratio, or function of ratio, of the intensity of two beams of light in the UV-Visible region. In qualitative analysis, organic compounds are identified by use of spectrophotometer. If any recorded data is available, quantitative spectrophotometric analysis is used to certain the identify of molecular species by its maximum absorbance (λmax) of the radiation. Spectrosphotometric technique is simple, rapid, moderately specific, and applicable to small quantities of compounds.

I. **Single component analysis:** The analysis of sample containing single component can be carried out using one of the following modes-

1. Standard absorptive value
2. Standard calibration graph
3. Single or Double point standardization
4. Area under curve method
5. Derivative spectroscopy

II. **Multi-Component analysis:** The analysis of sample containing multi-component can be carried out using one of the following modes-

1. Simultaneous equation method
2. Absorbance ratio method
3. Absorption correction method
4. Difference spectrophotometry
5. Derivative spectroscopy
6. Geometric correction method
7. Orthogonal polynomial method
8. Two-wavelength method
9. Area under the curve method
10. Multicomponent mode of analysis

Chemistry of azelnidipine

Azelnidipine is a lipopholic dihydropyridine calcium channel blocker antagonist. Dihydropyridine (DHP) calcium channel blockers are derived from the molecule dihydropyridine and often used to reduce systemic vascular resistance and arterial pressure.[2,3] Azelnidipine is a new and long acting dihydropyridine derivative with calcium antagonistic activity. Azelnidipine is inhibits Trans membrane Ca+2 influx through the voltage dependent channels of smooth muscle in vascular walls. They enter the cells through cell membrane, lower peripheral vascular resistance and arterial pressure. It is used for treatment of essential hypertension and angina pectoris. Calcium channel blockers (CCBs) have been shown to retard atherogenesis in animal models and to prevent the development of early lesions in human coronary arteries.[9]

Azelnidipine is officially reported in Indian Pharmacopoeia volume II 2018

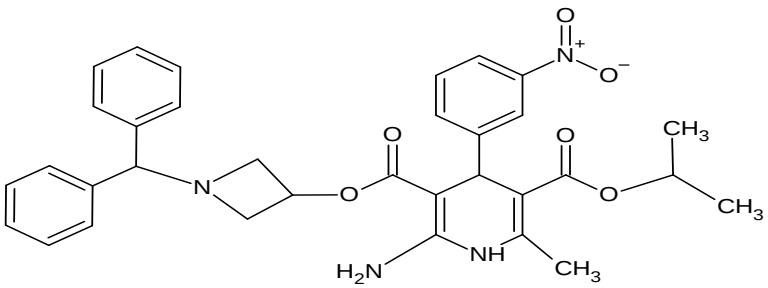
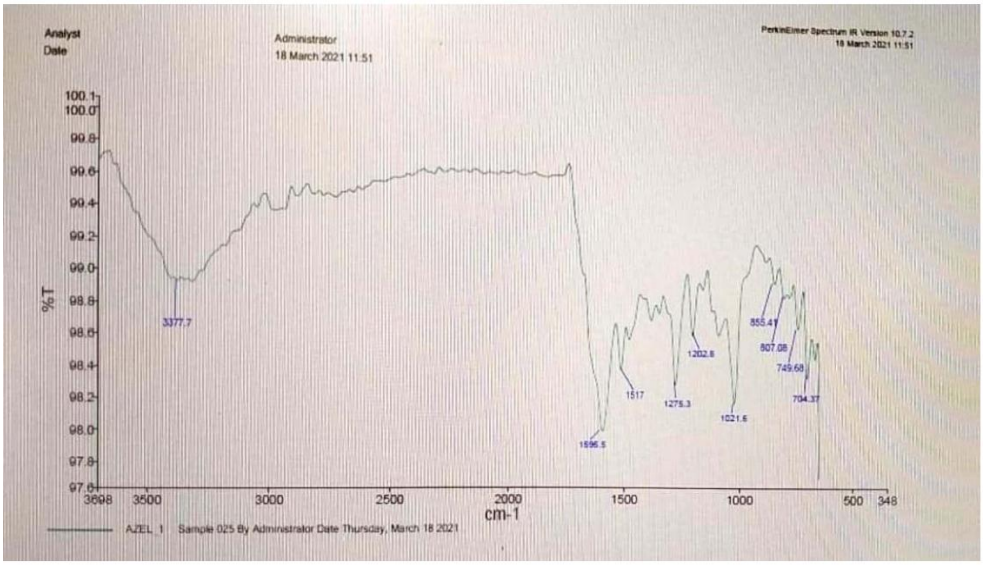


Fig. 1: Structure of azelnidipine.

IR spectra of azelnidipine

The sample's FTIR absorption spectra matched that of an azelnidipine reference standard or azelnidipine reference spectrum. The spectra were interpreted to reveal the confirmed

presence of a functional group in the drug. The peak reached by various stretching for different functional groups was essentially identical.[10] The peak at 3377.7 was ascribed to N-H stretching vibration, the peak at 2850.0 to aromatic stretching, and the peak at 1596.5 to C=C stretching, all of which conform to the structure of Azelnidipine.



Drug profile

Table no. 1: Drug profile.

Sr. no.	Parameter	Azelnidipine
1	Molecular wt.	582.6 g/mol
2	Molecular Formula	$C_{33}H_{34}N_4O_6$
3	IUPAC Name	3-*o*-(1-benzhydrylazetidin-3-yl)5-*o*-propan-2-yl 2-amino-6-methyl-4-(3- nitrophenyl)-1,4-dihydropyridine-3,5-dicarboxylate
4	Melting Point	122-123^{0}C
5	p^ka	7.89
6	Solubility	Slightly soluble in methanol, freely soluble in acetone, soluble in ethyl acetate, sparingly soluble in water.
7	Absorbtion	Orally absorbed
8	Bioavailibilty	Less than 50%
9	Half Life	16 – 24 hrs
10	C max	3.0 – 13.1 ng/ml
11	Plasma Protein Binding	≈90%
12	Chemical Purity	99.77%
13	CAS No.	123524-52-7

Marketed formulation

Table no. 2: Marketed formulation.

Sr. no.	Brand Name	Manufacturer	Dose
1	AZUSA	Ajanta Pharmaceuticals	16mg
2	AZELDIP	Glenmark Pharmaceuticals	16mg
3	UNIAZ	Torrent Pharmaceuticals	16mg
4	AZOVAS	JB Chemicals	8/16mg

Mechanism of action

Azelnidipine is a channel blocker that decreases Ca+2 trans membrane flow via vascular walls' voltage-based smooth muscle channels in vascular walls. Ca+2 groups including L-type, T-type, N-type, P/Q and R-type, Ca+2. Ca+2 is referred to as L-type. Calcium channels are a kind of channel found in the body.[9] obstructed, causing the vascular smooth muscle wall to contract. Relaxation and a reduction in PB. T-type their aldosterone sequence, and N expressed neurotransmitter release. L-type CCBs include azelnidipine, cilnidipine, benidipine, and efonidipine. L/N- and L/T-type CCBs are also known as secondgeneration CCBs.[11]

Pharmacodynamics

This azelnidipine does not reduce sympathetic nerve activity by causing bar-receptor reflex response tachycardia.[12] In vitro experiments revealed that azelnidipine reduces radiolabelled nitrendipine binding competitively. In comparison to amlodipine and nicardipine, azelnidipine exhibits a lengthy duration of action in vitro experiments in isolated rat aortic strips, which is consistent with its high lipophilicity.[13]

Pharmacokinetics

Average parameter values, (2) a quantitative relationship to human physiology (e.g., body height, liver, pulse, renal, and so on), and (3) patient class variety. Each of the three pharmacokinetic factors is provided and removed.[14] The pharmacokinetic profile of azelnidipine, a novel calcium antagonist, varies from that of amlodipine. [15]

Literature review

a. (K. Raskapur-2011)[1]

The maximum absorbance of azelnidipine is 255 nm, and linearity was seen in the concentration range of 214 g/ml, with a mean correlation value of 0.999. The developed UV Spectrophotometric approach was found to be accurate, sensitive, and precise, and it was successfully used to a pharmaceutical tablet formulation for Azelnidipine quantification.

Table no. 3.

Sr. no.	Parameter	Result
1	Wavelength(λ max)	255 nm
2	Solvent	Methanol
3	Accuracy	1.12 %
4	Interday Precision (%RSD)	0.416 %
5	Intraday Precision (%RSD)	0.211 %
6	LOD	0.37
7	LOQ	1.12
8	% Assay	98.33 - 99.16

The calibration curve was found to be linear over the range of 2-14 µg/ml for Azelnidipine. The instrument used for the UV detection was SHIMADZU 1800 UV-VISIBLE spectrophotometer with 1.0 cm matching quartz cells.

b. (P. Malairajan - 2021)[16]

UV-Visible Spectrophotometric determination was performed with Systronics PC- based double beam spectrophotometer 2202. The UV spectra were recorded over the wavelength 200-400nm. All the drug and chemical were weighed on digital laboratory electronic balanced.[1,7,8] The melting point of azelnidipine was seen as 119 ^{o}C while its ideal range is from 116-123^{o}C.[11,12] Various parameter of uv-spectroscopy for azelnidipine are given in table no 4.

Table no. 4.

Sr. no.	Parameter	Result
1	Wavelength(λ max)	257 nm
2	Solvent	Distilled grade methanol water
3	Accuracy	1.09 -0.83 %
4	Interday Precision (%RSD)	1.26 – 1.67 %
5	Intraday Precision (%RSD)	1.03 – 1.70 %
6	LOD	0.77
7	LOQ	2.36
8	% Assay	97.67 %

Correlation coefficient of Linearity was 0.9826.

c. (S. Shah – 2016)[17]

Various parameter of uv-spectroscopy for azelnidipine are given in table no 5.

Table no. 5.

Sr. no.	Parameter	Result
1	Wavelength(λ max)	257 nm
2	Solvent	Methanol:water (8:2)
3	Accuracy	0.15 -0.82 %
4	Interday Precision (%RSD)	-
a.	2 µg/ml	1.10 %
b.	6 µg/ml	0.10 %
c.	10 µg/ml	0.15 %
5	Intraday Precision (%RSD)	-
a.	2 µg/ml	1.15 %
b.	6 µg/ml	0.26 %
c.	10 µg/ml	0.29%
6	LOD	0.75
7	LOQ	2.75
8	% Assay	100.09 %

The value of % RSD for intra-day and interday precision was found to be less than 2. The value of % Recovery greater than 98% for this method shows that the method is accurate and free from the in interference of excipients used in formulation. % Recovery of formulation were found to be 99-102%.

CONCLUSION

The presented review highlights on UV- Spectroscopic analytical methods reported for estimation of azelnidipine in alone. According to this review, the most common used mobile phase for the estimation of the analyte is methanol and water to becomes a good resolution peak. In UV the correlation coefficient of calibration curve was found 0.98-0.99.

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