IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Human Journals
Research Article
April 2020 Vol.:18, Issue:1

Determination of Asenapine Maleate by UV Method

IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Juluri Krishna Dutta Tejaswi [*] [1]

[1] *Department of Pharmaceutical Analysis, NRI College of Pharmacy, Agiripalli Mandal, Vijayawada, Krishna district (AP), India.*

Submission: 24 March 2020
Accepted: 31 March 2020
Published: 30 April 2020

HUMAN JOURNALS
www.ijppr.humanjournals.com

Keywords: Asenapine Maleate, Acetonitrile, Methanol, Spectroscopic

ABSTRACT

The developed UV spectroscopic method followed Beer's law at the range of 10ppm to 50ppm and regression value obtained from a standard calibration curve of Asenapine Maleate was 0.999 which indicates good linearity. The relative standard deviation value obtained was less than 1 which indicates the precision of the method. The lower standard error value indicates the accuracy of the method. The Limit of Detection was found to be 0.154 ppm and Limit of Quantification was found to be 0.467 ppm which indicates the sensitivity of the method and Sandell's sensitivity was found to be 0.10899 ppm. The results obtained conveniently adopted for the routine estimation of Asenapine Maleate.

INTRODUCTION

Asenapine Maleate [1-2] is a second-generation (atypical) antipsychotic agent used in the treatment of schizophrenia with bipolar 1 disorder. Asenapine also belongs to the dibenzo-oxepino pyrrole class. It is also for severe post-traumatic stress disorder nightmares in soldiers as off-label use. FDA approved on August 13, 2009. Asenapine may improve cognitive function and negative symptoms in patients with schizophrenia. It is chemically (3aRS,12bRS)-5-Chloro-2-Methyl-2,3,3a,12btetrahydro-1Hdibenzo [2,3:6,7]oxepino[4,5-c]pyrrole(2z)-2-butene-dioate,org5222,trans-5-chloro-2,3,3a,12b-tetrahydro-2-Metyl -1H-dibenz(2,3:6,7) oxepino (4,5-c) pyrrole Maleate. Asenapine Maleate is a white to off-white non hygroscopic powder, slightly soluble in water, sparingly soluble in 0.1 M HCl. After a thorough literature survey, the present method was developed as per ICH Guidelines [3-5]. The proposed method was done keeping in view economy and using cost-effective mobile phase and buffer solution and the retention time was also found to be less compared to the existing methods as per literature reviews as shown in **Fig. 1.**

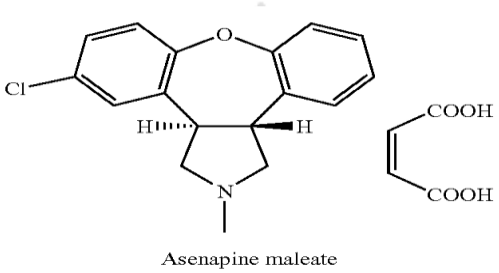

Fig. No. 1: Structure of Asenapine Maleate

MATERIAL AND INSTRUMENT [6-8]

Asenapine Maleate was obtained from Sun Pharma, Baroda. Methanol used was Thermo Electron India Pvt ltd; Lot No: 84776905-2. Ethanol used was Merck's Specialties Pvt ltd; Batch no: SG0F600451. Acetone used was Merck's Specialties Pvt ltd; Batch no: SF01600345. All other solvents used were of analytical grade only. Single Pan Balance manufactured by SHIMADZU Corporation of model no AX200. UV-Spectrophotometer manufactured by ELICO 159 India.

PREPARATION OF DRUG IN DIFFERENT SOLVENTS

Stock solutions were prepared by dissolving 10 mg of the pure drug made dilute up to 100ml using different solvents like Methanol, Ethanol, Water, and Acetone.

ABSORPTION MAXIMUM (λ_{Max}) [9-11]

The stock solution was diluted to get a concentration of 10ppm and scanned in the UV region (200-400nm). It was found that it exhibits maximum absorption at 270.9nm as shown in **Fig. 2-5.**

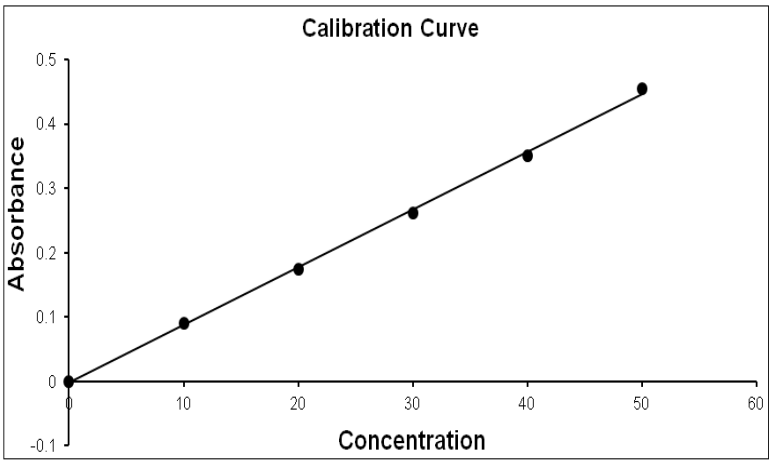

Figure No. 2: Standard Calibration Curve of Asenapine Maleate

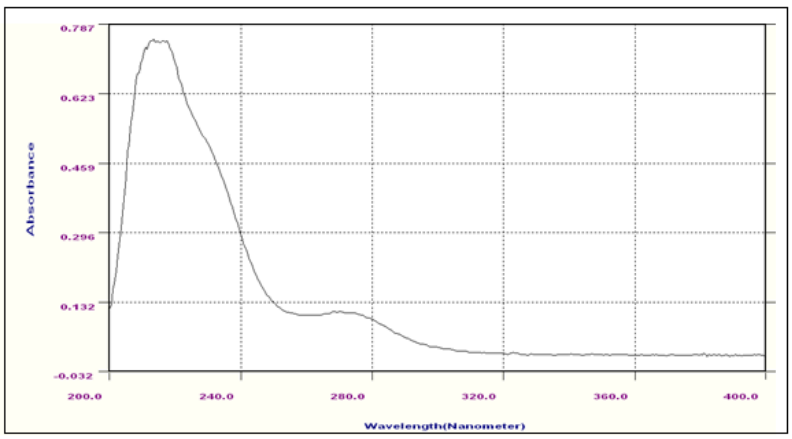

Figure No. 3: Determination of λ_{Max} of Asenapine Maleate in Ethanol

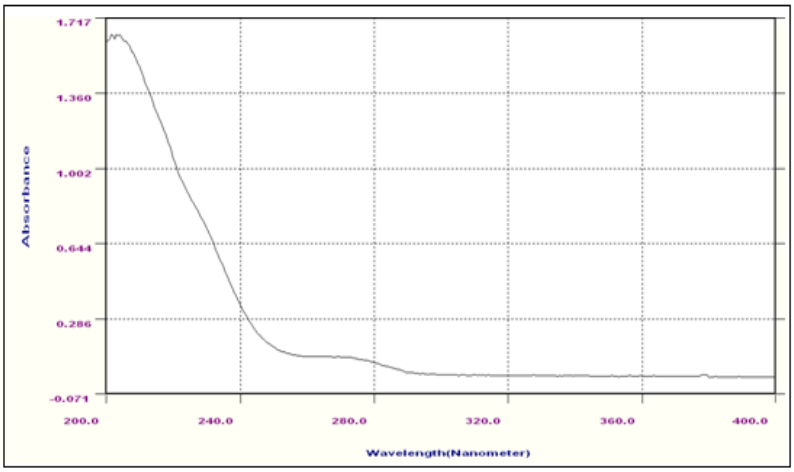

Figure No. 4: Determination of λ_{Max} of Asenapine Maleate in Water

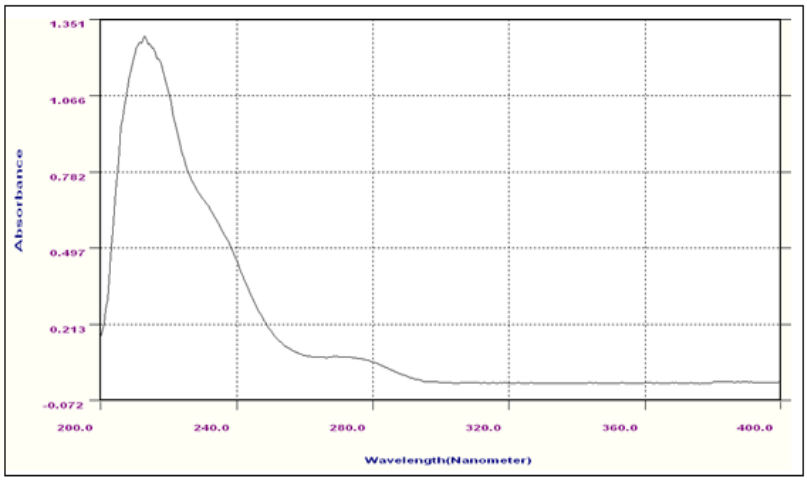

Figure No. 5: Determination of λ_{Max} of Asenapine Maleate in Methanol

METHOD VALIDATION [12-15]

Linearity

To find out the linearity range of the proposed UV spectrometric method, a curve was constructed by plotting absorbance obtained for the analyte against its concentrations. A series of 10 ppm, 20ppm, 30ppm, 40ppm, 50ppm were prepared for the standard calibration curve and absorbance was observed as shown in **Table 1**. A good linear relationship (r=0.99) was observed between the concentrations of Asenapine Maleate and the corresponding absorbance. The regression equation of the drug concentration over its absorbance was found to be Y=0.00904X-0.0052 (where y is the absorbance and x is the concentration of Asenapine Maleate) as shown in **Fig.6.**

Slope (m) = 0.00904

Intercept(c) = -0.0052

Regression factor (r) =0.999

Equation: y=0.00904x - 0.0052

Table No. 1: Linearity Values of Asenapine Maleate

Sr. No.	Concentration (ppm)	Absorbance
1.	10	0.09
2.	20	0.174
3.	30	0.262
4.	40	0.350
5.	50	0.454

Slope=0.00904: Intercept= -0.0052; Regression factor= 0.999

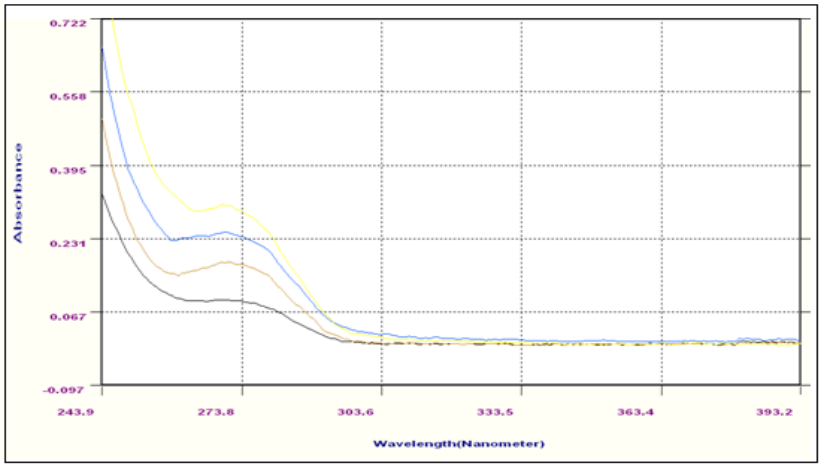

Figure No. 6: Linearity spectrum of Asenapine Maleate

Precision - Repeatability

The absorbance was observed repeatedly three times under the same experimental conditions as shown in **Table 2.**

Table No. 2: Precision Values of Asenapine Maleate

Sr. No.	Concentration(ppm)	Absorbance	Mean	Standard Deviation
1.	20	0.174	0.172	0.001527
	20	0.171		
	20	0.173		
2.	30	0.260	0.2603	0.00152
	30	0.262		
	30	0.259		
3.	40	0.349	0.35	0.001
	40	0.351		
	40	0.350		

Precision - Intermediate Precision

a. Analyst-Analyst: Three samples each of 30ppm concentration of Asenapine Maleate were prepared by three different analysts and absorbance was observed as shown in **Table 3.**

Table No. 3: Precision Values – Analyst – Analyst of Asenapine Maleate

Sr. No.	Concentration(ppm)	Absorbance	Mean	Standard Deviation
Analyst 1	30	0.263	0.262	0.001
	30	0.261		
	30	0.262		
Analyst 2	30	0.262	0.2613	0.00208
	30	0.259		
	30	0.263		
Analyst 3	30	0.264	0.262	0.00281
	30	0.263		
	30	0.260		

b. Spectrometer-Spectrometer: Three samples each of 30ppm concentration of Asenapine Maleate were prepared and absorbance was observed using different types of equipment as shown in **Table 4.**

Table No. 4: Precision Values - Spectrometer-Spectrometer of Asenapine Maleate

Instrument	Concentration(ppm)	Absorbance	Mean	Standard Deviation
Spectrometer-1 (ELICO)	30	0.262	0.262	0.001
	30	0.259		
	30	0.260		
Spectrometer-2 (SHIMADZU)	30	0.259	0.258	0.001527
	30	0.261		
	30	0.258		

c. Day-Day: Three samples each of 30ppm concentration of Asenapine Maleate were prepared and absorbance was observed. Again two fresh samples of the same concentration were prepared and absorbance was observed on the following day as shown in **Table 5.**

Table No. 5: Precision Values - Day-Day of Asenapine Maleate

Day	Concentration (ppm)	Absorbance	Mean	Standard Deviation
Day 1	30	0.262	0.262	0.001
	30	0.259		
	30	0.260		
Day 2	30	0.261	0.2603	0.001527
	30	0.263		
	30	0.259		

Precision - Reproducibility

Three samples each of 30ppm of Asenapine Maleate were prepared and absorbance was observed in different labs as shown in **Table 6.**

Table No. 6: Precision Values - Lab-Lab of Asenapine Maleate

Lab	Concentration(ppm)	Absorbance	Mean	Standard Deviation
Lab 1	30	0.262	0.262	0.001
	30	0.259		
	30	0.260		
Lab 2	30	0.264	0.2612	0.00208
	30	0.262		
	30	0.260		

Accuracy

Three samples each of 50 % (15ppm), 100 % (30ppm), 150 % (45ppm) concentrations of drugs were prepared and absorbance was measured as shown in **Table 7.**

Table No. 7: Accuracy Values of Asenapine Maleate

%	Concentration	Absorbance	% Recovery	Statistical Analysis		
				Mean	SD	%RSD
50%	**sample 1**	0.130	49.61%	49.74	0.5859	1.17
	sample 2	0.132	50.38%			
	sample 3	0.129	49.23%			
100%	**sample 1**	0.261	99.61%	99.86	0.7966	0.7977
	sample 2	0.264	100.76%			
	sample 3	0.260	99.23%			
150%	**sample 1**	0.393	150%	149.96	0.765	0.510
	sample 2	0.391	149.23%			
	sample 3	0.395	150.76%			

Robustness

A sample of 30ppm was prepared and absorbance was observed at ±5nm from absorption maxima as shown in **Table 8.**

Table 8: Robustness Values of Asenapine Maleate

Sr. No.	Concentration(ppm)	Wavelength(nm)	Absorbance
1.	30	265	0.259
2.	30	266	0.260
3.	30	267	0.261
4.	30	268	0.261
5.	30	269	0.261
6.	30	270	0.262
7.	30	271	0.261
8.	30	272	0.260
9.	30	273	0.260
10.	30	274	0.259
11.	30	275	0.257

System Sensitivity

A series of concentrations of 10 ppm, 20ppm, 30ppm, 40ppm, 50ppm were prepared and absorbance was measured. The Limit of Detection, Limit of Quantification, and Sandell's sensitivity were calculated from the data obtained as shown in **Table 9.**

Table No. 9: Sensitivity Values of Asenapine Maleate

Concentration (ppm)	Absorbance 1	Absorbance 2	Absorbance 3
10	0.09	0.085	0.092
20	0.174	0.178	0.169
30	0.262	0.265	0.258
40	0.350	0.402	0.346
50	0.454	0.459	0.448
Slope, m	0.00904	0.00972	0.0089

Average slope, m = 0.0092

Standard deviation, σ = 0.0004386

LOD = 3.3 σ /slope = 0.154µg/ml

LOQ = 10 σ /slope = 0.467µg/ml

SANDELL'S SENSITIVITY= 0.001/ mean of the slopes = 0.001/ 0.0092 = 0.10866 µg/ml

System Stability

The sample solution was analyzed after 24 hours at room temperature without any disturbance as shown in **Table 10.**

Table No. 10: Stability Values of Asenapine Maleate

Stability	Concentration(ppm)	Absorbance
1st day	30	0.262
After 24 hrs	30	0.261

RESULTS AND DISCUSSION

Table No. 11: Validation Results of Asenapine Maleate

Sr. No.	PARAMETERS	RESULTS	
1.	**ACCURACY**	50% sample	Mean = 49.74 S.D = 0.5859 % RSD = 1.177
		100% sample	Mean = 99.86 S.D = 0.7966 % RSD = 0.7977
		150% sample	Mean = 149.96 S.D = 0.765 % RSD = 0.510
2.	**SENSITIVITY**	LOD = 0.154 µg/ml LOQ = 0.467 µg/ml Sandell's sensitivity = 0.10866 µg/ml	
3.	**STABILITY**	No appreciable change	
4.	**LINEARITY**	Slope(m) = 0.00904 Intercept(c) = -0.0052 Regression factor(r) = 0.999 Equation: y= 0.00904x - 0.0052	

The proposed method was found to be simple, sensitive, rapid, and economical for the determination of Asenapine Maleate tablet formulation and had also been validated. The developed UV spectroscopic method followed Beer's law at the range of 10ppm to 50ppm and regression value obtained from a standard calibration curve of Asenapine Maleate was 0.999 which indicates good linearity. Hence the method can easily be adopted for the estimation of Asenapine Maleate.

REFERENCES

1. IP 2007 and USP 2005 pg No 22, for drug profile and activity.
2. U.S.P. Asian Edition United Pharmacopoeial Convention Inc, Rockville, 2005, Pg No 2386-2389.
3. ICH: Q2B, Analytical Validation – Methodology (November 1996), pg No 24.
4. ICH: Q2A, Text on validation of analytical procedure (October 1994), pg No 22.
5. ICH Q2 (R1), Validation of Analytical Procedures Text and Methodology November 2005, pg No 23.
6. Bently and Drivers, "Textbook of Pharmaceutical Chemistry," 8th Edition, 1985, O'Brein, Oxford University Press, Pg No 1 – 3.
7. Ewing, G.W, "Instrumental Methods of Chemical Analysis", 2nd Edition, 1960, MC Graw Hill Book Company, Pg No 1-3.
8. Gurdeep R. Chatwal and Sham K. Anand, "Instrumental Methods of Chemical Analysis 5th Edition, Himalaya Publishing House, Pg No 1.2 – 1.5.
9. James. W Munson, "Modern Methods of Pharmaceutical Analysis, 2001, Medical Book Distributors, Mumbai. Pg No 17-54.
10. Erwing, G. W., "Instrumental Methods of Chemical Analysis,' 2nd Edn.,1960 McGraw Hill Book Company, Pg No 3-5
11. Jenkins GL., Knevel, A.M and Digangi, F. E., "Quantitative Pharmaceutical Chemistry". 7th Edn. McGraw Hill Book Co., New York, Edition 1977, Pg No 297-299.
12. Beckett, A. H and Stenlake, J. B., "Practical Pharmaceutical Chemistry" 4th Edition. Part II, CBS Publisher and Distributor, New Delhi, 1997, Pg No 277-278
13. A.H. Beckett and J.B. Stanlake "Text Book of Practical Pharmaceutical Chemistry" 4th Edition Part II, C.B.S., Publishers and Distributors, New Delhi. Pg No158-164.
14. Sharma B.K., "Instrumental Method of Chemical Analysis", 23rd Edn. Goal publication house, 1991, Merrut, Pg No 39-133.
15. Ravi Shankar, "Textbook of Pharmaceutical Analysis"3rd Edition. R_x Publications, 2006, pg No 1-27.

Author Name – Corresponding Author

Dr. Juluri Krishna Dutta Tejaswi,

Department of Pharmaceutical Analysis, NRI College of Pharmacy, Agiripalli Mandal, Vijayawada-520007, Krishna district (AP), India.