International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 7; Issue 6(C); June 2018; Page No. 13292-13296
DOI: http://dx.doi.org/10.24327/ijcar.2018.13296.2363

Research Article

UV-SPECTROPHOTOMETRIC ANALYTICAL METHOD DEVELOPMENT AND VALIDATION FOR DETERMINATION OF TELMISARTAN IN PHARMACEUTICAL DRUG AND DRUG PRODUCT (TABLET DOSAGE FORM)

Rajesh S. Jadhav., Milind B. Ubale and Jagdish V. Bharad*

Department of Chemistry, Vasantrao Naik Mahavidyalaya, Aurangabad–431003, (M.S) India

A R T I C L E I N F O

Article History:

Received 8th March, 2018
Received in revised form 24th April, 2018 Accepted 16th May, 2018
Published online 28th June, 2018

Key words:

Validation, Telmisartan Tablet, UV Spectrophotometer.

A B S T R A C T

An easy, simple, specific, speedy, precise and accurate UV Spectrophotometric method have been developed and validated for content determination of Telmisartan. Drug Telmisartan demonstrated the absorption maxima in at 296.5 nm and found was linear for a range of 5 µg/ml –25 µg/ml with correlation coefficient of 0.9994. The limit of detection (LOD) of Telmisartan was found to be 1.3µg/ml and the limit of quantification (LOQ) of Telmisartan was found to be 4.5µg/ml. The analytical method validation of the above proposed method was performed by carrying out precision and accuracy studies. The Accuracy percentage recovery on three different levels i.e. 80%, 100% and 120% was found to be 79.6%, 100.7% and 117.9% respectively. The proposed analytical method demonstrated good Intra precision (Repeatability) with relative standard deviation 0.896% and Inter precision with relative standard deviation is 0.671% which is less than 2. The proposed analytical method was validated for the test parameter Specificity, Precision, Linearity and range, Ruggedness, Accuracy and recovery. Hence proposed analytical method for content determination of Telmisartan formulation drug in tablet dosage forms by UV spectrophotometer in pharmaceutical found easy, simple, accurate, precise and reproducible, economical and can be applied for the everyday quality control analysis.

INTRODUCTION

Telmisartan is an Anti-hypertensive drug belongs to Angiotensin II receptor antagonist (ARB) [1] used in effective hypertension, reduces the arterial blood pressure. The IUPAC name is 4'-[(1,4'-dimethyl-2'-propyl [2,6'-bi-1H-benzimidazol]-1'-yl) methyl]-[1,1'-biphenyl]-2-carboxylic acid. Telmisartan having molecular formula $C_{33}H_{30}N_4O_2$ and molecular weight 514.62g/mol[2]. It is official in United States pharmacopoeia [3] with -Potentiometric titration method. Literature survey reveals that few analytical methods are available including HPTLC [4], HPLC [5-9] and UV Spectrophotometry [10-21].

In the current assessment work, an easy, simple, accurate and sensitive method for determining Telmisartan content in drug substance pure form and drug product (Tablet Dosage Form) was introduced. No simple and rapid work has been reported for determination of Telmisartan. All these reported methods either took a long time for analysis or employ mobile phases with pH adjustment of Buffer solutions, Fine crushing of tablet, carefully weighing of crushed tablet powder avoiding lumps/granules of fine material all through sample preparation, which is tedious and anomalous[4-21], especially for routine testing of quality control samples of assay determination study. Hence it was felt necessary to build up an easy, simple, rapid, economical and precise Spectrophotometric method for the direct determination of Telmisartan (Tablet).

The current research work covenant with the development of UV Spectrophotometric method and it's validation as per International Conference on Harmonization (ICH) guideline [22-23]. The developed method was found to be easy, simple, specific, stable, rapid, accurate, precise, reliable, less expensive and time saving by UV Spectrophotometric method[10-21] for the determination of Telmisartan content in drug substance and drug product (Tablet Oral Dosage Form).

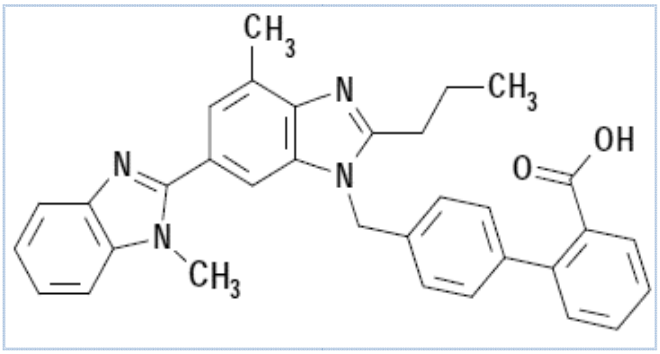

Figure 1 Chemical structure of Telmisartan

Corresponding author:* **Jagdish V. Bharad
Department of Chemistry, Vasantrao Naik Mahavidyalaya, Aurangabad–431003, (M.S) India

MATERIALS AND METHODS

Instrumentation and Materials

U.V. visible double beam spectrophotometers SL 210 Elico with Spectra treat software having path length 1cm U.V. matched quartz cells were used. Telma-20 mg Tablet (Telmisartan Tablet IP 20 mg, Manufacturer - Glenmark Pharmaceutical) sample procured from market and Telmisartan Standard from Cureworth Pharmaceuticals Mumbai, Maharashtra. All chemicals, solvents and reagents i.e. Sodium Hydroxide, Acetic acid, Water and Methanol used, were analytical grade and purchased from S.D. Fine Chem Ltd /Merck Ltd, India/Qualigens.

Method Development

Preparation of Diluent Solution

Transferred about 300 ml of water to the 1000 ml volumetric flask, then slowly added about 4 gm of Sodium Hydroxide with stirring and add 3 ml of Acetic Acid, stir and mixed well to dissolve completely, then with constant stirring slowly added Methanol up to mark to make volume 1000 ml. used this solution as diluent.

Preparation of Standard Solution

Weighed accurately about 120 mg of Telmisartan and transferred to 200 ml amber volumetric flask. Dissolved in diluent and made up the volume to 200 ml, further transferred 2 ml of solution to 100 ml amber volumetric flask.Made volume upto the mark to get a concentration 12µg/ml.

Selection of wavelength for analysis of Telmisartan

The standard solution having concentration 12µg/ml was scanned at 200 nm to 400 nm with diluent as the blank to detect maximum wavelength (Figure-2).

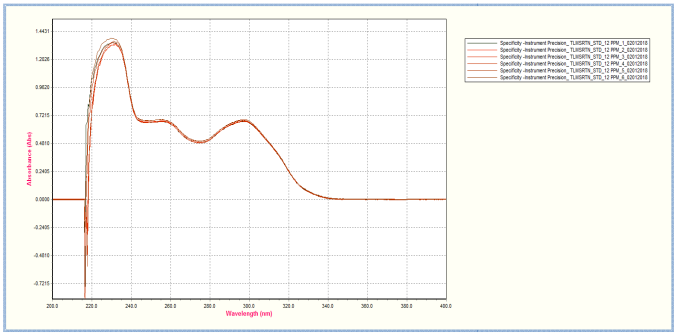

Figure 2 Estimation of Maxima of Telmisartan

From the above (Figure-2) spectra of Telmisartan wavelength maxima identified for quantification were 296.5 nm (λmax).

Validation of proposed Analytical Method

The proposed method was validated according to International Conference on Harmonization (ICH) guidelines for validation of analytical procedures [22-23]. Analysis of variance was used to ensure the validity and performance effectiveness of the proposed analytical methods.

Specificity

Specificity is the capacity to appraise obviously the analyte in the existence of components which could be predictable to be present. In general these might consist of impurities, degradants, matrix, etc. Specificity was performed by scanning of Diluent solution and Telmisartan Standard solution of concentrations 12 µg/ml, 15 µg/ml and 20 µg/ml in Spectrophotometric range from 200 nm to 400 nm to substantiate specific absorption maxima at predefined wavelength i.e. 296.5 nm and solution stability study executed to assess the solution stability at different time interval up to 26 hrs.

Instrument Precision

Instrument precision was carried out to assess the suitability of the developed analytical method with respect to capacity of instrument consistency to afford the precise wavelength maxima when scanned the Telmisartan Standard solution of having concentrations 12 µg/ml in the UV range from 200 nm to 400 nm. To make sure specific absorption maxima at predefined wavelength 296.5 nm with reproducible absorption detection. Six separate standard preparations were scanned / analyzed according to the proposed analytical method of analysis. The % RSD due to Telmisartan concentration for the six standards was found 0.957%. The % RSD due to Telmisartan concentration for the instrument precision meets the requirements. Results are tabulated in the Table 1.

Table 1 Instrument Precision

Sr.No.	Standard number	Absorbance @296.5 nm	% RSD
1	Standard Preparation -1	0.6678	
2	Standard Preparation -2	0.6745	
3	Standard Preparation -3	0.6703	
4	Standard Preparation -4	0.6689	0.957%
5	Standard Preparation -5	0.6847	Limit < 2%
6	Standard Preparation -6	0.6779	
	Average Absorbance	0.6740 →	

Linearity and Range

The linearity of an analytical method is the ability to elicit test results, which are directly proportional to the concentrations of drug in a given range. Linearity justifies the use of single-point calibrations. The correlation coefficient of the Regression line for was found that 0.9994.

Six levels of six different concentrations of Telmisartan Standard solution with concentrations range from 5µg/ml, 10µg/ml, 12µg/ml, 15µg/ml, 20µg/ml and 25µg/ml, in the range relative to the working concentrations, were prepared and recorded the absorbance as per proposed method of analysis. A linear regression curve was drawn, the correlation coefficient (R2) and assessment value calculated. The correlation coefficient (R2) for Telmisartan obtained is 0.9994. The plot is a straight line and the results are tabulated in the Table 2 and Curve is shown in the Figure 3.

Table 2 Linearity and Range

Sr. No.	Standard Concentration (µg/ml)	Absorbance @ 296.5 nm	Correlation coefficient
1	5	0.3107	
2	10	0.5478	
3	12	0.6792	
4	15	0.8163	0.9994
5	20	1.0654	Limit ≥0.999
6	25	1.3490	

Figure 3 Linearity and Range of Telmisartan

Limit of Detection and Limit of Quantification

For determination of Limit of Detection and Limit of Quantification assessed Telmisartan Standard solution through concentration's range from 5µg/ml, 10µg/ml, 12µg/ml, 15µg/ml, 20µg/ml and 25µg/ml, considering the relative range of the working concentrations followed by the slope ratio Limit of detection of Telmisartan were found to be 1.3 µg/ml and Limit of Quantitation of Telmisartan were found to be 4.5 µg/ml.

Analytical Method Precision

The precision of an analytical method expresses the degree of conformity surrounded by individual test results when the method is applied to multiple sampling of a homogenous sample.

Method of analysis for Tablet Formulation

Determined the weight of 10 tablets and transferred to 250 ml amber volumetric flask. Dissolved in about 150 ml diluent, Sonicated for 20 minute with intermittent shaking and made up the volume to 250 ml with diluent. The solution was filtered through Whatmann filter paper, discarding first few ml of filtrate, and further transferred 3 ml of solution to 200 ml amber volumetric flask.

Intra Precision (Repeatability)

This parameter determines the repeatability of Telmisartan Tablet 20 mg assay results under the same operating conditions over a short period of time. The % RSD due to Telmisartan Tablet 20 mg concentration for the six samples was found to be 0.896%. Six separated sample preparations were analyzed according to the proposed method of analysis. The % RSD due to Telmisartan Tablet 20 mg concentration for the assay meets the requirements. Results are tabulated in the Table 3.

Table 3 Intra Precision (Repeatability) Results

Sr. No.	Sample number	Telmisartan Tablet 20 mg		% RSD of Six Assay content
		% Assay content	Assay content in mg	
1	Sample Preparation -1	100.2	20.035	
2	Sample Preparation -2	100.4	20.070	
3	Sample Preparation -3	98.8	19.764	
4	Sample Preparation -4	98.6	19.713	
5	Sample Preparation -5	99.0	19.805	0.896% Limit < 2%
6	Sample Preparation-6	100.6	20.127	
	Average % Assay	99.6 ⟶	19.919	

Inter Precision (Repeatability)

This parameter determines the Intermediate repeatability of Telmisartan Tablet 20 mg, assay results under the same operating conditions test performed on a different day, using different makes of reagents and solvents. The % RSD due to Telmisartan Tablet 20 mg concentration for the six samples was found to be 0.671%. Six separated sample preparations were analyzed according to the proposed method of analysis. The % RSD due to Telmisartan Tablet 20 mg concentration for the assay meets the requirements. Results are tabulated in the Table 4.

Table 4 Inter Precision (Repeatability) Results

Sr. No.	Sample number	Telmisartan Tablet 20 mg		% RSD of Six Assay content
		% Assay content	Assay content in mg	
1	Sample Preparation -1	99.6	19.929	
2	Sample Preparation -2	98.9	19.778	
3	Sample Preparation -3	100.7	20.133	
4	Sample Preparation -4	99.2	19.849	0.671% Limit < 2%
5	Sample Preparation -5	98.9	19.772	
6	Sample Preparation -6	99.4	19.879	
	Average % Assay	99.4 ⟶	19.890	

Ruggedness

Ruggedness of the method was determined by carrying out the analysis on different days, different makes of reagents and solvents. The respective test assay results of Telmisartan Tablet 20 mg having concentration as 12µg/ml was illustrious. The result is expressed as shown in table 4. The developed method for estimation of Telmisartan Tablet 20 mg was found to be rugged as Shown in table 5.

Table 5 Ruggedness

Sr. No.	Precision	% RSD of assay of Six Preparation	Limit For Ruggedness
1	Intra Precision	0.896	
2	Inter Precision	0.671	
	% RSD of Overall 12 Assay content	0.762	NMT 2%

Accuracy

This parameter determines the accuracy of the assay results under the same operating conditions test.

A Telmisartan Tablet 20 mg sample was constituted analyzed for the accuracy with known quantity of standard samples of Telmisartan at 80%, 100%, 120% concentration levels and assayed as per the method stated under proposed analytical Methods respectively. Three determinations were performed under each concentration levels respectively. Results are shown in Tables 6, 7, 8. The % RSD due to recovery of Telmisartan at 80%,100%, 120% concentration levels was found to be 79.6%, 100.7% and 117.9% respectively. Nine sample preparations were analyzed according to the proposed method of analysis. The %RSD due to Telmisartan Tablet 20 mg concentration for the assay meets the requirement and accuracy of recovery is within 90.0% to 110%. Results are tabulated in the Table 6, 7, 8.

Table 6 Accuracy and Recovery Results @ 80 % Concentration level

Sr.No.	Accuracy @ 80% level	Recovery of Telmisartan Tablet 20 mg % Assay content	% Recovery 90.0% to 110%	% RSD
1	Sample Preparation -1	79.5		1.131
2	Sample Preparation -2	80.5	99.5	%
3	Sample Preparation -3	78.7		Limit
	Average % Assay ⟶	79.6		< 2%

Table 7 Accuracy and Recovery Results @ 100 % Concentration level

Sr. No.	Accuracy @ 100% level	Recovery of Telmisartan Tablet 20 mg % Assay content	% Recovery 90.0% to 110%	% RSD
1	Sample Preparation -1	102.9		
2	Sample Preparation -2	99.3		1.920%
3	Sample Preparation -3	99.7	100.7	Limit
	Average % Assay ⟶	100.7		<2%

Table 8 Accuracy and Recovery Results @ 120 % Concentration level

Sr.No.	Accuracy @ 120% level	Recovery of Telmisartan Tablet 20 mg % Assay content	% Recovery 90.0% to 110%	% RSD
1	Sample Preparation -1	117.7		
2	Sample Preparation -2	118.3		0.239%
3	Sample Preparation -3	117.8	98.3	Limit <
	Average % Assay	117.9 ⟶		2%

Solution Stability

Solution stability of the Telmisartan Tablet 20 mg sample solution was performed up to 26 hrs with different time interval and found the solution is stable showing cumulative % RSD of different time interval is 1.081 which is less than the 2. Hence the Telmisartan Tablet 20 mg sample solution is found stable up to 26 hrs at room temperature and recommended for 24 hrs solution stability (%RSD 0.789).

RESULTS AND DISCUSSION

The method discussed in the present work provides an easy, simple, stable, accurate, precise, reliable, rapid, less expensive (Economical), time *saving* and convenient method for the analysis of Telmisartan Tablet 20 mg using U.V. Spectrophotometry. λ max selected for quantitation was 296.5 nm. In the developed analytical method, the linearity was observed 0.9994 in the concentration range of 5 µg/ml -25 µg/ml.

Method precision for the Telmisartan Tablet 20 mg at concentrations level 12µg/ml was found in the range of 98.6%-100.7%. Accuracy of the proposed method was ascertained by recovery studies and the results were expressed as percent recovery and were found in the Range of 98.3%-100.7%. Values of standard deviation and coefficient of variance was satisfactorily indicating the accuracy of the method. Intra-day and Inter-day precision studies were carried out by analyzing the sample of Telmisartan Tablet 20 mg at different time interval on the same day and on different days respectively. Standard deviation and coefficient of difference for Intra-day and Inter-day precision studies was found to be less than 2 indicating precision of the proposed method.

Based on the outcome of analytical method development and analytical validation study test results, it was found that, the proposed analytical method for determination of Telmisartan and Telmisartan Tablet 20 mg by UV Spectrophotometry is Accurate, Precise, Reproducible, Stable, Easy, Simple, Rapid Time saving and less expensive (Economical). The analytical method can be employed for routine analysis in quality control of Telmisartan and Telmisartan Tablet in pharmaceutical.

Acknowledgement

The authors are thankful to Principal of Vasantrao Naik Mahavidyalaya Aurangabad for providing the laboratory facilities. Authors are thankful to Cureworth Pharmaceuticals Mumbai, Maharashtra for providing Telmisartan gift Standard and Dakshayni Pharmacy, Gulmandi Aurangabad for providing Sample 'Telma-20' (Telmisartan Tablet IP 20 mg, Glenmark Pharmaceuticals).

References

1. Telmisartan drug bank available online: www.drugbank.ca/ drug /DB00966.
2. The Merck Index, Maryadele J.O. Neil.Eds.14 Editions, Published by Merck Research
3. Lab, Division of Merck & Co. White House Station, NJ USA. 2006; 1069. 3. United States Pharmacopoeia Published by the United States Pharmacopeial convention Rockville MD US. Volume USP35-NF30 2012; 4776.
4. V.A.Patel and P.G.Patel. Development and Validation of HPTLC Method for the Simultaneous Estimation of Telmisartan and Ramipril in Combined Dosage Form. *International Journal on Pharmaceutical and Biological Research* 2010; Volume 1(1): 18-24.
5. Subhashini.E and B.Syama Sundhar. New Analytical Method Development and Validation for the Simultaneous Estimation of Telmisartan and Hydrochlorothiazide in Bulk and Tablet Dosage Form Using RP-HPLC. *Caribbean Journal of Science and Technology* 2014; Volume 2: 519-529.
6. Sunil Jawla, K Jeyalakshmi and T Krishnamurthy. Development and Validation of simultaneous HPLC method for Estimation of Telmisartan and Ramipril in Pharmaceutical Formulations. *International Journal of PharmTech Research* April-June 2010; Volume 2, No.2: 1625-1633.
7. Pravin Y. Khandagale, Nitin S. Bhajipale. RP-HPLC Method Development and Validation for Simultaneous Estimation of Cilnidipine and Telmisartan in Combined Pharmaceutical Dosage Form. *International Research Journal of Pharmacy* 2017; 8 (9):118-121.
8. G. Vijay Kumar, T. Murthy and K. Sambasiva Rao. Validated RP-HPLC Method for the Estimation of Telmisartan in Serum Samples. *International Journal of Research in Pharmacy and Chemistry* 2011; 1(3): 703-706.
9. Dhanashri S. Rane and Pratip K. Chaskar. Development and validation of stability indicating RP-HPLC method for simultaneous determination of Telmisartan and Hydrochlorothiazide from their combination drug product, Der Pharmacia Lettre 2013; 5 (6):127-134.
10. Vinit Chavhan, Rohini Lawande and Jyoti Salunke. UV Spectrophotometric Method Development and Validation for Telmisartan in Bulk and Tablet Dosage Form. *Asian Journal of Pharmaceutical and Clinical Research* 2013; Volume 6 Issue 4: 19-21.
11. Rajesh S. Jadhav and Jagdish V. Bharad. Analytical Method Development and Validation for estimation of Bisoprolol Fumarate in bulk and tablet dosage form by UV spectroscopic method, *International Journal of Universal Science and Technology*-ACTRA-2018002 March2018; 4 [1]:008-017.

12. Paola A. A. Borba, Caroline Cavalleri. Development and Validation of Analytical Methods for Telmisartan Quantification in Raw Material and in Tablets by UV-Spectrophotometer and HPLC. *Latin American Journal of Pharmacy* 2017; 36 (9): 1858-1866.
13. Kishanta Kumar Pradhan and Uma Shankar Mishra. Method development and Validation of Telmisartan in Bulk and Pharmaceutical Dosage Forms by UV Spectrophotometric Method. *International Journal of Research in Pharmaceutical Sciences* 2011;2(4): 526-530.
14. A.M Tamboli and M.J Jamadar. UV-Spectrophotometric Determination of Telmisartan and Hydrochlorothiazide in Combined Tablet Dosage Form Using Simultaneous Equation Method. *International Journal of Advances in Pharmaceutical Analysis*. IJAPA-2014; Volume 4 Issue 1: 18-22
15. Lakshmana Rao and Prasanthi T. Method development and validation for simultaneous determination of Telmisartan and Ramipril by UV Spectrophotometry. *Indian Journal of Pharmacy and Pharmacology* October-December 2016; 3(4); 221-224.
16. Rajesh S. Jadhav and Jagdish V. Bharad. Analytical Method Development and Validation of Spectroscopic Method for Estimation of Metoprolol Succinate. Scholars Research Library-Der Pharmacia Lettre 2017; 9 [6]:285-297.
17. Mayur Modi, Rikin Shah and R. Mashru. Development and Validation of Spectrophotometric Methods for Simultaneous Estimation of Metoprolol Succinate and Telmisartan in Combined Pharmaceutical Formulation. *International Journal of Pharmaceutical Sciences and Research* 2012; 3(5): 1348-1354.
18. K. P. Hirpara and Dave V. M,. UV-Spectrophotometric Determination for Simultaneous Estimation of Amlodipine Besylate and Telmisartan in Combination. *Journal of Pharmaceutical Sciences and Bioscientific Research*. JPSBR May-Jun 2012; Volume 2. Issue 3: (133-137).
19. Rajesh S. Jadhav and Jagdish V. Bharad. Development and Validation of Analytical method for estimation of Nimodipine content by UV spectroscopic method. World *Journal of Pharmaceutical Research* 2018; 7 [5]:1075-1084.
20. Pandey A., Sawarkar H., Singh M., Dr. P Kashyap, Ghosh P. UV Spectrophotometric Method for estimation of Telmisartan in Bulk and Tablet Dosage Form. *International Journal of Chem Tech Research* 2010; 2(1): 657-660.
21. Rajesh S. Jadhav and Jagdish V. Bharad. Analytical Method Development and Validation for estimation of Tamsulosin Hydrochloride by UV-Spectroscopic method. *International Journal of Chem Tech Research* 2017; Volume 10 No.5: 740-747.
22. International conference on harmonization of technical requirements for registration of Pharmaceuticals for Human Use: Q2 (R1) Validation of analytical Procedures Text and Methodology. Switzerland 2005: Version 4.
23. European Pharmacopoeia General Chapter Analytical Method Validation Published by European Directorate for Quality of Medicines and Healthcare (EDQM) France. 9.0th Edition 2016-17.

How to cite this article:

Rajesh S. Jadhav *et al* (2018) 'UV-Spectrophotometric Analytical Method Development And Validation For Determination of Telmisartan in Pharmaceutical Drug And Drug Product (Tablet Dosage Form)', *International Journal of Current Advanced Research,* 07(6), pp. 13292-13296. DOI: http://dx.doi.org/10.24327/ijcar.2018.13296.2363

****