Development and Validation of a Green UV–Spectrophotometric Method for the Estimation of Olmesartan Medoxomil Using Eco-Friendly Solvents

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Abstract:

The present study successfully established a validated UV spectrophotometric analytical method for the estimation of OlmesartanMedoxomil in bulk drug and marketed tablet formulations. The method was developed using a simple solvent system and optimized analytical conditions, ensuring ease of operation and reproducibility.

Validation of the method as per ICH guidelines confirmed that the method is linear, accurate, precise, robust, and selective. The assay results of marketed formulations demonstrated that the developed method can reliably estimate the drug content without interference from formulation excipients.

Statistical evaluation of validation parameters showed %RSD values well within acceptable limits, indicating high precision and reliability of the method. The robustness study further confirmed that minor variations in experimental conditions do not affect analytical performance.

In conclusion, the developed UV spectrophotometric method is economical, rapid, and suitable for routine quality control analysis of OlmesartanMedoxomil in pharmaceutical industries, academic laboratories, and regulatory environments. The method can be confidently applied for batch-to-batch quality assessment of tablet formulations containing OlmesartanMedoxomil

Key Words: High performance liquid chromatography (HPLC) ,olmesartan medoxomil (OM), ultra high-performance liquid chromatography (UPLC), UV spectroscopy.

INTRODUCTION

INTRODUCTION TO SPECTROSCOPY[1, 2, 3]

Spectroscopy is a general term for the science that deals with the interaction of various types of radiation with matter. Spectroscopy and Spectroscopic methods refer to the measurement of the intensity of radiation with a photometric transducer or other type of electronic device.

The spectrophotometric assay of drugs rarely involves the measurement of absorbance of samples containing only one absorbing component. The pharmaceutical analyst frequently encounters the situation where the concentration of one or more substances is required in samples known to contain other absorbing substances, which potentially interfere in the assay 4. If the formula of the samples is known, the identity and concentration of the interferences are known and the extent of interference in the assay may be determined.The present research envisages the development and validation of a simple, accurate, precise, and cost-effective UV spectrophotometric analytical method for the quantitative estimation of OlmesartanMedoxomil in its bulk drug and marketed tablet formulations (Olmesar 20 and Olmecip 20).

Materials & METHODS

CHEMICALS AND SOLVENT

Table No. 1: Chemicals and Solvents Used

S.NO.	CHEMICALS	MANUFACTURER
1.	OlmesartanMedoxomil	Working standard , macleods Pharmaceutical Ltd.
2	Acetonitrile(HPLC)	Merck Ltd., India
3	Methanol (HPLC)	Merck Ltd., India
4	Glacial Acetic Acid	Merck Ltd., India
5	Water(HPLC)	Merck Ltd., India

MARKETED FORMULATION OF OLMESARTAN MEDOXOMIL

1. Olmesar 20, Macleods Pharmaceutical Ltd.,Himachal Pradesh, (INDIA)

Batch no. AOJ-803

Olmesartan20mg

2. Olmecip 20, Macleods Pharmaceutical Ltd., Himachal Pradesh, (INDIA)

Batch no. NA-6183

Olmesartan 20mg

3 DETERMINATION OF SOLUBILITY OF OLMESARTAN MEDOXOMIL

Solubility of OlmesartanMedoxomil was performed in different solvents

ANALYTICAL METHOD DEVELOPMENT BY UV SPECTROPHOTOMETRY

INSTRUMENTS AND TOOLS (UV SPECTROPHOTOMETER)

Athermospectronic model of Elico India SL-159 UV/VIS Spectrophotometer with 1cm. matched quartz cells was used.

EXPERIMENTAL PROCEDURE

Preparation of Standard Stock Solution

10 mg of OlmesartanMedoxomil was weighed accurately and transferred to a 10ml volumetric flask, and the volume was adjusted to the mark with the mobile phase (acetonitrile: water (80:20 v/v), to give a stock solution of 1000ppm.

Preparation of Working Standard Solution

From stock solutions of OlmesartanMedoxomil 1 ml was taken and diluted up to 10 ml. from this solution 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4 ml solutions were transferred to 10ml volumetric flasks and make up the volume up to 10 ml with mobile phase, gives standard drug solution of 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24 □g/ ml concentration.

Preparation of the Calibration Curves of the Drug

Each of the standard drug solutions were injected 3 times and the mean peak area of drug was calculated) and plotted against the concentration of the drug. The regression equation was found out by using this curve. A typical chromatogram and the calibration curve were obtained.

Preparation of Analysis of Tablet formulation

Twenty tablets were accurately weighed and finely powered. Tablet powder equivalent to 10 mg of OlmesartanMedoxomil was taken in 10 ml of volumetric flask; resultant solution was filtered through Whatmann filter paper and finally volume made up to mark with same solvent. 1 ml of filtrate was taken in 10 ml volumetric flask and volume was made up to 10 ml with mobile phase to obtain concentration of 100µg/ml. Further 0.1 ml of this solution was taken and diluted up to 10 ml obtain final concentration of 10µg/ml of OlmesartanMedoxomil. The resulting solution was again filtered using Whatmann filter paper no.41 and then sonicated for 10 min.

Finally diluted sample was taken and absorbance was measured by using spectrophotometer at 258 nm. Concentration of OlmesartanMedoxomil was found out by using regression equation .

VALIDATION

LINEARITY

Linearity of analytical procedure is its ability (within a given range) to obtain test, which are directly proportional to concentration of analyte in the sample. The calibrationplot was contracted after analysis of twelve different (from 2 to 24 □g/ ml) concentrations and absorbance for each concentration was measured three times, and mean was calculated. The regression equation and correlation coefficient of curve .

ACCURACY

Recovery studies were performed to validate the accuracy of developed method. To preanalysed sample solution, a definite concentration of standard drug (80%, 100%, and 120%) was added and then its recovery was analyzed and result was shown in Table.

PRECISION

REPEATABILITY

Standard dilutions were prepared and three replicates of each dilution were analyzed in same day for repeatability and results were subjected to statistical analysis. Standard dilutions were prepared and three replicates of each dilution were analyzed in different days and by different analysts. Statistical analysis was carried out.

(A) Intermediate Precision

(a) Day to Day

(b)Analyst to Analyst

The intermediate precision expresses with in laboratories variation: different days, different analysts, different equipment etc. The standard dilution was prepared and three replicate of each dilution were analyzed by different analysts for all the developed methods

ROBUSTNESS

As per ICH norms, small, but deliberate variations, by altering the pH and / or concentration of the mobile phase were made to check the method capacity to remain unaffected. The change was made in the ratio of mobile phase, instead of acetonitrile: water (80:20v/v), acetonitrile: water (70:30v/v) was used as a mobile phase.

RESULTS AND DISCUSSION

RESULTS OF SOLUBILITY STUDY

Table No. 2: Solubility of OlmesartanMedoxomil

S. No.	Solvent	Solubility
1	Water	Insoluble
2	0.1 N HCl	Insoluble
3	0.1 N NaoH	Soluble
4	Methanol	Freely soluble
5	Acetonitrile	Freely soluble
6	80% Acetonitrile	Soluble
6	50 % Acetonitrile	Sparingly soluble
7	Ethanol	Soluble
8	Acetate buffer pH 3.7	Soluble
9	Phosphate buffer pH 7.4	Soluble

RESULTS OF U.V. METHOD

PREPARATION OF THE CALIBRATION CURVES OF THE DRUG

Table No. 3: Linearity of OlmesartanMedoxomil

Conc µg/mL	0	2	4	6	8	10	12	14	16	18	20	22	24
Rep.													
1	0	0.125	0.201	0.321	0.457	0.539	0.625	0.786	0.889	0.996	1.121	1.297	1.502
2	0	0.150	0.236	0.339	0.483	0.593	0.732	0.807	0.936	1.103	1.231	1.411	1.457
3	0	0.076	0.295	0.366	0.434	0.626	0.785	0.909	1.091	1.171	1.338	1.333	1.491
Mean	0	0.117	0.244	0.342	0.458	0.586	0.714	0.834	0.972	1.090	1.230	1.347	1.450
S.D.	00	0.037	0.047	0.022	0.024	0.043	0.081	0.065	0.105	0.088	0.108	0.058	0.024
R.S.D%	000	0.321	0.194	0.663	0.053	0.074	0.114	0.078	0.108	0.080	0.088	0.043	0.015

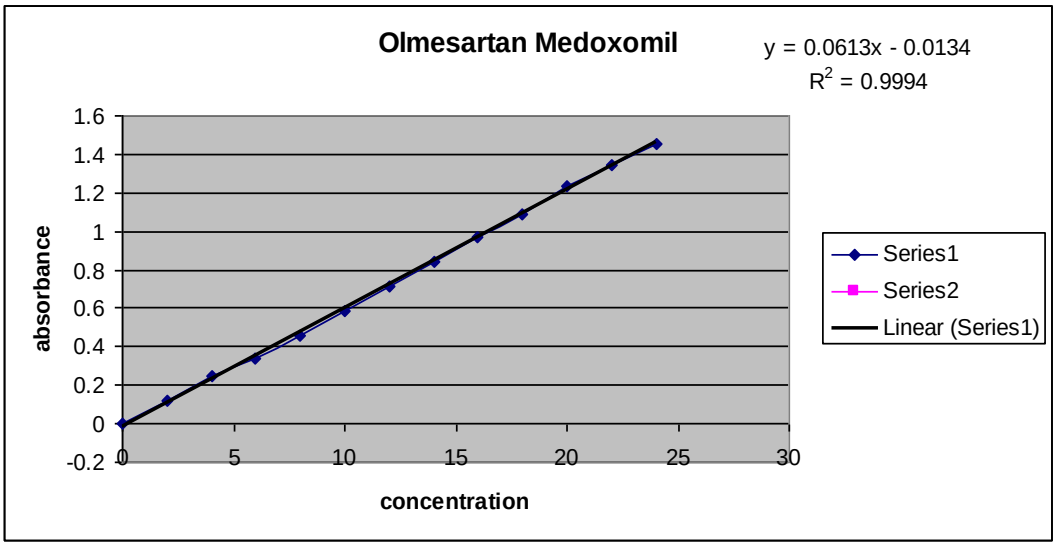

Figure No. 1: Standard Calibration Curve of Pure OlmesartanMedoxomil

Regression Equation

Y= mx +c, AUC = 0.0134conc. + 0.0134

Y= AUC

m= slope = 0.0613

X= Conc. in µg/ml

c= Intercept 0.0134

r^2= 0.9996

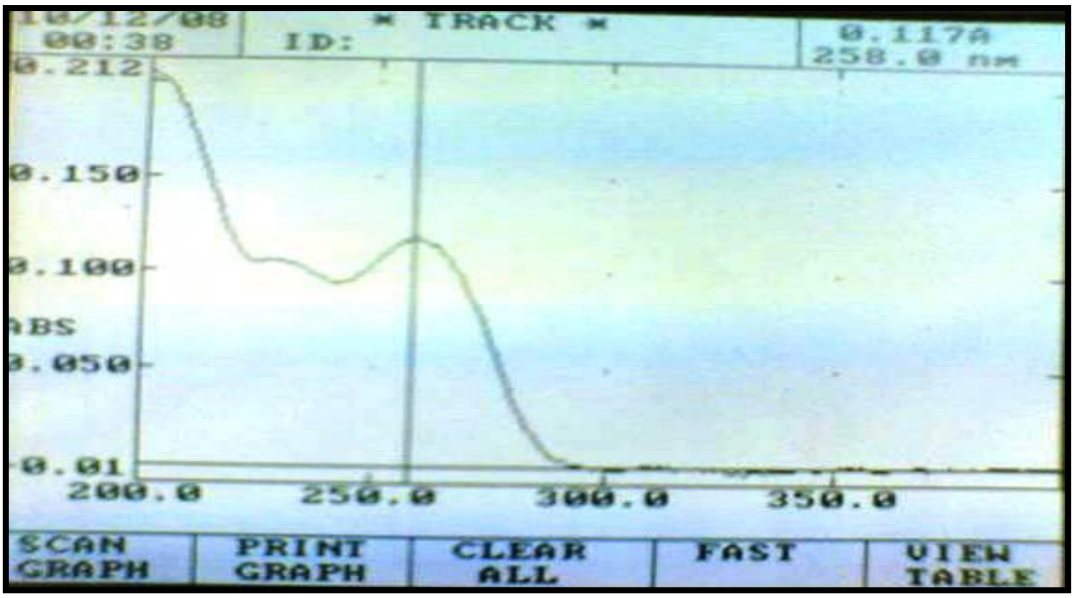

Figure No. 2: UV spectra of Pure OlmesartanMedoxomil

RESULT OF ASSAY OF TABLET FORMULATION

Table No. 3: AssayofOlmesartanMedoxomilin Dosage Forms

Brand Name	OlmesartanMedoxomil	
	Label Claim in mg	% Purity on Mean Value
Olmesar 20	20 mg	99.09%
Olmecep 20	20mg	99.30%

RESULT OF VALIDATION PARAMETER OF UV METHOD

Accuracy

Table No. 4: Recovery study for accuracy of OlmesartanMedoxomil

Conc. Of drug in sample (µg/ml)	10	10	10
Std. Drug soln. added (µg/ml)	8	10	12
Amt. Recovered Replicate 1	7.965	9.960	12.342
Amt. Recovered Replicate 2	7.960	9.978	12.250
Amt. Recovered Replicate 3	7.955	9.963	12.110
Mean	7.960	9.967	12.234
SD	0.005	0.009	0.116
%RSD	0.0006	0.0009	0.0095

Precision

- **Repeatability**

Table No 5: Result of repeatability for OlmesartanMedoxomil

Conc. of Drug in sample µg/ml	2	4	6	8	10	12
Replicate 1	2.12	3.95	5.98	8.12	10.22	12.23
Replicate 2	2.05	3.98	5.96	8.10	10.24	12.22
Replicate 3	2.10	3.99	5.99	8.05	10.10	12.12
Mean	2.09	3.97	5.97	8.09	10.18	12.19
SD	0.036	0.020	0.015	0.036	0.075	0.060

(A) Intermediate Precision:

(a) Day to Day

Table No. 6: Result of intermediate precision forOlmesartanMedoxomil

Conc. of Drug in sample µg/ml	2	4	6	8	10	12
Replicate 1	1.99	3.98	6.99	8.97	9.96	11.98
Replicate 2	1.98	3.97	6.97	8.99	9.97	11.97
Replicate 3	1.97	3.96	6.97	8.98	9.98	11.96
Mean	1.98	3.97	6.97	8.98	9.970	11.97
SD	0.010	0.010	0.011	0.010	0.010	0.010
%RSD	0.0050	0.0025	0.1655	0.0011	0.001	0.0008

(b) Analyst to Analyst

Table No. 7: Result of intermediate precision for OlmesartanMedoxomil

Conc. of Drug in sample µg/ml / Replicate	2	4	6	8	10	12
Replicate 1	1.98	3.99	5.97	7.96	9.98	11.98
Replicate 2	1.96	3.98	5.98	7.97	9.97	11.96
Replicate 3	1.97	3.95	5.97	7.99	9.98	11.97
Mean	1.97	3.97	5.97	7.97	9.97	11.97
SD	0.010	0.020	0.005	0.015	0.005	0.010
%RSD	0.0050	0.0052	0.0009	0.0019	0.0005	0.0008

Robustness

Table No. 8: Result of Robustness study for OlmesartanMedoxomil

Replicate	Concentration(µg/ml)		
	6	**12**	**18**
Replicate 1	5.95	11.98	17.98
Replicate 2	5.98	11.97	17.96
Replicate 3	5.96	11.96	17.97
Mean	5.96	11.97	17.97
SD	0.015	0.010	0.010
%RSD	0.0025	0.0008	0.0005

Optical parameter

Table No. 9: Result of Optical Parameter

S.N	Parameters	Observation
1	λ max	536 nm
2	Beer's law limit (µg/mL)	2 – 24 µg/mL
3	Regression equation *	AUC=0.0134 Conc. + 0.0134
4	Correlation Coefficient (r^2)	0.9996
5	Molar Absorptivity (L mol^{-1} cm^{-1})	3.267 x 10^5
6	Sandell's Sensitivity µg/mL- 0.001 absorbance unit	0.0170

DISCUSSIONS

The solubility of OlmesartanMedoxomil in different solvents and combination acetonitrile and water was selected for the method development because it is commonly used and it is easily available. The scanning result of pure OlmesartanMedoxomil when it was scan in UV range i.e. 200 – 400 nm and the λ max was found to be 258 nm and its was selected for the method development. The standard curve of pure OlmesartanMedoxomil, regression equation was found from that standard curve, R^2 value is 0.9994 so it is Linear. The result of analysis of two different marketed Tablet formulations, the RSD of the Average of 3 determinations was found to be below 1. So that method can be used for the estimation of OlmesartanMedoxomil from its Tablet dosage form.

The recovery results of OlmesartanMedoxomil on addition of standard drug. The mean percentage recovery was found and RSD was also found to be below 1. The repeatability results of marketed tablet formulations. Both the formulations were analysed and S.D. and R.S.D. was found to be within the range. The mean value for the precision was found to be less than 1. The results of robustness study and it was found that there is very negligible change in mobile phase result was remain unaffected. The optical characteristics of pure OlmesartanMedoxomil by spectrophotometry Beer's law limit (µg/ml), Regression equation, Correlation Coefficient (r^2), Molar absorptivity (L mol^{-1} cm^{-1}), Sandell's sensitivity was calculated.

CONCLUSION

In conclusion, the developed UV spectrophotometric method is economical, rapid, and suitable for routine quality control analysis of OlmesartanMedoxomil in pharmaceutical industries, academic laboratories, and regulatory environments. The method can be confidently applied for batch-to-batch quality assessment of tablet formulations containing OlmesartanMedoxomil

REFERENCES:

1. D.A. Skoog, D.M. West, and J.F. Holler, **Principles of Instrumental Analysis,** 1994, 6th Ed., Saunders college Publishing, 336-362,817-818.
2. G.W. Ewing, **Instrumental Methods of Chemical Analysis**, 1960, 2nd Ed., McGraw Hill Book company, Inc, New York, 2-3.
3. K.A. Corners, **A Text Book of Pharmaceutical Analysis**, 2002, 3rd Ed., John Wiley and Sons, NJ, 581-622.
4. B.K. Sharma, **Instrumental Methods of Chemical Analysis**, 1999, 18th Ed., Goel Publishing Housing, Meerut, 1-77.
5. H.H. Willard, L.L. Merritt, J.A. Dean,and F.A. Settle, **Instrumental Methods of Analysis**, 2001, 7th Ed., CBS Publishers and Distributors, New Delhi, 592-604.
6. G.R. Chatwal,S.K. Anand, **Instrumental Methods of Chemical Analysis**, 2005, 5th Ed., Himalaya Publishing House, Mumbai, 2.150-2.181, 2.624-2.639.
7. S. Rabisankar, **Text Book of Pharmaceutical Analysis**, 2nd Ed., R_x Publications, 2.1-2.13, 18.1-18.15.
8. A.V. Kasture, K.R. Mahadik, S.G. Wadodkar, H.N. More, **Pharmaceutical Analysis- Instrumental Method**, 2003, 9th Ed., Part-II, NiraliPrakashan, Pune, 6-7, 10, 49-50, 156-159.
9. W. Kemp, **Organic Spectroscopy**, 1996, 3rd Ed., MacMilan Press Ltd, Hampshire, 1-7.
10. L.R. Snyder,J.J. Kirklad, L.J. Glajch, L.E. Limbird, **Practical HPLC Method Development**, 1996, Wiley Interscience Publishing Inc, Co., USA, 1,3,15,631.
11. V.R. Meyer, **Practical High Performance Liquid Chromatography**, 2004, 4th Ed., John Wiley and Sons, 6-9, 87-92, 114, 228-234, 261-263.
12. P.D. Sethi, **High Performance Liquid Chromatography- Quantitative Analysis of Pharmaceutical Formulations**, 2001, 5th Ed., CBS Publication and Distributors, New Delhi, 15, 101-102.
13. *International Conference on the Harmonization,* Draft guideline on Validation of analytical Procedure for Pharmaceutical Availability, Federal Register, 1994, 59, 9750.
14. *International Conference on the Harmonization*, Draft guideline on Validation of analytical Procedure for Pharmaceutical Availability, Federal Register, 1995, 60, 11260.
15. Belal F., Al-Zaagi I.A., Gadkariem E.A.,Abounassif M.A., "A Stability-Indicating LC Method for the Simultaneous Determination of Ramipril and Hydrochlorothiazide in Dosage Forms" **Journal of Pharmaceutical and Biomedical Analysis**, 2001, 24, 335-342.