RESEARCH ARTICLE

Quantitative analysis method development and validation for Irbesartan in bulk drug by Ultraviolet spectroscopy

Amit Asati[2]*, Anita Shinde[1], Suman Malik[2], K. C. Asati

[1]Department of Chemistry I. E. H. E, Bhopal, India
[2]Department of Chemistry, Sadhu Vaswani College Bairagarh, Bhopal, India

J. Adv. Pharm. Edu. & Res.

ABSTRACT

A simple, rapid and precise ultraviolet spectroscopy method was developed and validated for quantitative analysis of irbesartan in bulk drug. It is an angiotensin II receptor (AT1 subtype) antagonist. It is used for the treatment of hypertension. It shows maximum absorbance at 246 nm. Beer Lambert's was obeyed in the concentration range of in the range of 5-30 µg/ml. The method was successfully validated in accordance to USP pharmacopeia and ICH guideline for accuracy, precision, rang and linearity. The linear regression analysis data for calibration plots showed good linear relationship and obtain correlation factor is greater than 0.999 for irbesartan. The % Recovery/Accuracy was within the range between 98% and 102%. The percentage RSD for precision was found to be less than 2%. Thus method was successfully applied for routine analysis of irbesartan in bulk samples.

Keywords: Accuracy, ICH guideline, Irbesartan, Precision, Validation, ultraviolet spectroscopy USP pharmacopeia.

INTRODUCTION

Irbesartan is in a group of drugs called angiotensin II receptor antagonists. Irbesartan keeps blood vessels from narrowing, which lowers blood pressure and improves blood flow. Irbesartanis used to treat high blood pressure (hypertension). Irbesartan is used for the treatment of hypertension. It may be used alone or in combination with other antihypertensive agents. Irbesartan is a non-peptide compound, chemically described as a 2-butyl-3-[p-(o-1H-tetrazol-5-ylphenyl)benzyl]-l ,3-diazaspiro[4.4]non-l -en-4-one. Its empirical formula is $C_{25}H_{28}N_6O$, and the structural formula is shown in Fig.1. Irbesartan is a white to off-white crystalline powder with a molecular weight of 428.5. Irbesartan is slightly soluble in alcohol and methylene chloride and practically insoluble in water [1-4].

The objective is to develop ultraviolet spectroscopy method and validate. Validation is the process of generating experimental data that provides evidence that the performance of an analytical method is adequate for reliably assessing product quality [5-8]. The validation procedure has been performed by UV spectroscopy. The method has been validated for linearity, precision (system repeatability, method repeatability, and method reproducibility), accuracy, range [9-14]. Ultraviolet spectroscopy refers to absorption spectroscopy in the ultraviolet spectral region which ranges 200nm to 400nm. Compounds which are colourless absorb radiation in this region. In uv spectroscopy, only valance electrons absorb energy, thereby the molecule undergoes transition from ground state to exited state. This absorption is characteristic and depends on the nature of electrons present. Molecules containing π-electrons or non-bonding electrons (n-electrons) can absorb the energy in the form of ultraviolet to excite these electrons to higher anti-bonding molecular orbital.

Medical options, several classes of drugs are used for treatment of Hypertension. Actually now days cost of medicines are too much high. There are two major ways to reduce the cost of medicine.

1) By route of synthesis

2) By analysis cost

Here an attempt has been made to reduce the cost of medicine by reducing the analysis cost and develop

Address for correspondence

Amit Asati
Department of Chemistry,
Sadhu Vaswani College
Bairagarh, Bhopal, India
Email: amit.asati29@gmail.com

Access this article online
www.japer.in

such type of analytical method in which, there is Minimum solvent consumption, reduced analysis time, chemicals and reagents which are used in the method are cheap and easily available. So the purpose of my research works to develop the analytical method for anti-hypertensive pharmaceutical drugs by ultraviolet spectroscopy and validate these methods with the guidance of United state Pharmacopeia (USP) and International Conference on Harmonization (ICH).

MATERIALS AND METHODS

Chemicals and Reagents and instrumentation:- Pure samples of irbesartan were obtained as gift. LC grade Methanol was purchased from Merck Company Mumbai. The analysis of the drug was carried out on a shimadzu uv-2450 uv-vis spectrophotometer with single beam mono chromator. Irbesartan shows maximum absorbance at 246 nm. Beer Lambert's was obeyed in the concentration range of in the range of 5-30 µg/ml.

Standard solution Preparation:-

Stock A:-Accurately weigh and transfer 25mg of irbesartan working standard into a 100mL volumetric flask, add about 70mL of diluent and sonicate to dissolve it completely and make volume up to the mark with the same.

5ppm solution: Take 1mL of the above A solution into a 50mL volumetric flask and dilute up to the mark with diluent.

10ppm solution: Take 2mL of the above A solution into a 50mL volumetric flask and dilute up to the mark with diluent.

15ppm solution: Take 3mL of the above A solution into a 50mL volumetric flask and dilute up to the mark with diluent.

20ppm solution: Take 4mL of the above A solution into a 50mL volumetric flask and dilute up to the mark with diluent.

25ppm solution: Take 5mL of the above A solution into a 50mL volumetric flask and dilute up to the mark with diluent.

30ppm solution: Take 6mL of the above A solution into a 50mL volumetric flask and dilute up to the mark with diluent.

Assay of irbesartan sample:- Accurately weigh and transfer equivalent to 25mg of irbesartan sample into a 100mL volumetric flask, add about 70mL of diluent and sonicate to dissolve it completely and make volume up to the mark with the same. Further pipette out 4mL of the above stock solution into a 50mL volumetric flask and dilute up to the mark with diluent. Obtain solution concentration was 20µg/ml. absorbance of irbesartan was measured. Calculate % Irbesartan by following formulae.

Calculation

$$\textbf{Irbesartan}\ (\%) = \frac{(A-I)}{S \times C} \times 1000$$

Where,

A = Absorbance of Irbesartan in sample

I = Intercept value obtained from linearity curve

S = Slop value obtained from linearity curve

C = Concentration of Irbesartan in sample (mg/ml)

Results and Discussion

Method validation: The objective of the method validation is to demonstrate that the method is suitable for its intended purpose as it is stated in ICH guidelines. The method was validated for linearity, precision (repeatability and intermediate precision), accuracy, specificity, stability and system suitability.

Linearity:- The linearity of an analytical procedure is its ability to elicit test results that are directly, or by a well-defined mathematical transformation, proportional to the concentration of analyte in sample within a given range. It should be established initially by visual examination of a plot of signals as a function of analyte concentration of content. If there appears to be a linear relationship, test results should be established by appropriate statistical methods (e.g., by calculation of a regression line by the method of least squares). In some cases, to obtain linearity between the response of an analyte and its concentration, the

test data may have to be subjected to a mathematical transformation. Data from the regression line itself may be helpful for providing mathematical estimates of the degree of linearity. The correlation coefficient, y-intercept, slope of the regression line, and residual sum of squares should be submitted.

Six standard solutions of Irbesartan were prepared from three stocks in the range of 25% to 150 % of the nominal concentration and taken absorbance once. Linearity regression analysis demonstrated the acceptability of the method for quantitative determination of Irbesartan over the concentration range of about 5ppm to 30ppm of the nominal concentration. Linearity graph was shown in Fig.2 and slope, intercept correlation factor and Regression equation were shown in Table.1

Precision:-The precision of an analytical method is the degree of agreement among individual test results when the method is applied repeatedly to multiple samplings of a homogeneous sample. The precision of an analytical method is usually expressed as the standard deviation or relative standard deviation (coefficient of variation) of a series of measurements. Precision may be a measure of either the degree of reproducibility or repeatability of the analytical method under normal operating conditions. The ICH documents recommend that repeatability should be assessed using a minimum of nine determinations covering the specified range for the procedure (i.e., three concentrations and three replicates of each concentration, or a minimum of six determinations at 100% of the test concentration).

System Repeatability:- Standard solution is prepared at three difference concentration form different stock solution 15ppm, 20ppm and 25ppm were analysed and taken absorbance on triplicate and RSD of absorbance at each level were calculated. The percentage RSD of absorbance was less than 1.0%. Result are presented in Table.2

Method repeatability:- Six preparation of Irbesartan sample was analyzed from sample preparation to final results by the same analyst and the percentage RSD of obtained results was less than 2% and obtained result were within given range 100 ± 2. Result are presented in Table.3

System Reproducibility:- Three Irbesartan sample are analysed by this method in duplicate preparation and obtain result are in Table.4

Accuracy:- It is defined as the closeness of test results obtained by the method to the true value. It may often be expressed as percent recovery by the assay of known, added amounts of analyte. Accuracy is a measure of the exactness of the analytical method. The ICH documents recommend that accuracy be assessed using a minimum of nine determinations over a minimum of three concentration levels, covering the specified range (i.e., three concentrations and three replicates of each concentration). The three different concentrations of Irbesartan standard solutions were determined from three replicate analysis, using the linear regression lines (linearity section). The deviations of the obtained results (expressed as percentage accuracy) were calculated from the true values were presented in Table.5

The average deviations from true value are less than 2.0 %.

Range:- The range obtained from Linearity, Precision and Accuracy is summarized - ibesartan-5ppm to 30ppm (25% to 150% of nominal sample concentration)

CONCLUSION

The method validation demonstrated that The Method is selective, precise, linear, and accurate for over the required concentration ranges of 5 to 30 ppm (25 to150 % of Irbesartan nominal sample concentration) for quantitative analysis of irbesartan by UV spectroscopy. So this method should be used in routine for quantitative analysis of irbesartan.

ACKNOWLEDGEMENT

All authors are grateful for principal of sadhu vaswani college, bairagarh Bhopal for providing research centre where research work was carried out. Thanks

to all faculty of this institute for giving all possible facilitates encouragement. Finally thanks to our family for giving moral support and confident.

Irbesartan Concentration(ppm)	Irbesartan Area
5.04ppm	0.1699
10.01ppm	0.3315
15.04ppm	0.5014
20.17ppm	0.6655
25.02ppm	0.8387
30.08ppm	0.9966
Slope	**33.1022**
Intercept	**0.0019**
Correlation factor	**0.9999**

Table1: Linearity Data

System Repeatability		
S No.	**Concentration(ppm)**	**Absorbance**
1	15.04	0.5032
2		0.5066
3		0.5029
	RSD (%)	**0.4**
1	20.17	0.6737
2		0.6756
3		0.6737
	RSD (%)	**0.2**
1	25.02	0.8387
2		0.8349
3		0.8276
	RSD (%)	**0.7**

Table 2: System Repeatability data

Method Repeatability		
Concentration (ppm)	**Absorbance**	**% Irbesartan**
20.18	0.6674	99.6
20.07	0.6632	99.6
20.21	0.6713	100.1
20.25	0.6728	100.1
20.04	0.6681	100.4
20.13	0.6682	100.0
Average		**100.0**
STDEV		**0.318**
%RSD		**0.3**

Table 3: Method Repeatability data

Method Reproducibility				
S No.	**Concentration (ppm)**	**Absorbance**	**% Irbesartan**	**% Irbesartan Average**
Sample-I Pre-I	20.25	0.6711	100.0	99.8
Sample-I Pre-II	20.31	0.6757	99.6	
Sample-II Pre-I	20.15	0.6694	100.2	100.0
Sample-II Pre-II	20.34	0.6741	99.9	
Sample-III Pre-I	20.46	0.6788	100.0	99.9
Sample-III Pre-II	20.25	0.6699	99.8	

Table 4: Method Reproducibility data

Injection No	Level	Concentration (ppm)	Area	Calculated concentration (ppm)	Accuracy (%)
1	75 %	15.04	0.5032	15.145	100.71
2			0.5066	15.248	101.39
3			0.5029	15.136	100.65
Average			**0.5042**		**100.9**
1	100 %	20.14	0.6737	20.296	100.61
2			0.6756	20.353	100.90
3			0.6737	20.296	100.61
Average			**0.6743**		**100.7**
1	125 %	25.02	0.8387	25.280	101.06
2			0.8349	25.166	100.60
3			0.8276	24.945	99.72
Average			**0.8337**		**100.5**

Table 5: Accuracy test data of Irbesartan

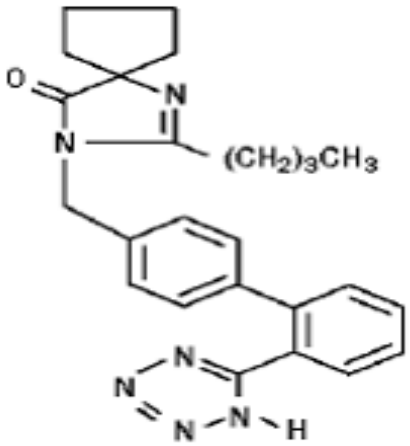

Fig 1: Irbesartan chemical Structure

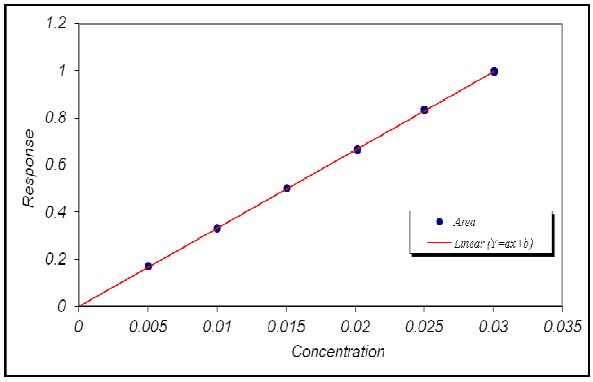

Fig.2: Linearity graph

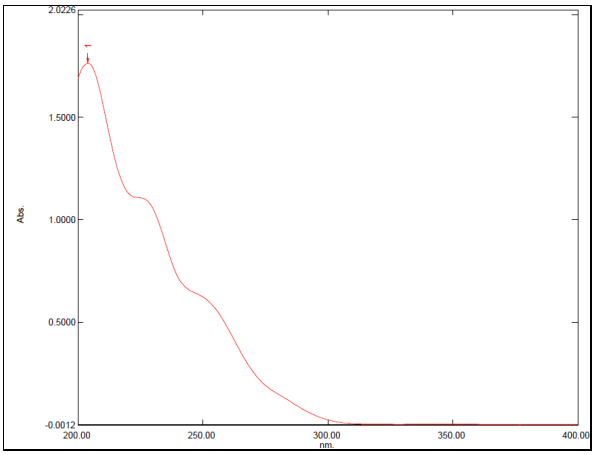

Fig.3: Typical UV scan spectra of irbesartan 20ppm

REFERENCE

1. The Merck Index, An Encyclopedia of Chemicals, Drugs and Biologicals, Thirteenth Edition, Merck & Co. Inc., 2001, 13:3453.
2. P Palatini. The Journal of Clinical Hypertension., 2005, 7, 96–101.
3. USP 32 <1225>: "Validation of Compendial Methods".
4. Guidance for Industry – Analytical Procedures and Method Validation (August-2000).
5. W.D. Snyder, L. Blumberg, in: P. Sandra, M.L. Lee (Eds.), Proceedings of the 14th International Symposium on Capillary Chromatography, Baltimore, MD, May 1991, p. 28
6. WHO, Guidelines for Stability Testing of Pharmaceutical Products Containing Well Established Drug Substances in Conventional Dosage Forms, in WHO Expert Committee
7. Willard Hobart. H., Merritt L.L., Dean John. A., Instrumental Methods of Analysis, 7th edition, CBS Publishers, 580-610.
8. International Conference on Harmonization of Technical Requirement for Registration of Pharmaceuticals for Human use, ICH harmonized tripartite Guideline, Validation of Analytical procedures Text and methodology Q2 (R1), 2005.
9. R. Jenke, "Chromatographic Method Validation: A review of Current Practices and Procedures. I. General Concepts and Guidelines", J. Liq. Chrom. and Rel. Technol., vol. 19 (1996), pp. 719-736.
10. Albero, I., Rodenas, V., Garcia, S., and Sanchez, Pedreno, C., "Determination of Irbesartan in the presence of Hydrochlorothiazide by derivative spectorphotometry", J.Pharm.Biomed.Anal., 2004, 29 (1-2), pp. 229-305.
11. Vetuchi, C., Giannandrea, A. Carlucci, G., and Mazzeo, P."Determination of hydrochlorothiazide and Irbesartan in Pharmaceuticals by fourth-order UV derivative spectrophotometry," Farmaco, 2005, 60(8), pp.665-670.
12. Gagigal E, Gonzalez L, Alonso RM, Jimenez RM. Experimental design methodologies to optimise the spectrofluorimetric determination of Losartan and Valsartan in human urine. Talanta 2001;54:1121-33.
13. Wang L, Asgharnejad M. Second derivative UV spectrometric determination of simvastatin in its tablet dosage form. J Pharm Biomed Anal 2000;21:1243-1248.
14. Surekha A, Jain NK. Difference spectrophotometric estimation of amlodipine besylate. Indian drugs 2000;37(7):351-353.

How to cite this article: Amit Asati[2]*, Anita Shinde[1], Suman Malik[2], K. C. Asati; Quantitative analysis method development and validation for Irbesartan in bulk drug by Ultraviolet spectroscopy; J. Adv. Pharm. Edu. & Res. 2014: 4(1): 101-105.

Source of Support: Nil, **Conflict of Interest:** Nil