Oriental Journal of Chemistry Vol. **26**(4), 1553-1556 (2010)

UV spectrophotometric method for the quatitation of metformin hyrochloride in pharmaceutical dosage form

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(Received: October 09, 2010; Accepted: November 12, 2010)

ABSTRACT

A sensitive and accurate UV spectrophotometric method for the determination of metformin hydrochloride in tablet dosage form has been evolved. The various parameters, such as linearity, precision, accuracy, limit of detection and limit of quantitation were studied according to International Conference on Harmonization guidelines (ICH).The method is accurate, precise (% CV=0.763) and linear within the range 1-16 µg/mL with coefficient of correlation, r^2=0.9995. The limit of detection and limit of quantitation were found to be 22.34 and 67.69 ng/mL respectively. The proposed method was successfully employed for the quantitative determination of metformin tablet dosage form with no interference from any other excipients and diluents.

Key words: UV spectrophotometric methods, metformin hyrochloride.

INTRODUCTION

Metformin hydrochloride (C_4 H_{11} N_5. HCl) is used as oral hypoglycemic drug from the biguanide class and used in the management of type 2 diabetes mellitus[1]. Chemically, it is known as 2-(N, N-dimethylcarbamimidoyl) guanidine with a molecular weight of 165.62. It is white crystalline powder, hygroscopic, bitter in taste and odorless. Major action of metformin HCl lay in increasing glucose transport across the cell membrane in skeletal muscle [2]. It is soluble in water but insoluble in ether and chloroform. The pKa of metformin HCl is 2.8 and 11.51 and the melting range is 230-231 ^oC [3,4].

Objective

Several assay techniques have been described for quantitative determination of metformin HCl in pharmaceutical formulations including high performance liquid chromatography (HPLC), fluorometry, radioimmunoassay and gas chromatography. Most of these are either time consuming; involving expensive instrumentation or using expensive organic solvent. The investigated method includes UV spectrophotometric method for estimation of the metformin HCl from the tablets. This method is easy, least expensive and based on the direct determination of drug with a high degree of sensitivity and accuracy[5].

Apparatus and software

Absorption spectral measurements were carried out using Shimadzu UV-1800 model UV – Visible spectrophotometer with 1 cm quartz matched cuvettes. A UV probe personal spectroscopy software version 2.33 was used for instrument control and Microsoft excel for data analysis.

Chemicals

Metformin HCl was supplied by Zydus

Research Centre, Ahemdabad as gift sample and used as such. Water used for the preparation of different dilutions was generated by triple stage distillation unit at our institute. The marketed pharmaceutical formulation was taken of one of the reputed Pharmaceutical manufacturers.

EXPERIMENTAL

Preparation of standard stock solution and dilution

The standard stock solution was prepared by dissolving metformin HCl in distilled water to give final concentration of 100 µg/mL. An appropriate aliquot portion of 0.2, 0.4, 0.6, 0.8, 1.2, 1.6 mL of metformin HCl was transferred from stock solution to prepare a series of concentration from 1-16 µg/mL (1, 2, 4, 6, 8, 12, 16 µg/mL) of metformin HCl.

Selection of wavelength (λ_{max})

The drug solutions were scanned separately between 200nm to 400nm and λ_{max} was observed at 233 nm as shown in Fig-1.

Assay of tablet

Preparation of stock solution and dilutions

Ten tablets of metformin HCl were accurately weighed and powdered in a mortar. An amount equivalent to 10 mg metformin HCl was taken and dissolved in 10 mL of a triple distilled water and diluted 100 times to make stock solution of 100 µg/mL.

An appropriate aliquot portions of 0.2, 0.8, 1.6 mL of metformin HCl was transferred from stock solution to separate 10 mL volumetric flasks and added solvent (triple distilled water) to make the volume up to the mark to obtain concentration equivalent to 2, 8, and 16 µg/mL of metformin HCl.

RESULTS

Calibration data was constructed in the range of the expected concentration of 1 to 16 µg/mL. Beer's law was obeyed over this concentration range. The regression equation was found to be y=0.0853x + 0.0168.

Table 1: Data representing accuracy of metformin hcl tablets

S. No.	Conc. of Metformin in tablet Claimed (µg/mL)	Found (µg/mL)	% Accuracy of Metformin
1	2	1.897	94.85
2	8	8.719	108.9
3	16	16.211	101.319
Mean			101.689

Table 2: Regression data of the calibration lines for quantitative determination of metformin by uv method

S. No.	Parameters	Metformin HCL
1	Measured wavelength(λ max)	233nm
2	linearity range (µg/ml)	1-16 µg / ml
3	slope(m)	0.0853
4	intercept(c)	0.0168
5	correlation coefficient(r)	0.9995
6	LOD	22.34 ng / ml
7	LOQ	67.69 ng / ml
8	Standard deviation	1.89
9	% CV	0.763
10	% accuracy	100.45 ± 1.89

Method validation[6,7]

The method validation was carried out as per the ICH guideline

Accuracy

The % accuracy was found to be 100.45 ± 1.89 (mean ± standard deviation) and the results are shown in Table-1.

Precision

The precision was represented in the form of % CV and was found to be < 2% (0.763).

Linearity

The linearity (r^2) was found to be 0.9995[8,9].

Range

The study was carried out with the dilutions that were prepared in the range of 1 to 16 µg/mL.

LOD

The limit of detection was found to be 22.34 ng /mL

LOQ

The limit of quantification was found to be 67.69 ng/mL

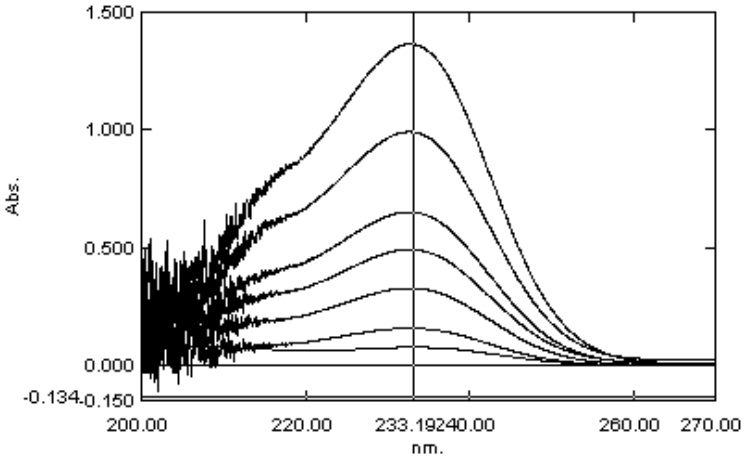

Fig. 1: Calibration scan of Metformin Hydrochloride (concentration- 1, 2, 4, 6, 8, 12 and 16 µg/mL)

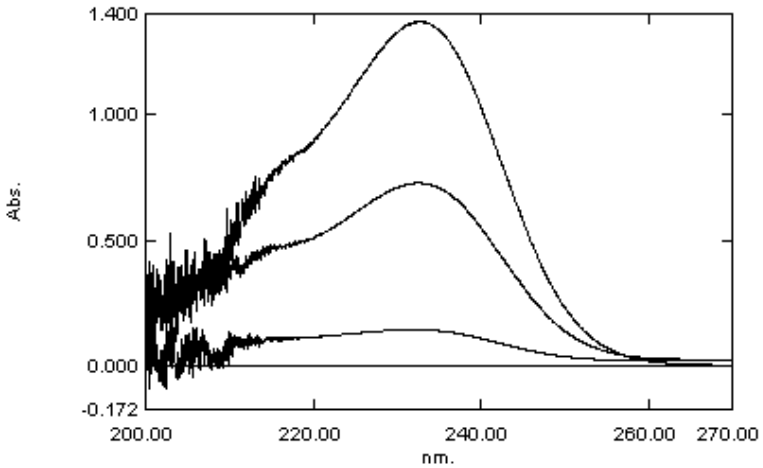

Fig. 2: UV Scan of assay performed for the estimation of Metformin HCl in Tablet

Molar absorptivity

The molar absorptivity was found to be 1117.935 l/mol.cm

DISCUSSION

The data obtained for the estimation of metformin HCl in bulk and drug formulation evidenced the high level of accuracy (100.45±1.89) and precision (%CV= 0.76) and shown linearity (r^2 = 0.9995) within the range of 1 – 16 µg/mL. The found concentration of active ingredient in tablet dosage form showed that the amount of drug present is consistent with the label claim as shown in Fig-2.

So the proposed spectroscopic method which is simple, accurate, precise, and sensitive can be successfully applied for routine quantitative estimation of metformin hydrochloride in pharmaceutical formulation. The whole summary is shown in Table-2.

ACKNOWLEDGEMENTS

The authors are grateful to Zydus Research Centre, Ahemdabad for providing gift sample of the drug. The Authors thank to Principal, Bhopal Institute of Technology & Science - Pharmacy, for providing support and instrumental facilities to carry out the present Investigation.

REFERENCES

1. Merck and Co., The Merck Index: an Encyclopedia of Chemicals, Drugs and Biological, published by Merck Research Laboratories, USA, 5938 (2006).
2. The Council of the Royal Pharmaceutical Society of Great Britain, The Martindale: The Extra Pharmacopoeia, published by Royal Pharmaceutical Society, UK, 357.2(2005).
3. General Medical Council (Great Britain), British Pharmacopoeia, 15 th Ed., B.P. Commission: HMSO, UK, 64 (1988).
4. Sahoo, D. K., Sharma, R., and Chaturvedi, S. C., Indian Journal of Pharmaceutical Sciences, 34 (2008).
5. Alison E. B. and Graham S.C., Analytical Profiles of Drug Substances and Excipients, Academic Press Limited, USA, 243.
6. ICH Expert Working Group, Validation of Analytical Procedures: Definition and Methology Q2 (R^1), ICH Harmonized Tripartite Guideline, USA, (1994).
7. Arayne, M.S., Sultana, N., Zuberi, M.H., and Siddiqui F. A., Asian Journal of Research in Chemistry, Vol-06, 55(2006).
8. James E. and Muth D. E., Statistics and Pharmaceutical Statistical Applications, 1st Edition, Marcel Dekker, Inc., New York, 327 (1999).
9. Chow S. C., Encyclopaedia of Bio Pharmaceutical Statistics, 1st Edition, Marcel Dekker, Inc., New York, 13 (2000).