Academic Sciences International Journal of Pharmacy and Pharmaceutical Sciences

ISSN- 0975-1491 Vol 4, Suppl 4, 2012

Research Article

"DEVELOPMENT AND VALIDATION OF UV SPECTROPHOTOMETRIC METHOD FOR SIMULTANEOUS ESTIMATION OF IBUPROFEN AND FAMOTIDINE IN BULK AND FORMULATED TABLET DOSAGE FORM"

BHAVIK R KESUR*, DR. VIJAY R SALUNKHE, DR. CHANDRAKANT S MAGDUM

Rajarambapu College of Pharmacy, Kasegaon, Maharashtra, India. Email: kesur_bhavik@yahoo.com

Received: 04 April 2012, Revised and Accepted: 21 May 2012

ABSTRACT

A simple, rapid, accurate, precise, and economic spectrophotometric method for simultaneous estimation of ibuprofen and famotidine in bulk and formulated tablet dosage form have been developed. Method is based on solving simultaneous equation. Ibuprofen and famotidine show absorbance maximum at 265 and 287 nm respectively, so absorbance was measured at the same wave lengths for the estimation of ibuprofen and famotidine. Both drugs obey the Beer Lambert's law in the concentration range of 20-140µg/mL and 2-10µg/mL for ibuprofen and famotidine respectively. Methods are validated according to ICH guidelines and can be adopted for the routine analysis of ibuprofen and famotidine in pure and tablet dosage form.

Keywords: Ibuprofen, Famotidine, Simultaneous equation, Validation.

INTRODUCTION

The 2-arylproprionic acid derivative, Ibuprofen [RS-2-(4-isobutyl-phenyl)propionic acid][1], is one of the most potent orally active antipyretic, analgesic and nonsteroidal anti-inflammatory drug (NSAID) used extensively in the treatment of acute and chronic pain, osteoarthritis, rheumatoid arthritis and related conditions. Ibuprofen is characterized by a better tolerability compared with other NSAIDs. The techniques most recent used for determination of ibuprofen included High performance liquid chromatographic [2, 3], Thin layer chromatographic [2, 3], electrochemical and spectrophotometric [2, 3] methods.

Famotidine, chemically 3-[[[2-[(Aminoiminomethyl) amino]-4–thiazolyl] methyl] thio]-N-(aminosulfonyl) propanimidamide[1] is used in the treatment of gastric ulcer, duodenal ulcer, stress ulcer and gastritis. Various methods have been reported for the estimation of famotidine by titrimetry, HPLC [4], HPTLC, spectrophotometric [5,6,7] methods.

The literature revealed that no UV-spectrophotometric method is yet reported for the estimation of combined dosage form. The method is developed in solvent 0.1N NaOH. Furthermore volatile nature of any solvent creates problem in accuracy while 0.1 N NaOH being aqueous in nature serves for the accuracy. Also NaOH is more economic than any other solvents. Method validation is an important issue in pharmaceutical analysis.

It confirms that the analytical procedure employed for the analysis is suitable and reliable for its intended use. In present study, all validation parameters for quantitative analysis of ibuprofen and famotidine in tablets were tested and data were evaluated according to their acceptance criteria [9].

Thus, this method is more accurate and cost effective. This paper describes simple, rapid, accurate, precise and economical method for simultaneous determination of ibuprofen and famotidine in tablet dosage form.

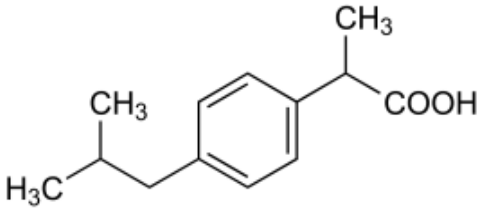

Fig. 1: Ibuprofen [8]

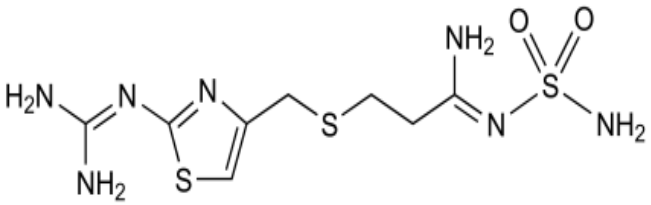

Fig. 2: Famotidine [8]

MATERIALS AND METHODS

Instruments

Absorbance measurements was made on Shimadzu 1800 UV/Visible spectrophotometer with a pair of matched quartz cells of 1 cm width, Elder digital balance used for weighing, and Ultra sonicator of Prama instruments was used sonicating the drug and sample solution.

Materials

Pure famotidine was kindly gifted from Cadila Healthcare Limited, Ahmedabad and ibuprofen purchased from Block pharma ltd. Kolhapur. The formulated tablets (Label claim: famotidine-13.3 mg, ibuprofen- 400 mg) was used for analysis. All the chemicals and reagents were of analytical grade.

Selection of common solvent

After assessing the solubility of drugs in different solvents 0.1N NaOH has been selected as common solvent for developing spectral characteristics [8, 2, 10].

Selection of wavelength

A representative spectrum of Ibuprofen and Famotidine in 0.1N NaOH is shown in Fig1. The dilution was obtained to the concentration of 10µg/mL for ibuprofen and 10µg/mL for famotidine solutions. Both the solutions were scanned in UV range (200-400nm) in 10 mm cell against solvent blank. The study of spectrum revealed that ibuprofen show a well defined λ_{max} at 265 nm whereas famotidine shows at 287 nm. These two wavelengths were selected for development of simultaneous equation.

Preparation of standard stock solution and Study of Beer-Lambert's Law

The standard stock solutions of ibuprofen and famotidine were prepared by dissolving 50 mg of each drug in 0.1N NaOH and final volume was adjusted with same solvent in 50 mL of volumetric flask to get a solution containing 1000µg/mL of each drug. Aliquots of working stock solutions of ibuprofen and famotidine were prepared with 0.1N NaOH solution to get concentration in range of 20-140µg/ml for ibuprofen and 2-10µg/ml for famotidine. The absorbances of resulting solutions were measured at their respective λ_{max}. A calibration curve as concentration vs. absorbance (Fig-4, 5) was constructed to study the Beer-Lambert's Law and regression equation.

Method (Simultaneous equation method) [11]

If a sample contains two absorbing drug each of which absorbs at the λ_{max} of the other, it may be possible to determine both drugs by the technique of simultaneous equation.

Two wavelengths selected for the development of the simultaneous equations are 265 nm and 287 nm. The absorptivity values determined for ibuprofen are 0.00217 (ax1), 0.00020 (ax2) and for famotidine are 0.02861 (ay1), 0.0509 (ay2) at 265 nm and 287 nm respectively. These values are means of six estimations.

Analysis of the tablet formulations

Twenty formulated tablets were accurately weighed and powdered. A quantity of powder equivalent to 50 mg of Ibuprofen was transferred to 50 mL volumetric flask and dissolved in 0.1N NaOH and final volume was made up with 0.1N NaOH. The sample solution was then filtered through Whatman filter paper No.41. From the above solution 5 mL of solution was taken and diluted to 50 mL with 0.1N NaOH to get final concentration containing 100µg/mL of ibuprofen and 3.32µg/mL of famotidine. Analysis procedure was repeated six times with tablet formulation. The results of tablet analysis are reported in Table 2.

Validation of the developed method [12, 13]

Linearity

For each drug, appropriate dilutions of standard stock solutions were assayed as per the developed methods. For method the Beer-Lambert's concentration range was found to be 20-140µg/mL for ibuprofen and 2-10µg/mL for famotidine. The linearity data for method is presented in Table 1.

Accuracy

To check the accuracy of the proposed method, recovery studies were carried out 80%, 100% and 120% of the test concentration as per ICH guidelines. The recovery study was performed three times at each level. The result of the recovery studies are reported in table 3.

Precision: Interday and Intraday precision

The interday and intraday precision was determined by assay of the sample solution on the same day and on different days at different time intervals respectively (six replicates). The results of the same are presented in Table 2.

Ruggedness study

It expresses the precision within laboratories, Variation like different analyst. Ruggedness of the methods was assessed by carrying out assay 3 times with different analyst by using same equipment.

Limit of Detection

The detection limit is determined by the analysis of samples with known concentrations of analyte and by establishing the minimum level at which the analyte can be reliably detected.

$$DL = \frac{3.3\ \sigma}{S}$$

Where σ = the standard deviation of the response

S = the slope of the calibration curve

Limit of Quantitation

The quantitation limit is generally determined by the analysis of samples with known concentrations of analyte and by establishing the minimum level at which the analyte can be quantified with acceptable accuracy and precision.

$$QL = \frac{10\ \sigma}{S}$$

Where σ = the standard deviation of the response

S = the slope of the calibration curve

RESULT AND DISCUSSION

Linearity range for ibuprofen and famotidine are 20-140µg/mL and 2-10µg/mL at respective selected wavelengths. The coefficient of correlation for ibuprofen at 265 nm and for famotidine at 287 nm is 0.9993 and 0.9999 respectively. Both drugs shows good regression values at their respective wavelengths and the results of recovery study reveals that any small change in the drug concentration in the solution could be accurately determined by the proposed methods. Percentage estimation of ibuprofen and famotidine from tablet dosage form by method is 99.53% and 98.71% with standard deviation <2 (Table 1 & 4).

Spectra of ibuprofen and Famotidine

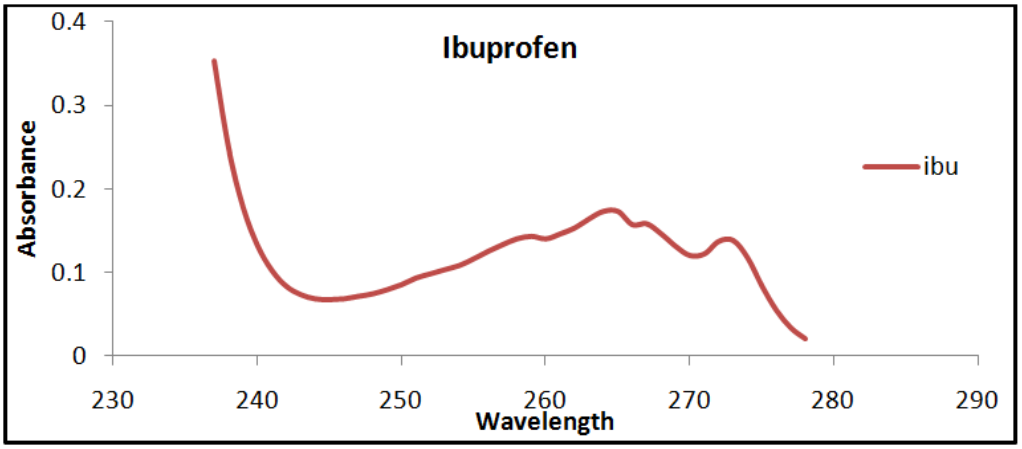

Fig. 3: Spectra of Ibuprofen

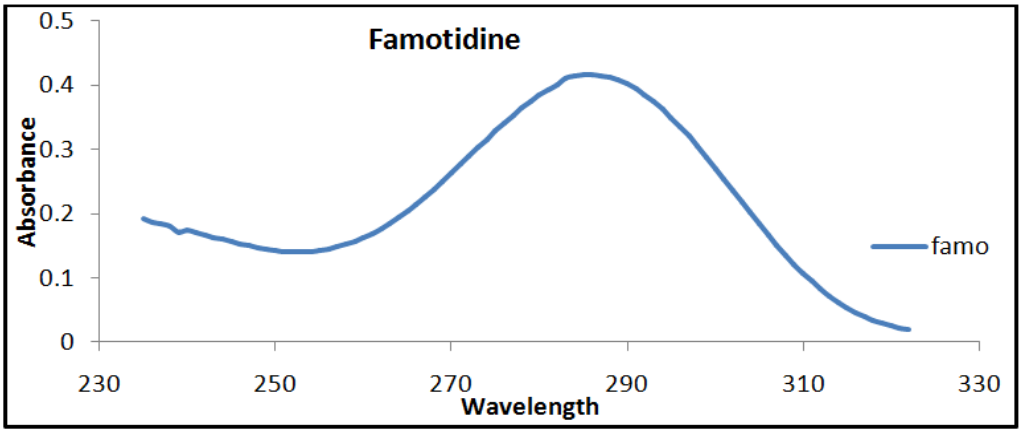

Fig. 4: Spectra of Famotidine

Calibration curve of ibuprofen and famotidine

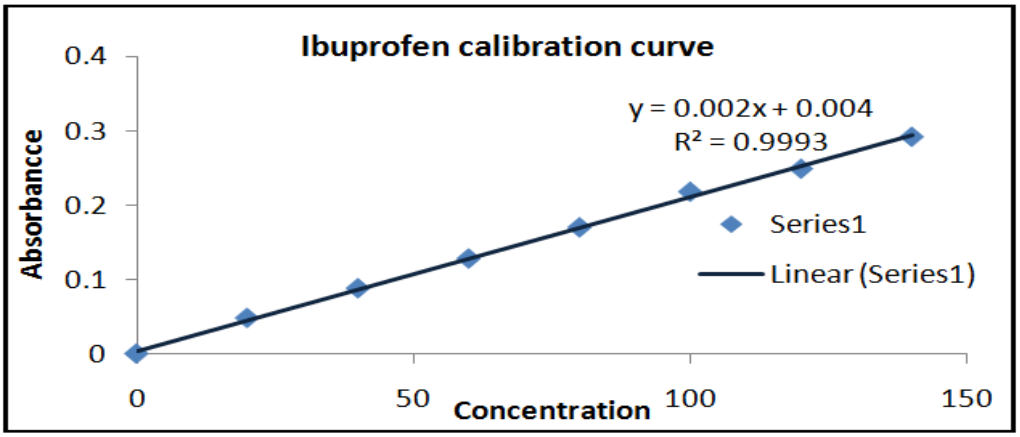

Fig. 4: Calibration curve of ibuprofen

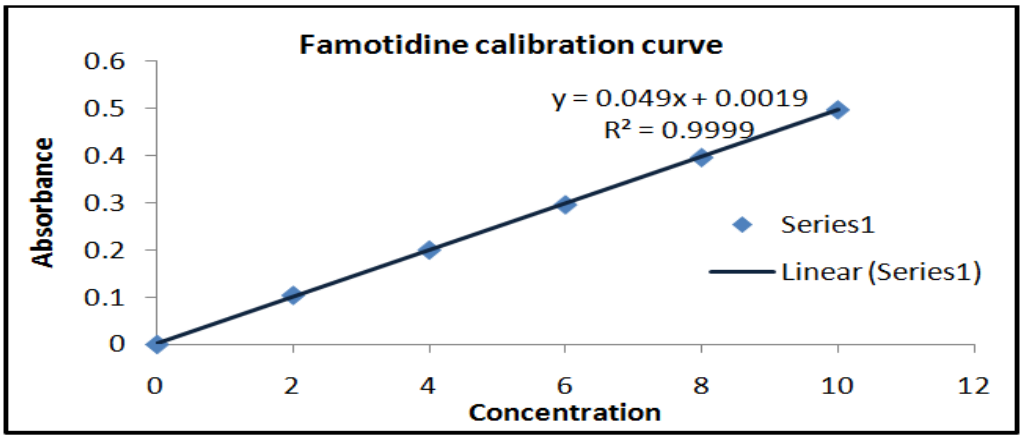

Fig. 5: Calibration curve of famotidine

Table 1: Result of Validation parameters [12, 13]

Parameters	Ibuprofen	Famotidine
Detection wavelength	265 nm	287 nm
Linearity range	20-140µg/mL	2-10µg/mL
Slope	0.002072	0.049386
Intercept	0.004083	0.001905
Correlation coefficient	0.9993	0.99993
Regression equation (y =a + bc)	Y=0.002x-0.004	Y=0.049x-0.0019
Limit of detection	2.202µg/mL	0.087µg/mL
Limit of quantitation	6.6747µg/mL	0.264µg/mL

The validity and reliability of proposed methods are assessed by recovery studies. Sample recovery for both the methods is in good agreement with their respective label claims, which suggest non interference of formulation additives in estimation (Table 3).

Precision is determined by studying the repeatability and intermediate precision. Repeatability result indicates the precision under the same operating conditions over a short interval of time and interassay precision. Intermediate precision study expresses within laboratory variation in different days. In both intra and inter day precision study for both the methods % RSD are not more than 2.0% indicates good repeatability and intermediate precision (Table 2).

Table 2: Interday and Intraday precision [12, 13]

Interday precision			**Intraday precision**	
	%Amount Found ± SD*	**% RSD**	**%Amount Found ± SD***	**% RSD**
Ibuprofen	99.80±0.574	0.5760	100.55±0.7023	0.6985
Famotidine	98.76±0.3893	0.3941	99.58±0.8759	0.6796

*Average of six determinations

Table 3: Recovery studies [12, 13]

Percentage level	**Ibuprofen % Recovery ± SD***	**%RSD**	**Famotidine % Recovery ± SD***	**%RSD**
80%	100.1±0.697	0.696	101.38±0.548	0.540
100%	101.04±0.183	0.181	102.81±0.347	0.338
120%	99.81±0.433	0.434	101.67±0.839	0.825

*Average of six determinations

Table 4: Result of analysis of tablet formulation

Formulation	**Drug**	**Label Claim**	**Amount found ± S.D***	**% label claim ±S.D***
	Ibuprofen	400 mg	398.12±1.565	99.53±0.393
Tablet	Famotidine	13.3 mg	13.12±0.0429	98.71±0.3227

*Average of three determinations

Table 5: Ruggedness study

Formulation	**Drug**	**Label Claim**	**Amount found ± S.D***	**% label claim ±S.D***
	Ibuprofen	400 mg	402.8±2.468	100.7±0.617
Analyst 1	Famotidine	13.3 mg	13.32±0.03670	100.16±0.276
Analyst 2	Ibuprofen	400 mg	398.32±3.219	99.58±0.8049
	Famotidine	13.3 mg	13.12±0.04091	98.66±0.3076

*Average of three determinations

CONCLUSION

The proposed spectrophotometric method is simple, rapid, accurate, precise, and economic and validated in terms of linearity, accuracy, precision, specificity and reproducibility. This method can be successfully used for simultaneous estimation of ibuprofen and famotidine in pure and formulated tablet dosage form.

ACKNOWLEDGEMENT

The authors are thankful to Cadila Healthcare Limited, Ahmedabad for generous gift of pure drug sample to carry out the study.

REFERENCES

1. The United State Pharmacopoeia, The National Formulary-2004, by authority of the united states pharmaceutical convention, Inc, 776, 953
2. Indian Pharmacopoeia. The Controller of Publications, Govt. of India, New Delhi; 2007. Vol-II, 1217, 529.
3. Anurekha Jain: Practicals in modern pharmaceutical instrumental analysis, Nirali prakashan, 4.12.
4. Dragicazendelovska and Traje Stafilov*: High-performance liquid chromatographic determination of famotidine in human plasma using solid-phase column extraction, J.Serb.Chem.Soc. 68(11)883–892(2003), JSCS – 3109.
5. N.Rami Reddy, K.Prabhavathi, Y.V.Bhaskar Reddy, and I.E.Chakravarthi: A new spectrophotometric determination of Famotidine from tablets, Journal of Pharmaceutical Science, September-October 2006.
6. R.Sahu, Preeti Nagar, S.Bhattacharya and Deepti Jain: Simultaneous spectrophotometric estimation of Famotidine and Domperidone in combined tablet dosage form, Indian Journal of Pharmaceutical Sciences, July-August 2006.
7. Y.K.Agrawal, K.Shivram Chandra, G.N.Singh and B.E.Rao: Spectrophotometric determination of famotidine in pharmaceutical preparation, Journal of Pharmaceutical & Biomedical Analysis, Vol-10, No-7:521-523, 1992.
8. Clarke's Analysis of Drugs and Poisons, Third edition, monographs of Ibuprofen and Famotidine.
9. ICH Q2B, ICH Harmonised Tripartite Guideline: validation of analytical procedures: methodology, Recommended for adoption at step 4 of the ICH process on 6 November 1996, by the ICH Steering Committee.
10. florey: Analytical profiles of drug substance, Vol- 27, 265.
11. The Merck Index. 13th edition. Whitehouse Station NJ USA: Merck and Co. Inc.; 2006, 3961, 4906.
12. The pharmaceutical codex, principles & practice of pharmaceutical, 12th edition, the pharmaceutical press, London, 908.
13. Robert. A. Nash, Alfred. H. Wachter: Pharmaceutical process validation, an international third edition, revised & expanded: 507-522.