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DEVELOPMENT AND VALIDATION OF SPECTROPHOTOMETRY METHOD FOR THE SIMULTANEOUS ESTIMATION OF IBUPROFEN AND FAMOTIDINE

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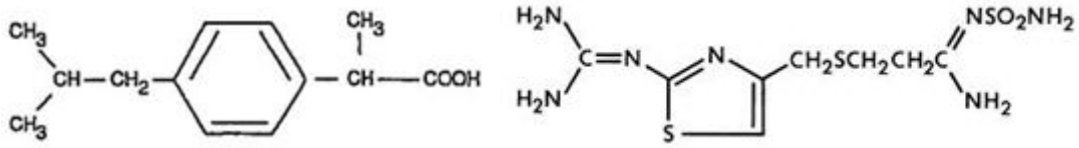
ABSTRACT

A simple, sensitive, precise and accurate Spectrophotometric method had been developed and validated for the quantitative estimation of Ibuprofen and Famotidine in combination. The wavelength maxima found for Ibuprofen and Famotidine were 264.0nm and 287.0nm using 0.1N NaOH respectively. The Iso-absorptive point was found 274.5nm. In the developed Q-Absorbtion Ratio method absorbance was measured at 264.0 nm (λ_{max} of Ibuprofen) and 274.5 nm (iso-absorptive point). Beer's law obeyed in the concentration range of 120-420 µg/ml and 4-24 µg/ml for Ibuprofen and Famotidine respectively.The developed method was validated in terms of accuracy, precision, linearity, limit of detection, limit of quantitation. The proposed method can be used for the estimation of Ibuprofen and Famotidine in combined dosage forms.

INTRODUCTION

Ibuprofen is a NSAID (Non Steroidal Anti-inflammatory drug) indicated for the relief of signs and symptoms of the rheumatoid arthritis and osteoarthritis, but the side effect of gastric ulceration was the big problem, Famotidine is a H_2 Receptor Antagonist. Ibuprofen individually gives relief from Rheumatoid and Osteoarthritis but side effect of Gastric ulceration was the big problem, but in combination with the Famotidine the side effect of gastric ulceration was also removed along with the above diseases. The present work involves the development of Q-Absorption Ratio method for the above combination. A survey of literature revealed no spectrophotometric method has been reported till now for the above combination. Hence an attempt was made to develop Q-Absorbance Ratio method with greater accuracy and sensitivity.



a. **b.**

Figure 1: Chemical structure of Ibuprofen (a) and Famotidine (b)

MATERIALS AND METHODS

Pure Ibuprofen (IBU) was obtained as a gift sample from GLPL, Vadodara, Gujarat (India) and pure Famotidine (FAM) was obtained as a gift sample from Alembic Ltd., Vadodara, Gujarat (India). As a solvent 0.1N NaOH was used throughout the study. Double beam UV/Visible spectrophotometer Shimadzu model 1800 with a pair of 10 nm matched quartz cells was used to measure absorbance of resulting solutions.

Q-ABSORPTION RATIO METHOD:

Determination of the Iso-absorptive point

The standard solutions of Ibuprofen and Famotidine (10 µg/ml) were scanned in the UV range of 200-400 nm. Iso-absorptive point was obtained at 274.5nm from overlay spectra of both drugs.

Preparation of standard stock solution of IBUPROFEN (1000µg/ml):

Accurately weighed quantity of IBUPROFEN 25 mg was transferred into 25 ml volumetric flask, dissolved and diluted up to mark with 0.1N NaOH. This will give a stock solution having strength of 1000 µg/ml. Then from this solution further dilutions were made for the linearity measurement.

Preparation of standard stock solution of FAMOTIDINE (1000µg/ml):

Accurately weighed quantity of FAMOTIDINE 25 mg was transferred into 25 ml volumetric flask, dissolved and diluted up to mark with 0.1N NaOH. This will give a stock solution having strength of 1000 µg/ml

Preparation of Working Standard Solution of FAMOTIDINE (100µg/ml)

FAMOTIDINE solution, 100µg/ml, was prepared by diluting 1 ml of stock solution to 10 ml with 0.1N NaOH. Then from this solution further dilutions were made for the linearity measurements.

Preparation of Calibration curve for Q-Absorption Ratio Method

The stock solutions for IBU and FAM were freshly prepared in 0.1N NaOH. Aliquots of both the stock solutions were diluted further again using 0.1N NaOH to get the concentration of IBU as 120,180,240,300,360,420µg/ml and that of FAM as 4,6,8,10,12,14µg/ml respectively to study the verification of Beer's law. Then the calibration curve was plotted. It gives Correlation coefficient 0.998, 0.998 at 264.0 nm and 287.0 nm for Ibuprofen and famotidine respectively.

RESULTS AND DISCUSSION

Simple UV spectra of the drugs and Overlay spectra showed that Ibuprofen and Famotidine can be determined using wavelength maxima at 264.0 nm and 287.0 nm, and iso-absorptive point at 274.5 nm shown in the figure 2, 3 & 4 respectively. The concentration of the drugs was calculated using regression equation derived from calibration curve. The results were depicted in Table 1, 2 and 3.

LINERITY AND RANGE

The linearity and range for Q-Absorption Ratio method was determined at six concentration levels for Ibuprofen and Famotidine. The linearity and range were found as 120-420 µg/ml and 4-24 µg/ml for IBU and FAM respectively. The calibration curve was constructed by plotting absorbance against concentration of drugs. As shown in Fig. 5 to 8.

ACCURACY

The accuracy of the methods was determined by the method of standard addition at three different levels. The recovery studies were carried out by spiking standard of each drugs equivalent to 80%, 100%, and 120% to the original amounts present in each drug formulations. The average recoveries were as reported in Table 1 and Table 2.

PRECISION

The precision of the method was assessed by replicate analysis of pharmaceutical preparations. The precision of Q-Absorption Ratio method was obtained by analyze on the same day (intra-day) and analyze on the different days by triplicate analysis (inter-day) precision and expressed as relative standard deviation percentage (R.S.D. %).The data on precision were reported in Table 3.

LIMIT OF DETECTION AND QUANTIFICATION

The limit of detection (LOD) and limit of Quantification (LOQ) was estimated from the standard calibration curve. The residual standard deviation of regression line or standard deviation of y intercepts of regression lines used to calculate LOD and LOQ. Here, LOD=3.3* D/S and LOQ=10*D/S. Where, D is the standard deviation of y intercept of regression line and S is the slope of calibration curves. The data on LOD and LOQ were reported in Table 3.

Table 1 Recovery data for Ibuprofen

Level of recovery	Amt of Std IBU added (µg/ml)	Total amt of IBU (µg/ml)	Amt of IBU found (µg/ml)	Amount of IBU recovered (µg/ml)	% Recovery	Mean % recovery ± SD
80%	96	216.35	216.23	95.88	99.87	99.89 ± 0.03
80%	96	216.35	216.29	95.94	99.93	
80%	96	216.35	216.24	95.89	99.88	
100%	120	240.35	240.26	119.91	99.92	99.92 ± 0.01
100%	120	240.35	240.28	119.93	99.94	
100%	120	240.35	240.26	119.91	99.92	
120%	144	264.35	264.27	143.92	99.94	99.94 ± 0.08
120%	144	264.35	264.40	144.05	100.03	
120%	144	264.35	264.16	143.81	99.86	

Table 2 Recovery data for Famotidine

Level of recovery	Amt of Std FAM added (µg/ml)	Total amt of FAM (µg/ml)	Amt of FAM found (µg/ml)	Amount of FAM recovered (µg/ml)	% Recovery	Mean % recovery ± SD
80%	3.2	7.21	7.19	3.18	99.37	99.89 ± 0.65
	3.2	7.21	7.20	3.19	99.68	
	3.2	7.21	7.23	3.22	100.62	
100%	4.0	8.01	7.99	3.98	99.50	99.66

	4.0	8.01	7.98	3.97	99.25	± 0.65
	4.0	8.01	8.02	4.01	100.25	
120%	4.8	8.81	8.80	4.79	99.79	99.92 ± 0.43
	4.8	8.81	8.83	4.82	100.41	
	4.8	8.81	8.79	4.78	99.58	

Results obtained revealed that % recovery of Ibuprofen and Famotidine was within acceptance criteria given in ICH i.e 98-102%

Table 3: Validation Parameters for Q-Absorption Ratio method

Parameters			**Q-Absorption Ratio method**		
		Ibuprofen at 274.5 nm	**Famotidine at 274.5 nm**	**Ibuprofen at 264.0 nm**	**Famotidine at 264.0 nm**
Slope		0.0001	0.0260	0.001	0.028
Intercept		0.075	0.075	0.100	0.039
Correlation coefficient		0.999	0.999	0.998	0.998
Linearity range (µg/ml)		120-420	4-24	120-420	4-24
LOD (µg/ml)		0.197	0.159	0.176	0.145
LOQ (µg/ml)		0.590	0.490	0.552	0.473
Precision (%RSD)	Intraday	0.021	0.226	0.024	0.203
	Interday	0.051	0.410	0.060	0.326

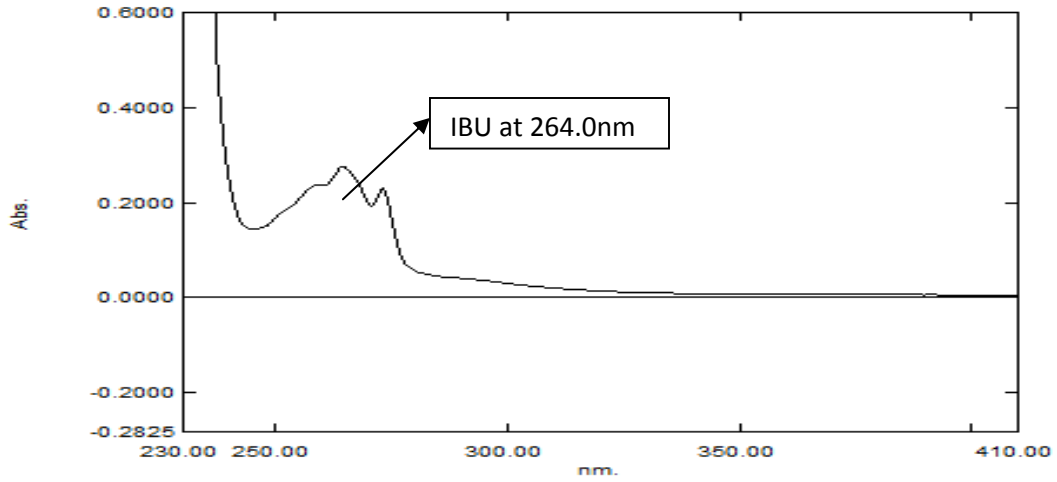


Figure: 2: Spectra of Ibuprofen standard showing λ_{max}

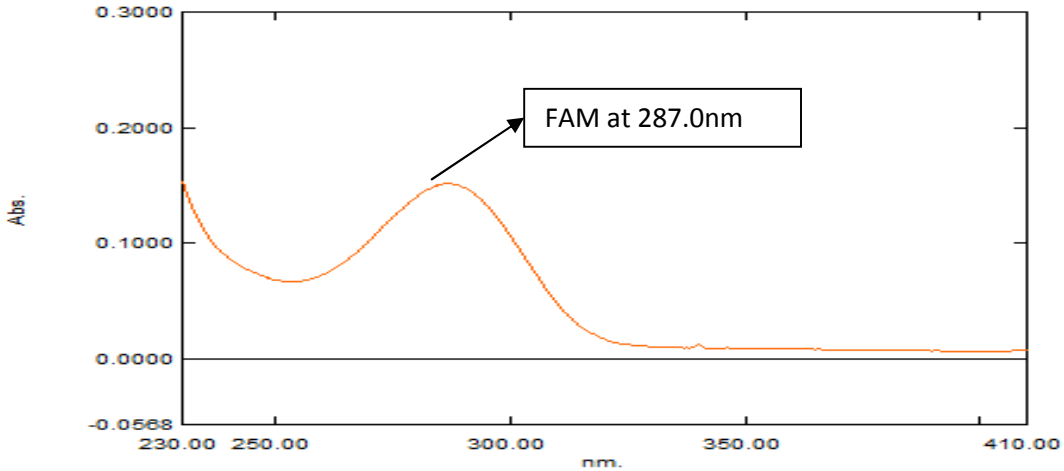


Figure: 3: Spectra of Famotidine standard showing λ_{max}

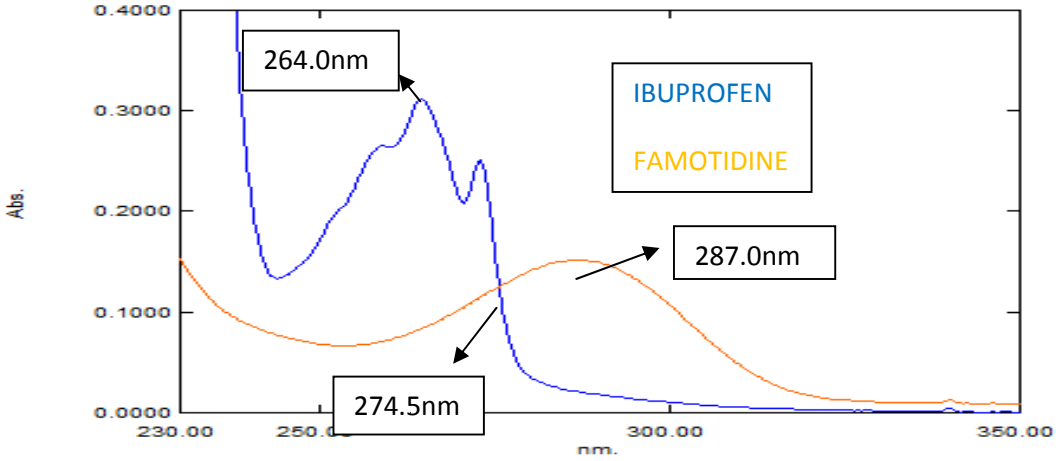


Figure 4: Overlay spectra of Ibuprofen and Famotidine

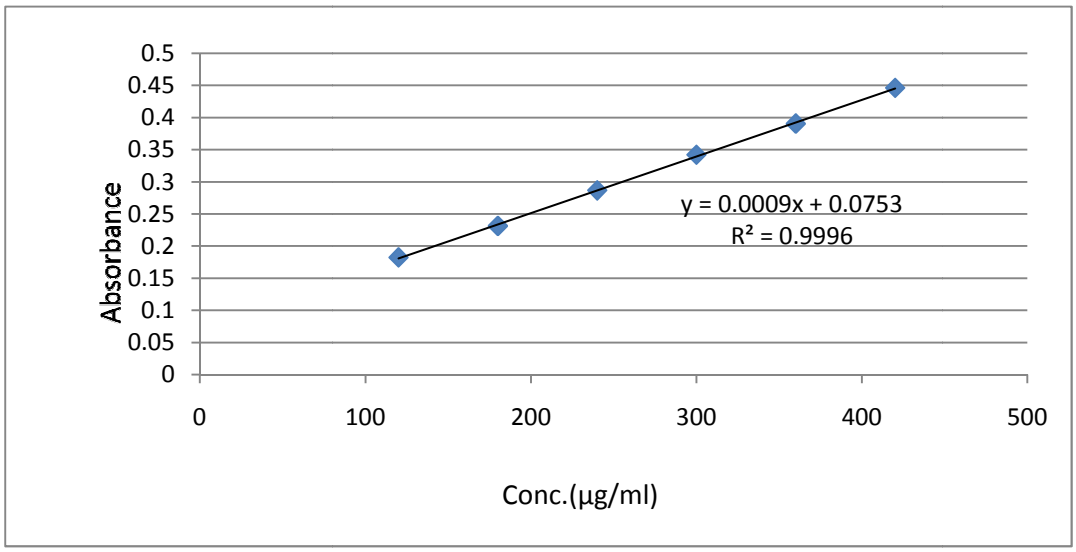


Figure 5: Linearity curve of Ibuprofen at 274.5 nm for Q-Absorption Ratio method

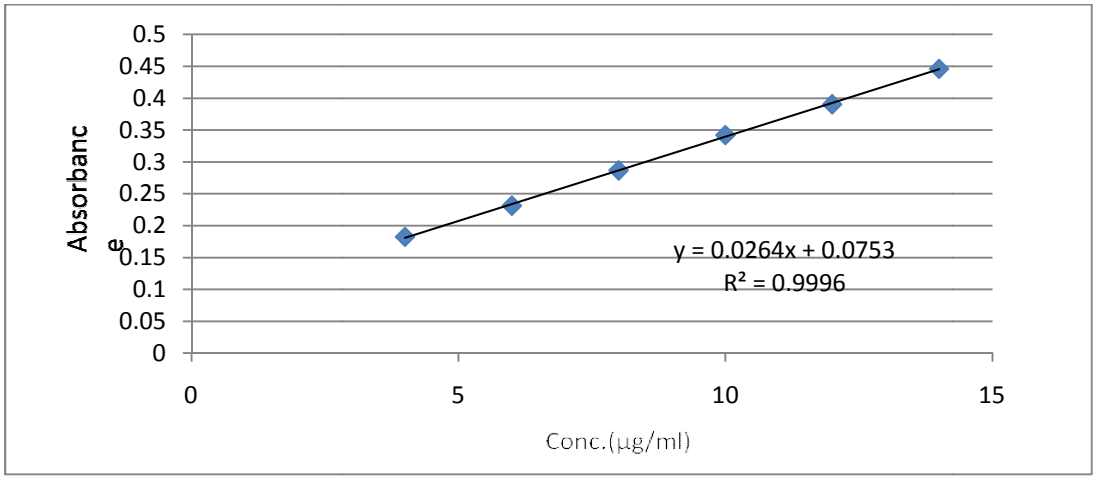


Figure 6: Linearity curve of Famotidine at 274.5 nm for Q-Absorption Ratio method

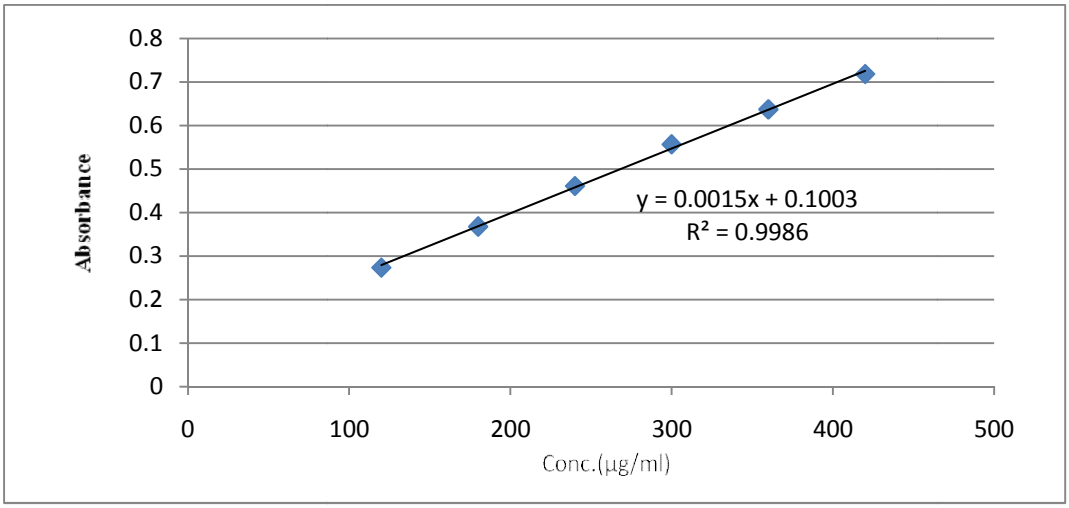


Figure 7: Linearity curve of IBU at 264.0 nm for Q-Absorption Ratio method,

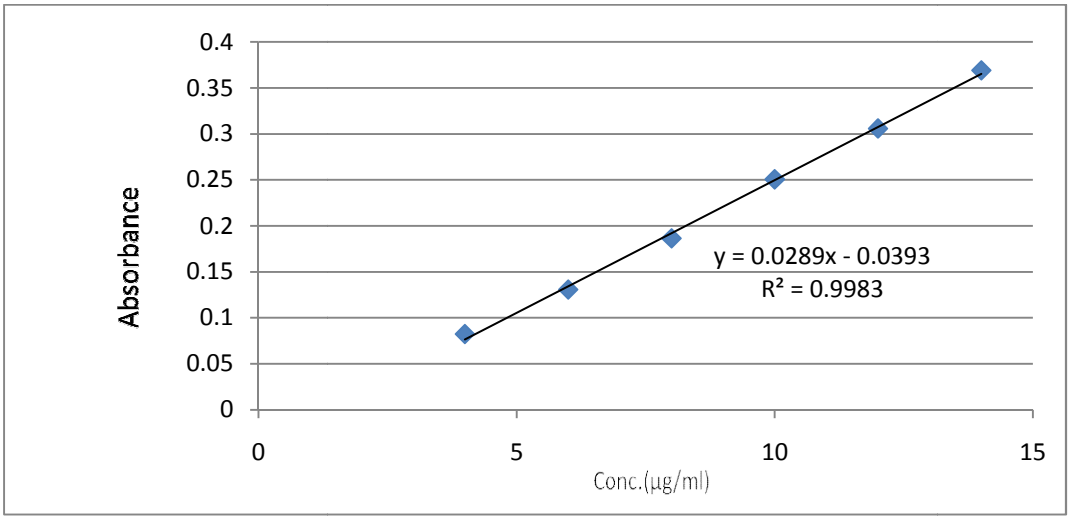


Figure 8: Linearity curve of FAM at 264.0 nm for Q-Absorption Ratio method.

CONCLUSION

Q-Absorption Ratio method was developed for the determination of Ibuprofen and Famotidine in pharmaceutical dosage form. The low value of relative standard deviation for repeated measurement indicates that the method is precise. The value of SD in recovery study is less than two, which indicates that the methods can be used for estimation of the Ibuprofen and Famotidine without any interference. Hence proposed method is simple, accurate, precise, rapid and cost effective.

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