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Research Article

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UV spectrophotometric derivative methods for estimation of fexofenadine hydrochloride in bulk drug and pharmaceutical dosage form

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ABSTRACT

Simple and precise UV spectrophotometric methods by second and third order derivative have been developed and validated for the estimation of fexofenadine hydrochloride in bulk and its tablet formulation. The standard and sample solutions of fexofenadine hydrochloride were prepared in 0.1 N Hydrochloric acid. Fexofenadine hydrochloride was estimated at 215 nm for the second order derivative and 233.7 nm for third order derivative respectively. Beer's law was obeyed in the concentration range of 1 to 14 µg / ml with coefficient of correlation values were 0.9992 for second order derivative method and 0.9997 for third order derivative method respectively. These methods were tested and validated for various parameters according to ICH guidelines. The precision expressed as relative standard deviation were of 0.8908 % and 1.152% for the above two methods respectively. The proposed methods were successfully applied for the determination of fexofenadine hydrochloride in pharmaceutical formulation. Results of the analysis were validated statistically and were found to be satisfactory. The proposed methods are simple, easy to apply, low-cost and require relatively inexpensive instruments.

Keywords: Fexofenadine hydrochloride, UV - Derivative spectroscopy 0.1 N hydrochloric acid

INTRODUCTION

Fexofenadine is described as second or third generation antihistamine. Its chemical name is RS -2 [4-(hydroxydiphenyl- methyl)-1 piperidyl]butyl] phenyl]- 2methyl-propanoic acid. ($C_{32}H_{39}NO_4$). It is indicated for relief from physical symptoms associated with seasonal allergic rhinitis and for the treatment of chronic urticaria. It prevents the aggravation of rhinitis and urticaria and reduces the severity of the symptoms associated with those conditions, providing relief from the repeated sneezing, runny nose, itchy eyes and generated body fatigue. This drug is official in USP [1], IP [2] pharmacopoeia. In literature survey EE capillary electrophoresis [3], HPLC [4-7] and spectrophotometric [8-11], non aqueous titration [12] methods have been reported for assay of fexofenadine.

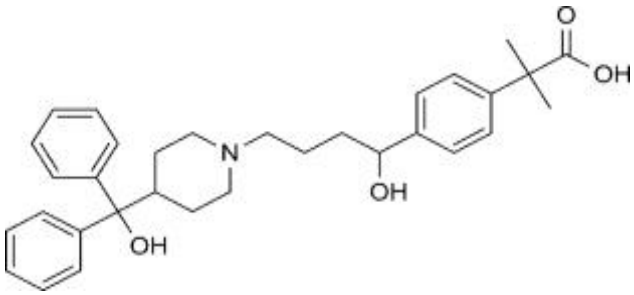

Fig.1 Structure of fexofenadine hydrochloride

EXPERIMENTAL SECTION

Material and Methods

Shimadzu UV-1800 was used with 10 mm matched quartz cell to measure absorbance of solution.
A Shimadzu analytical balance with 0.01 mg was used.

Chemical and Reagents

Reference standard of fexofenadine hydrochloride was obtained from reputed firm with certificate analysis. All spectral absorbance measurements were made on Shimadzu UV-1800 with 10 mm matched cell.

Preparation of Standard Solution

About 10 mg of standard fexofenadine hydrochloride was weighed accurately and transferred in 100 ml of volumetric flask. About 30 ml of 0.1 N Hydrochloric acid was added and sonicated for 15 minutes. The volume was adjusted up to the mark with 0.1 N Hydrochloric acid to give concentration as 100 µg /ml.

Estimation from tablets

Twenty tablets were weighed accurately and average weight of each tablet was determined. Powder equivalent to 10 mg of fexofenadine hydrochloride was weighed and transferred in 100 ml of volumetric flask. A 30 ml of 0.1 N Hydrochloric acid was added and sonicated for 15 minutes and filtered. The filtrate and washing were diluted up to the mark with 0.1 N Hydrochloric acid to give concentration as 100 µg /ml. Such solution was used for analysis.

Method A: Second order derivative method

For the selection of analytical wavelength, 10 µg /ml solution of fexofenadine hydrochloride was scanned in the spectrum mode from 300 nm to 200 nm by using 0.1 N Hydrochloric acid as blank. The second order derivative spectrum was obtained by using derivative mode by UV probe 2.42 software. From the spectrum, the amplitude of the derivative spectrum was measured between 215 nm (Fig. 2).

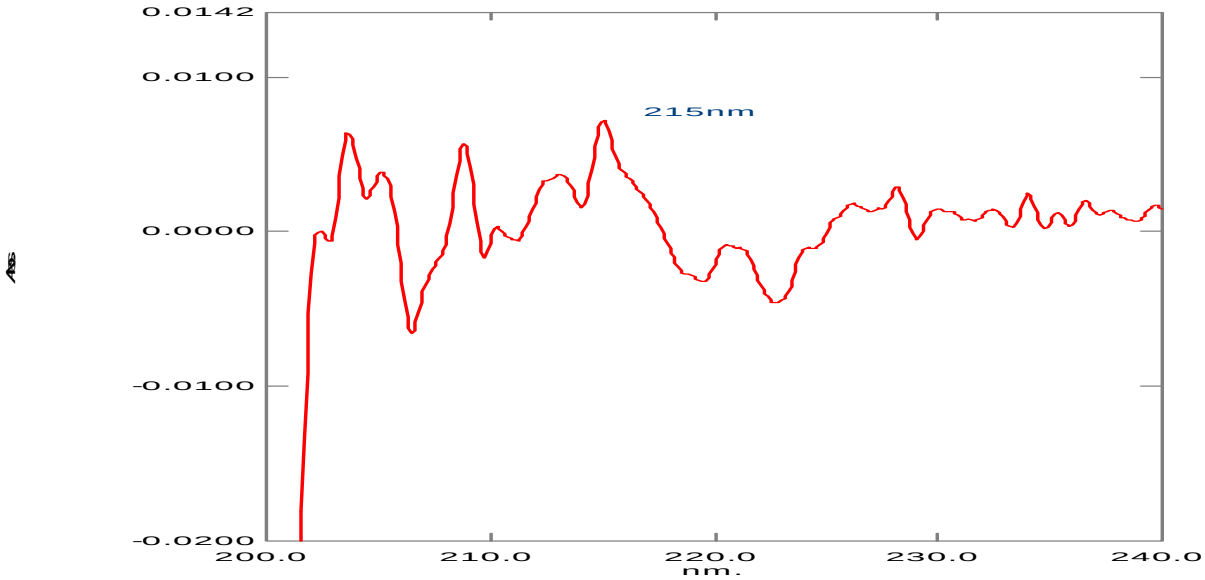

Fig. 2 Second order derivative spectrum of fexofenadine hydrochloride (10 µg/ml) showing absorbance at 215 nm

Into series of 10 ml graduated flask, varying amount of standard solutions of fexofenadine hydrochloride was pipette out and volume was adjusted with 0.1 N Hydrochloric acid as solvent. Solutions were scanned between 300 nm to 200 nm in spectrum mode. The second order derivative spectra were obtained by using derivative mode. Amplitudes of the resulting solutions were measured at 215 nm by using 0.1 N Hydrochloric acid as blank. The calibration curve was prepared in the concentration range of 1 to 14 µg/ml. (Fig. 3)

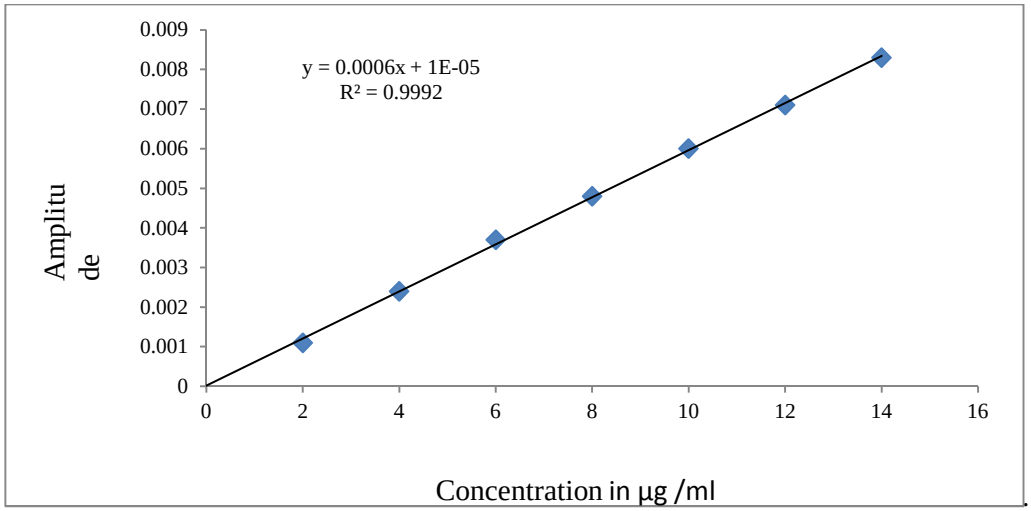

Fig. 3. Calibration curve for fexofenadine hydrochloride at 215 nm by second order derivative Spectroscopy

Method B: Third order derivative method

For the selection of analytical wavelength, 10 µg /ml solution of fexofenadine hydrochloride was scanned in the spectrum mode from 300 nm to 200 nm by using 0.1 N Hydrochloric acid as blank. The third order derivative spectrum was obtained by using derivative mode by UV probe 2.42 software. From the spectrum, the amplitude of the derivative spectrum was measured between 233.7 nm (Fig. 4).

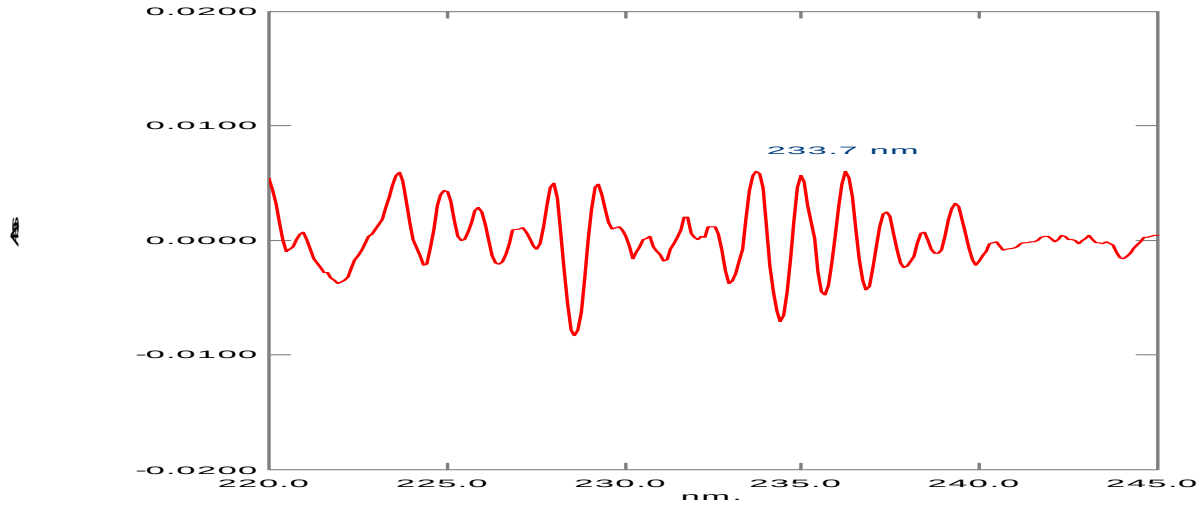

Fig. 4. Third order derivative spectrum of fexofenadine hydrochloride (10 µg/ml) showing absorbance at 233.7 nm

Into series of 10 ml graduated flask, varying amount of standard solutions of fexofenadine hydrochloride was pipette out and volume was adjusted with 0.1 N Hydrochloric acid as solvent. Solutions were scanned between 300 nm to 200 nm in spectrum mode. The third order derivative spectra were obtained by using derivative mode. Amplitudes of the resulting solutions were measured at 233.7 nm by using 0.1 N Hydrochloric acid as blank. The calibration curve was prepared in the concentration range of 1 to 14 µg/ml. (Fig. 5)

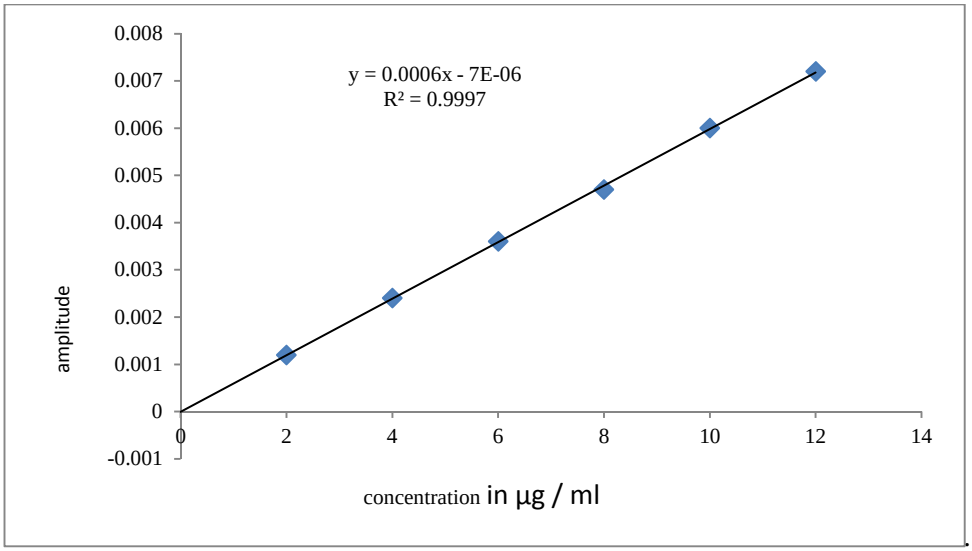

Fig. 5. Calibration curve for fexofenadine hydrochloride by area under curve spectroscopy

Results of analysis are given in table 1.

Table 1: Values of results of optical and regression of drug

Parameter	First order derivative method	Third order derivative method
Detection Wavelength (nm)	215	233.7
Beer Law Limits (µg/ml)	1-14	1-14
Correlation coefficient(r^2)	0.9992	0.9997
Regression equation (y=b+ac)		
Slope (a)	0.0006	0.0006
Intercept (b)	-0.00001	-0.000007

Validation

Accuracy

Accuracy of the proposed methods was carried as on the basis of recovery studies. It is performed by the standard addition method. Recovery studies were performed by adding standard drug at different levels to the pre-analyzed tablets powder solution and the proposed method was followed. From the amount of the drug estimated, the percentage recovery was calculated. The results of the analysis are shown in table (2, 3).

Table 2: Results of recovery of fexofenadine hydrochloride for first order derivative method

Amount of Sample Added in (µg/ml)	Amount of Standard Added in (µg/ml)	Total amount recovered	Percentage recovery (%)	Standard deviation	Percentage of relative standard deviation (C.O.V.)
2	0	1.9523	97.619	0.0752	3.856
2	2	4.0000	100.002	0.0890	2.227
2	4	6.0238	100.396	0.1064	1.767
2	6	7.9761	99.702	0.1064	1.334
				Mean =0.09433	Mean =2.2965

Table 3: Results of recovery of fexofenadine hydrochloride for third order derivative method

Amount of Sample Added in (µg/ml)	Amount of Standard Added in (µg/ml)	Total amount Recovered	Percentage Recovery (%)	Standard Deviation	Percentage of relative standard deviation (C.O.V.)
2	0	2.0001	100.002	0.09622	4.811
2	2	3.9761	99.4047	0.1150	2.892
2	4	6.0002	100.003	0.1360	2.268
2	6	7.9761	99.7023	0.1150	1.4419
				Mean=0.1155	Mean =2.853

Precision

The method precision was established by carrying out the analysis of homogenous powder blend of tablets. The assay was carried out of drug by using proposed analytical method in six replicates. The values of relative standard deviation lie well within the limits indicated the sample repeatability of the method. The results obtained are tabulated in table 4.

Table 4: Precision- method precision

Experiment no.	Weight of fexofenadine hydrochloride (mg)	Content fexofenadine hydrochloride (mg)	
		second order derivative	third order derivative
1	10	10.002	10.004
2	10	10.003	10.166
3	10	10.166	9.8333
4	10	10.002	10.0001
5	10	9.8333	10.0004
6	10	10.000	9.8333
	Standard deviation	0.0890	0.1150
	%RSD	0.8908	1.152

Inter-day and intra-day precision

An accurately weighed quantity of tablets powder equivalent to 10 mg of fexofenadine hydrochloride was transferred to 100 ml of volumetric flask. A 30 ml of 0.1 N Hydrochloric acid was added and sonicated for 15 minutes and filtered. The filtrate and washing were diluted up to the mark with 0.1 N Hydrochloric acid to give concentration as 100 µg /ml. Such solution was used for analysis.

For second order derivative method

Solution was scanned between 300 nm to 200 nm in spectrum mode. The first order derivative spectrum was obtained by using derivative mode. Amplitude of the resulting solution was measured at between 220 nm to 210 nm by using 0.1 N Hydrochloric acid as blank. The amplitude of final solution was read after 0 hr., 3 hrs. and 6 hrs. in 10 mm cell 215 nm for second order derivative (method A). Similarly the amplitude of the same solution was read on 1^{st}, 2^{nd} and 5^{th} day. The amount of fexofenadine hydrochloride was estimated by comparison with standard at 215 nm for second order derivative, table 5.

For third order derivative method

Solution was scanned between 300 nm to 200 nm in spectrum mode. The area under curve of resulting solutions was measured at between 245 nm to 255 nm by using 0.1 N Hydrochloric acid as blank. The area under curve of final solutions was read after 0 hr., 3 hrs. and 6 hrs. in 10 mm cell at 215 nm to 225 nm (method B). Similarly area under curve of the same solution was read on 1^{st}, 2^{nd} and 5^{th} day. The amount of fexofenadine hydrochloride was estimated by comparison with standard at 233. 7 nm for third order derivative (table 5).

Table 5: Summary of validation parameter for intra-day and inter-day

Sr. no.	Parameters	Second order derivative method	Third order derivative method
(A)	Intra-day precision (n=3) Amount found ± % RSD	99.15 % 2.158	99.145% 2.267
(B)	Inter-day precision (n=3) Amount found ± % RSD	98.165% 1.562	98.694% 1.378
(c)	Ruggedness Analyst to analyst(n= 3) %RSD	1.127	1.360

Limit of Detection (LOD) and Limit of Quantification (LOQ)

The limit of detection (LOD) is defined as the lowest concentration of an analyte that an analytical process can reliably differentiate from back-ground levels. In this study, LOD and LOQ were based on the standard deviation of the response and the slope of the corresponding curve using the following equations-

$LOD = 3.3\ \sigma/S$ and $LOQ = 10\ \sigma/S$

Where σ is the standard deviation of the signal to noise ratio of the sample and S is the slope of the related calibrations graphs.

The limit of quantification (LOQ) is defined as the lowest concentration of the standard curve that can be measured with an acceptable accuracy, precision and variability .The values of LOD and LOQ are given in table 6.

Table 6: Values of results of LOD and LOQ

Parameters	Second order derivative method	Third order derivative method
Limit of Detection (µg/ml)	0.2683	0.3175
Limit of Quantification (µg/ml)	0.8132	0.9622

Ruggedness

The ruggedness of the method is defined as degree of reproducibility of results obtained by analysis of fexofenadine hydrochloride sample under variety of normal test conditions such as different laboratories, different analysts and different lots of reagents. Quantitative determination of fexofenadine hydrochloride was conducted spectrophotometrically on one laboratory. It was again tested in another laboratory using different instrument by different analyst. The assays obtained in two different laboratories were well in agreement. It proved ruggedness of the proposed methods.

RESULTS AND DISCUSSION

The second and third order derivative UV-spectroscopic methods are useful for routine analysis of fexofenadine hydrochloride in bulk drug and formulation. The derivative spectroscopy method applied has the advantage that it locates hidden peak in the normal spectrum. It eliminates the interference caused by the excipients and the degradation products present, if any, in the formulation. The method was validated according to International Conference on Harmonization guidelines for validation of analytical procedures. Fexofenadine hydrochloride has the absorbance maxima at 215 nm and 233.7 nm for second and third order derivative methods respectively. The polynomial regression data for the calibration plots showed good linear relationship in the concentration range of 1 to 30 µg/ml and given in table1. Recovery studies were carried out by adding the pure drug to the previously analyzed tablet powder sample and shown in table 2, 3. The percentage recovery value indicates non interference from excipients used in formulation. The reproducibility and accuracy of the method were found to be good, which was evidenced by low standard deviation.

CONCLUSION

The most striking features of two methods are its simplicity and rapidity, not requiring tedious sample solutions preparations which are needed for other instrumental methods. From the results obtained it can be concluded that the proposed methods are fully validated and found to be simple, sensitive, accurate, precise, reproducible, rugged and robust and relatively inexpensive. So, the developed methods can be easily applied for the routine quality control analysis of fexofenadine hydrochloride in pharmaceutical formulation.

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REFERENCES

[1] The United States Pharmacopeia. United States Pharmacopeia convention Inc, Rockville, **2008**, USP 29 NF 24, Vol no.30 (4), 1208.
[2] Indian Pharmacopeia, Controller of Publication, Delhi, **2007**, Vol- 1, II, III.
[3] Breier AR, Garcia SS, Jablonski A, Steppe M, Schapoval. ,*J AOAC Int*. **2005,** 88 (4),1059-63.
[4] Sevgi Karakuş, İlkay Küçükgüzel, Ş.Güniz Küçükgüzel. ,*Journal of Pharmaceutical and Biomedical Analysis*, **2008**, 46(2),295-302.
[5] Farya zafar, Muhammad Harris Shoaib and Rabia Ismail Yousuf, *Pakistan Journal of Pharmacology*, **2011,** 28 (1), 43-49.
[6] Hadir M Maher, Maha A Sultan and Ileana V Olah, *Chemistry Central Journal*, **2011**,5 (76),1-10.
[7] Rajan V. Rele, *Der Pharmacia Lettre*, 2016, 8 (6):224-228.
[8] B Narayan and K Veena *Journal of Scientific & Industrial research*, **2010,** 69, 368-372
[9]K Suresh Kumar, V Ravichandran, MK Mohan Maruga Raja, R Thyagu, A Dharamsi. *Indian journal of Pharmaceutical Science*, **2006,** 68 (6), 841-842.
[10] R. Vijay Amrithraj, Purna Chander S., Jabir Aboobacker O. and Anudeep M., *International Journal of Research in Pharmaceutical and Biomedical Sciences*, **2011**, 2 (2),738-739.
[11] Dobariya Chandrika T., Bhumika R. Patel, Zarna R. Dedania, S. M. Vijendraswamy, *Journal of Pharma Research*, **2015**, 4 (2) 63-68.

[12] Rele Rajan V. and Sawant Swapnil A**.,** *Journal of Chemical and Pharmaceutical Research*, **2013**, 5(4), 286-289.