International Journal of ChemTech Research
CODEN(USA): IJCRGG ISSN : 0974-4290
Vol. 3, No.2, pp 786-790, April-June 2011

Development and Validation of Spectrophotometric methods for determination of Aceclofenac in Tablets

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Abstact: The present study describes two simple validated spectrophotometric methods for the quantitation determination of aceclofenac in tablets. The technique was applied using methanol as a solvent. The zero order spectrum of aceclofenac shows λmax at 277.2 nm and the determination of aceclofenac were done A1%, 1cm values at 277.2 nm and by comparison with standard at the selected wavelength (Method I) and the first derivative absorbance values at 261.6 nm when (n=3) (Method II). The drug was found to obey beer lamberts law over the range of 5-25 µg/mL. Percent recovery values were found to be 99.01-99.64 by Method I while it was 101.33-101.66 by Method II for two different marketed formulations. Reproducibility of the spectrophotometric method was indicated by the SD values. The intraday and interday precision data proved the ruggedness of the method. The methods were found to be precise, specific, rugged and can be adopted for routine analysis of the drug.
Keywords: Aceclofenac, zero order spectra, derivative spectroscopy, tablets.

Introduction

Aceclofenac (ACF) a phenylacetic acid derivative used in the management of osteoarthritis, rheumatoid arthritis and ankylosing spondilitis. Chemically it is 2[(2,6- Dichlorophenyl)amino]phenyl acetoxyacetic acid[1]. It is official in B.P[2]. Literature survey revealed that spectrophotometric method based on reaction between drug and p-dimethylaminocinnamaldehyde[3], HPLC in human plasma[4-5] and HPTLC[6] methods have been reported for the estimation of aceclofenac in combination but no validated zero order and fist derivative spectrophotometric method has been reported for the estimation of aceclofenac. In the present investigation, simple, accurate and precise spectrophotometric method for determination of in tablet formulation has been described.

Materials and Methods

Experimental

Aceclofenac working standard was a gift sample from MAsal Labs Ltd. The Shimadzu UV-VISIBLE spectrophotometer (model UV-1700) was employed for all spectrophotometric measurements. UV-spectra of reference and test solutions were recorded in 1cm quartz cell over the range of 200-400nm.

Reagents and chemicals

Methanol of AR grade purity was procured from local supplier. The commercially available marketed capsule brand containing Aceclofenac 100 mg in each tablet (Acenac,Aristo Ltd. And Aceclo, Medley Ltd) has been used for estimation.

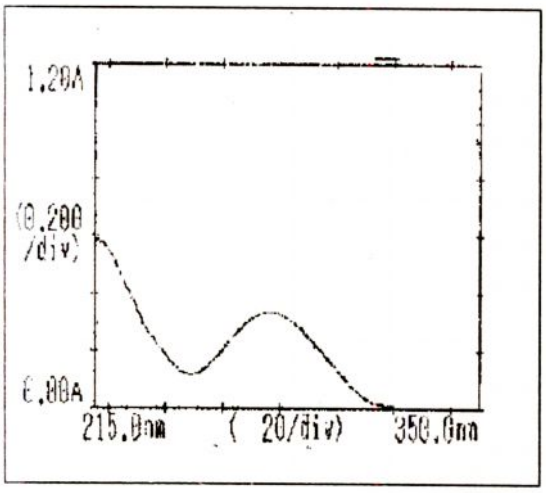

Fig. I:Zero order spectrum of Aceclofenac

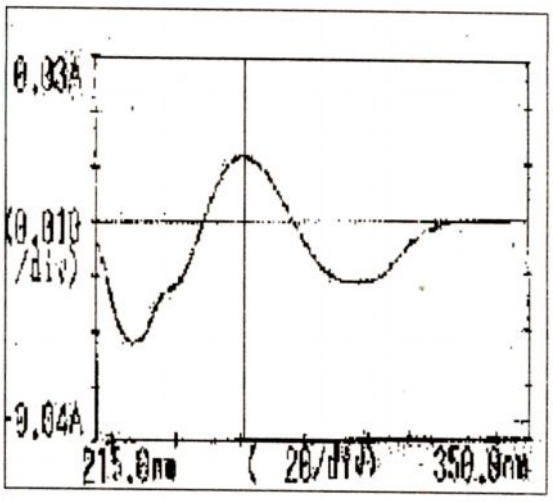

Fig II: First order derivative spectrum of Aceclofenac (n=3)

Preparation of standard stock solution

An accurately weighed quantity of Aceclofenac (~25 mg) was transferred into a 50 mL volumetric flask, diluted up to the mark with methanol to get a standard stock solution of 0.5 mg/mL. The working standard solution having concentration of 10 µg/mL of ACF was prepared and scanned in the UV range (400-200 nm) in 1.0 cm cell against solvent blank and zero order and first order spectra's were recorded. The zero order and first order spectra so recorded are shown in figures **I** and **II** respectively.

Construction of calibration curve

Different aliquots of standard solution (conc.100 µg/mL) were pipetted to prepare a series of concentration from 5-25 µg/mL. The zero order absorbance values at 277.2 nm and the first order derivative absorbance values at 261.6 nm (n=3) were read and calibration curve was constructed by plotting concentration vs. absorbance of ACF. The drug was found to obey Beer's Law in the concentration range of 5-25 µg/mL for both the proposed methods. The statistical data are shown in Table I.

Table I: The Statistical Data of Calibration Curve

Parameters	Zero order	First order
Analyticalwavelengths(nm)	277.2	261.6
Linearity range (µg/mL)	5-25	5-25
Correlation coefficient	0.9987	0.9995
Detection limit (µg/mL)	0.25	0.25

Determination of absorptivity value

Five working standard solution having concentration of about 10 µg/mL of ACF were prepared and the absorbance was read in 1.0 cm cell against solvent blank at 277.2 nm. The absorptivity value was found to be **324.47±0.61**

Assay

An accurately weighed quantity of tablet powder equivalent to about 25 mg of Aceclofenac (on labeled claim basis) was transferred to 50 mL volumetric flask, containing methanol, sonicated for 15 min and diluted up to the mark with methanol to get the concentration 500 µg/mL (Stock solution). The solution was then filtered through Whatmann filter paper (no. 41). A 5.0 mL portion of stock solution was diluted to 50 mL with methanol to give a solution of 50µg/mL. Aliquots of this solution were appropriately diluted to get concentration of 15µg/mL of ACF (on label claim basis). The absorbance of the resultant solution were read at the selected wavelengths and the amount of ACF was estimated by comparison with the standard and by taking A(1%,1cm) as 324.47±0.61 at 277.2 nm (Method I) and comparing the derivative absorbance of standard with that of the sample at 261.6 nm (Method II). The results of estimation are shown in Table II .

Table II: Results of estimation of Aceclofenac in marketed formulation

Drug	Labeled claim (mg)	Method I				Method II
		Comparison with standard		By A(1%,1cm)		Derivative spectroscopy
		277.2 nm		277.2 nm		261.6 nm
		% of labeled claim*				% of labeled claim*
Formulation 1	25.0	1.	99.99	1.	99.18	101.43
		2.	100.78	2.	100.18	101.58
		3.	100.75	3.	99.93	101.14
		4.	100.42	4.	99.61	100.82
		5.	100.15	5.	99.42	100.39
Mean ±SD,CV		100.41		99.66		101.07
		0.35		0.399		0.473
Formulation 2	25.0	1.	100.04	1.	101.40	101.23
		2.	99.70	2.	99.41	100.05
		3.	101.34	3.	99.23	102.90
		4.	99.20	4.	100.07	99.60
		5.	100.41	5.	100.53	101.73
Mean ±SD,CV		100.138		100.12		101.102
		0.807		0.881		1.33

Validation

Analytical method validation was performed as per USP[7] guidelines. The method was validated in terms of accuracy, precision, ruggedness, robustness, specificity, linearity and range and limit of detection.

Accuracy

The accuracy of the proposed method was ascertained by recovery studies performed by standard addition method. To a preanalysed tablet powder equivalent to 25 mg, pure drug was added at four different levels viz. 5mg, 10mg, 15mg, 20mg. The contents in the flask were appropriately diluted with methanol and zero order absorbance at 277.2 nm and first order derivative absorbance values at 261.6 nm were read and the amount of total drug was calculated and the amount of pure drug recovered was calculated using following formula, Percent recovery= (T-A/S)* 100. Results of recovery studies are shown in Table III. The results indicate excellent recoveries ranging from 99.01% to 101.66%. The results indicate that there was no interference from the excipients.

Table III: Results of Recovery study

Formulation	Amt. of pure drug added (mg)	277.2 nm	261.6 nm
		% Recovery	% Recovery
Formulation 1	5.1	100.39	100.98
	9.5	99.89	102.2
	15.1	99.27	100.76
	19.5	99.02	101.38
Mean		99.64	101.33
±SD		0.618	0.634
Formulation 2	5	98.16	101.4
	9.4	101.27	102.34
	14.9	98.45	101.47
	19.3	98.18	101.45
Mean		99.01	101.66
±SD		1.50	0.45

Precision

Precision of the analytical method is expressed as SD or RSD of series of measurement by replicate estimation of drugs by proposed method. The percent SD were found to be ±0.35 and ±0.39 at 277.2 nm by comparison with standard and by A (1% 1cm) respectively and ±0.47 by derivative spectroscopy at 261.6 nm for formulation I. Similarly, the percent SD for formulation II were found to be ±0.80 & ±0.88 at 277.2 nm by comparison with standard and by A (1%1cm) and ±1.33 by derivative spectroscopy at 261.6 nm respectively. Results of estimation are shown in Table II.

Intermediate Precision

The intermediate precision was evaluated by the intraday (within day) and interday (between days) study. The results of estimation by proposed methods are shown in Table IV.

Robustness and ruggedness

Robustness of the proposed method was evaluated deliberately substituting ethanol as solvent. Ruggedness of the proposed method was carried out for three different analysts. The result did not show any considerable statistical difference suggesting that the method developed was robust and rugged. Results are shown in Table IV.

Specificity

It is the ability of an analytical method to assess unequivocally the analyte of interest in the presence of components that may be expected to be present such as impurities, degradation products and matrix components. Assay of ACF was carried out successively by keeping the sample for 24hrs under following different conditions.

1. At 50^{o}C after addition of 1mL 0.1N NaOH
2. At 50^{o}C after addition of 1mL 0.1N HCl
3. At 50^{o}C after addition of 1mL 3% H2O2
4. At 60^{o}C
5. At different humidity condition i.e. 75% and 58%

Dilutions of all these solutions were made as described under assay. Results of estimation are shown in Table V.

Table IV: Results of Ruggedness and Robustness study

Parameter	Labeled claim (mg)	Method I		Method II
		Comparison with standard	By A(1%,1cm)	Derivative spectroscopy
		277.2 nm	277.2 nm	261.6 nm
		Mean of % label claim ± S.D.		
Different analyst	25.0	101.04±0.991	100.48±0.82	101.58±0.86
Interday		100.78±1.02	99.30±1.07	100.82±1.05
Intraday		99.98±1.35	97.76±1.02	99.86±1.32
Robustness study		101.43±0.83	100.64±0.73	100.29±0.47

Table V: Results of Specificity study

Conditions	Method I		Method II
	Comparison with standard	By A(1%,1cm)	Derivative spectroscopy
	277.2 nm	277.2 nm	261.6 nm
	% of labeled claim		
0.1N NaOH	70.64	73.82	75.47
0.1N HCl	108.02	109.86	110.62
60^{o}C	101.34	102.42	96.97
3% H2O2	100.31	101.12	97.13
Humidity (75%)	102.59	103.25	99.52
Humidity (58%)	101.87	101.97	98.31

Limit of Detection
The limit of detection of ACF was found to be 0.25µg/mL.

Linearity and range
Accurately weighed quantities of capsule powder equivalent to 80, 90, 100, 110 and 120% of label claim of ACF were taken and dilutions were made as per the experimental procedure. The graphs of concentration Vs absorbance were plotted and found to be linear and the coefficient of correlation at 277.2 nm and 261.6 nm was found to be 0.9938 and 0.9956 respectively.

Results and Discussion

In the present study, quantitative determinations of aceclofenac in tablet formulations was carried out by uv-spectrophotometric method [i.e. by comparison with standard and by A (1%,1 cm)] and derivative uv-spectrophotometric method. Figure I and Figure II show the zero order and first order spectrum of standard aceclofenac in methanol. Beer's law was obeyed in the concentration range of 5-25 µg/mL and correlation coefficient for zero order and first order derivative spectrum were found to be 0.9987 and 0.9995 respectively (Table I). Results of estimation in marketed formulations and recovery results in formulation I and II shows that method is accurate and precise (Table II and III). The proposed methods were validated as per USP guidelines. The intraday SD was found to be 1.35 and 1.02 for method I and 1.32 for method II. Also interday SD was found to be 1.02 and 1.07 for method I and 1.32 for method II respectively. SD for robustness and ruggdness study were found to be well below the limits for method 1 and 2 (Table IV). Result of specificity study are shown in Table V which indicate that % of labeled claim in all the stress conditions were found to be different than the untreated sample, indicating susceptibility of drug to various stress conditions.

Hence we conclude that the proposed methods are quite reliable, accurate and precise for the quantitative estimation of aceclofenac in marketed formulation and can be adopted for routine analysis of the drug.

Acknowledgement
The authors are thankful to Principal S.K.B. College of Pharmacy, Kamptee for providing the necessary facilities and Maral Labs Ltd. for providing gift sample of the drug.

References

[1]British Pharmacopoeia,Vol.I, Controller of Her Majesty's Stationary Office Norwish, 2004, 36

[2] i bid, 36-37.

[3]Zwilla N.H.,Abdul Azim Mohammad M.,El-Kausy N. M., and El-Moghazy Aly, *J. Pharm Biomed Anal,* 2002, 27(1-2): 24351

[4] Jin Y., Chen H., Gu S., and Zeng I., *Se Pu*, 2004, 2293): 252-4

[5]Hinz B.,Auge D.,Rau T.,Rietbrock S.,Brune K.,and WernerU.,Biomed Chromatogr., 2003, 1794): 268-75

[6]El-sahartyY.S., Refaat M., El-Kousy N.M.and El-Moghazy Aly S.M.,JPharm biomed Anal., 2002, 27(1-2) : 23451

[7] The United State Pharmacopoeia**,** USP 28/ NF 23, Asian Edition, The United States Pharmacopoeial Convention, Inc., Rockville, MD. 2749-2751

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