Analytical method development and validation of Aceclofenac in Bulk and Marketed Formulation

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Abstract

The present work reveled that UV Spectrophotometric method was developed for the quantitative determination of Aceclofenac in bulk drug and pharmaceutical dosage forms and has an absorption maximum at 273 nm in distilled water. The Beer's law was obeyed over the concentration range of 5-40 µg/ml. The correlation coefficient was found to be 0.999 and it has showed good linearity, reproducibility, precision in this concentration range. The % recovery values were found to be within 99.23%showed that the method was accurate. The LOD and LOQ were found to be 0.461073 µg /ml and 1.39719µg/ml respectively.

Keywords: Aceclofenac, UV spectrophotometer, LOD, LOQ etc.

1. Introduction

Spectroscopy is the branch of science dealing with the study of interaction between Electromagnetic radiation and matter. It is a most powerful contrivance available for the study of atomic and molecular structure/s and is used in the analysis of wide range of samples. Optical spectroscopy includes the region on electromagnetic spectrum between 100 Å and 400 µm.

Ultraviolet-Visible Spectro-photometry is one of the most frequently employed techniques in pharmaceutical analysis. It involves measuring the amount of ultraviolet or visible radiation absorbed by a substance in solution. Instrument which measure the ratio, or function of ratio, of the intensity of two beams of light in the U.V-Visible region are called Ultraviolet-Visible spectrophotometers. In qualitative analysis, organic compounds can be identified by use of spectrophotometer, if any recorded data is available, and quantitative Spectrophotometric analysis is used to ascertain the quantity of molecular species absorbing the radiation. Spectrophotometric technique is simple, rapid, moderately specific and applicable to small quantities of compounds. Aceclofenac, chemically, 2-[2-[2-[(2,6-dichlorophenyl)amino]phenyl]acetyl]oxyacetic acid has anti- inflammatory and analgesic properties. It is a potent inhibitor of cyclo-oxygenase (COX) which is involved in the production of prostaglandins[1].Aceclofenac is practically soluble in water so hydrotropic agents utilized to increase the water solubility.[2] According to the Biopharmaceutical Classification System (BCS) drug substances are classified to four classes upon their solubility and permeability. Aceclofenac falls under the BCS Class II, poorly soluble and highly permeable drug. **Aceclofenac** is a Non-Steroidal Anti-Inflammatory Drug

(NSAID) analog of diclofenac. It is used for the relief of pain and inflammation in rheumatoid arthritis, osteoarthritis and ankylosing spondylitis.

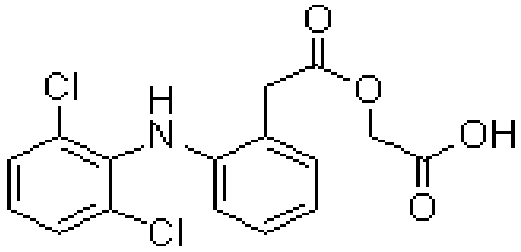

Fig 1: Structure of Aceclofenac (2-[2-[2-[(2, 6-dichlorophenyl) amino] phenyl] acetyl] oxyacetic acid**.**

2. Material and methods

*2.1. Instruments used***:** Jasco 1800 spectrophotometers with 1 cm matched quartz cell were used.[3]

2.2 Preparation of reagents:

Weighed accurately 0.1 g of Aceclofenac and transferred in to 100 ml of volumetric flask already containing distilled water and volume was made up to the mark with distilled water (1000 µg /ml). Further dilution of 100 µg /ml solution of Aceclofenac was made using Distilled Water.

2.3 Preparation of standard stock solution

Stock solution of Aceclofenac 100 µg /ml was prepared in distilled water .From this stock solution, appropriate dilution was made and scanned in the UV range 200-400 nm. The absorbance of Aceclofenac was found to be 273 nm. This increased solubility of Aceclofenac is due to the hydrotropic solubilization phenomenon. Aliquots of in the range of 5-40µg /ml were prepared with the same solvent and scanned under Photometric mode for Absorbance at 273.6 nm[9].

Experimental:

*Preparation of standard calibration curve of bulk drug***.**

1. *Preparation of standard stock solution*

Accurately weighed and transferred 0.1 gm Aceclofenac (bulk drug) in 100 ml volumetric flask and dissolved in distilled water (1000 µg/ml Stock solution A). From the stock solution, 10 ml was withdrawal and transferred in to 100ml volumetric flask containing distilled water. Further dilutions were made to obtain the final concentration of 100 µg/ml.

2. *Preparation of calibration curve*

Fresh aliquots of Aceclofenac from 0.5-4.0ml (5 µg/ ml-40µg/ml) were transferred into a series of 10 ml volumetric flasks to provide final concentration range of 5-40µg/ml. The solutions in each flask were made up to the mark with distilled water. The absorbance of solution was measured at 273nm against the reagent blank. The amount of Aceclofenac in the sample solution was computed from its calibration curve.

3. Results and Discussion

UV method validation of drug:-

The UV method was developed for synthesized impurity as per ICH (Q2B) guidelines.[4]

3.1. Linearity: The synthesized impurity shows maximum absorbance at 273nm and obeys Beer- Lamberts law in the concentration range of 5-40µg/ml.

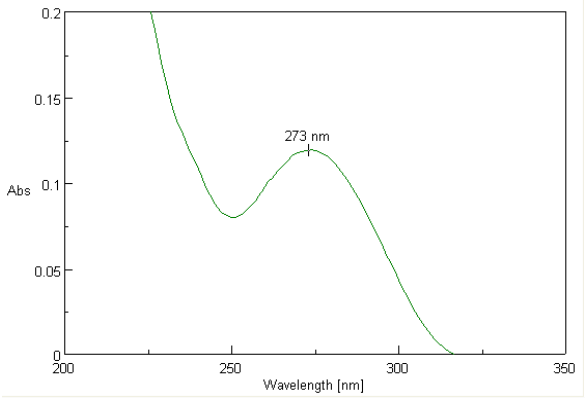

Fig 2: UV Spectra of Aceclofenac (Drug)

Table 1: Linearity of Impurity of Aceclofenac (Bulk) by Uv Specrtophotometry.

Sr .No.	Concentration (µg/ml.)	Absorbance at 273nm
1.	5	0.11199
2.	10	0.228006
3.	15	0.329431
4.	20	0.469315
5.	25	0.579062
6.	30	0.687707
7.	35	0.793187
8.	40	0.917944

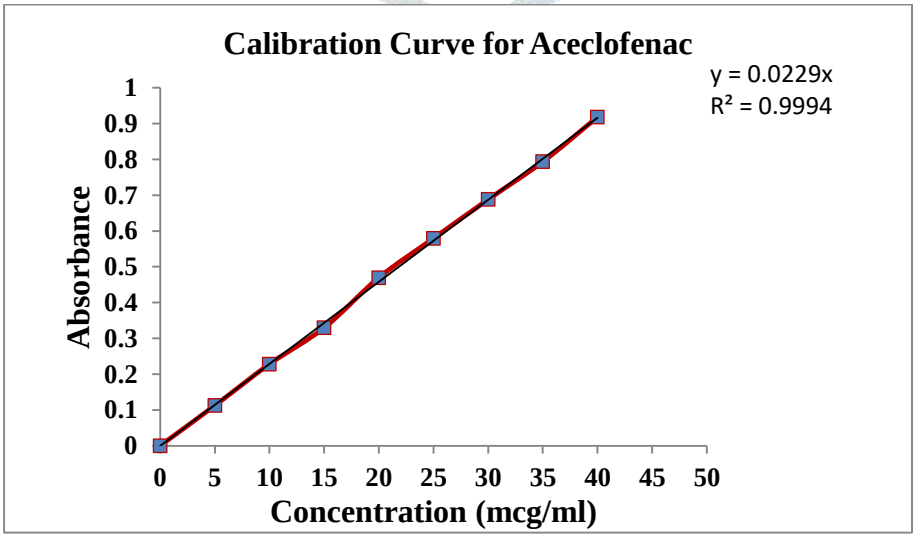

Fig 3: Graph of linearity of Aceclofenac (Bulk) by UV Specrtophotometry.

3.2. Precision: Precision of the method was demonstrated by intra-day and inter-day variation studies. The precision of an analytical method is the degree of agreement among individual

Test results when the method is applied repeatedly to multiple samplings of homogenous samples. It provides an indication of random error results and was expressed as coefficient of variation (CV).

Table 2: Observations for precision by UV.

Sr. No.	Concentration (µg/ml)	Absorbance at 273nm	Mean	S.D.	%RSD
1.	40	1.04607	1.029528	0.015928	1.54710
2.	40	1.01404			
3.	40	1.04817			
4.	40	1.01098			
5.	40	1.02335			
6.	40	1.03456			

Table 3:- Intraday precision after 4 hours.

Sr.No.	Concentration (µg/ml)	Absorbance at 273 nm(after4hr)	Mean	S.D.	%RSD
1.	40	1.02602	1.02648	0.01185	1.15494
2.	40	1.03201			
3.	40	1.01210			
4.	40	1.04621			
5.	40	1.01798			
6.	40	1.02456			

Table 4: Interday precision after 24 hr

Sr.No.	Concentration (µg/ml)	Absorbance at 273nm (after 24 hr.)	Mean	S.D.	%RSD
1.	40	1.02507	1.02486	0.00860	0.83940
2.	40	1.03110			
3.	40	1.01476			
4.	40	1.03668			
5.	40	1.01549			
6.	40	1.02610			

Table 5: Result of robustness study by change in solvent.

Sr. No.	Concentration (µg/ml)	Absorbance at 273nm (after 24 hr.)	Mean	S.D.	%RSD
1.	40	1.02507	1.02486	0.00860	0.83940
2.	40	1.03110			
3.	40	1.01476			
4.	40	1.03668			
5.	40	1.01549			
6.	40	1.02610			

Table 6: Result of ruggedness study by change in analyst.

Sr. No.	Conc. (µg/ml)	Absorbance	Mean	S.D	% R.S.D
1.	40	1.04607	1.02952	0.01592	0.01547
2.	40	1.01404			
3.	40	1.04817			
4.	40	1.01098			
5.	40	1.02335			
6.	40	1.03456			

Table 7: Summary of precision studies.

Sr. No.	Parameter	S.D.	%RSD
1.	Precision	0.015928	1.54710
2.	Intraday precision	0.01185	1.15494
3.	Interday precision	0.00860	0.83940
4.	Robustness	0.003851	0.81406
5.	Ruggedness	0.01592	0.01547

3.3 Accuracy: Accuracy is the closeness of the test results obtained by the method to the true value. To study the accuracy, 20 tablets of each brand were weighed and powdered. Various Dilutions of sample solution were prepared. Analysis of the same was carried out. Recovery studies were carried out at three different levels i.e.50%, 100% and 150% *b*y adding standard drug solution to the sample solution.

Table 8: Result of recovery study by UV

Tablets	Amount of sample (µg/ml.)	Amount of drug (µg/ml.)	% recovery
50	10	5	99.03
100	10	10	99.16
150	10	15	99.51

Table 9: Summary of method validation.

Sr. No.	Parameter	Observation
1.	Linearity range	5-40µg/ml
2.	Slope	0.114
3.	Intercept	-0.002
4.	Correlation coefficient	0.999
5.	LOD	0.461073 µg/ml
6.	LOQ	1.3971929 µg/ml

4. Conclusions

The proposed method for the estimation of Aceclofenac was found to be simple, sensitive and reliable with good precision and accuracy. The developed Spectrophotometric method was validated for estimation of Aceclofenac using accuracy, precision, linearity, range and robustness, %R.S.D for all parameter were found to be less than 2, and it indicates the validity of method. Assay results showed the accuracy of proposed method for estimation of Aceclofenac. This method can be conveniently employed for the routine analysis and the quality control of Aceclofenac in pharmaceutical dosage forms. The sample recovery from the formulation was in good agreement with its respective label claim.

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