International Journal of
Medicinal Chemistry & Analysis
e ISSN 2249 – 7587
Print ISSN 2249 - 7595
www.ijmca.com
Research Article

UV SPECTROPHOTOMETRY METHOD FOR THE ESTIMATION OF AMINOPHYLLINE IN BULK AND PHARMACEUTICAL FORMULATIONS

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ABSTRACT

The main objective was to develop and validate the UV spectrophotometric method for the estimation of aminophylline in bulk and its tablet dosage formulations as per ICH guidelines. Distilled water is used as a solvent. the λ_{max} of the Aminophylline was found to be 272 nm. The linearity in the concentration range 5-30 µg/ml with correlation co efficient of 0.9996. The accuracy studies of proposed method was performed at three different levels, 20%, 40%, 60% and recovery was found to be in the range of 100.82%. The limit of detection and limit of quantification were found to be 0.0383 and 0.1160 (µg/ml respectively. The % RSD less than 2 which indicates the accuracy and precise of the method the above method was a rapid tool for routine analysis of aminophylline in the bulk and its tablet dosage forms.

Keywords: Aminophylline, Bulk drug, Formulation.

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INTRODUCTION

Aminophylline is a drug combination that contains theophylline and ethylenediamine in a 2:1 ratio. Once in the body, theophylline is released and acts as a phosphodiesterase inhibitor, adenosine receptor blocker [1], and histone deacetylase activator. Similar to other theophyllines, aminophylline is indicated for the treatment of lung diseases such as asthma, chronic bronchitis, and COPD [2]. Aminophylline is the salt of theophylline [3]. After ingestion, theophylline is released from aminophylline, and theophylline relaxes the smooth muscle of the bronchial airways and pulmonary blood vessels and reduces airway responsiveness to histamine, methacholine, adenosine, and allergen [4].

Access this article online

Home page: http://ijmca.com/

DOI: http://dx.doi.org/10.21276/ijmca.2020.10.2.1

Quick Response code

Received:21.02.20 | **Revised**:12.03.20 | **Accepted**:18.03.20

Aminophylline is chemically 3,7-dihydro-1,3-dimethyl-1H-purine-2,6-dione compound with 1,2-ethanediamine (2:1); theophylline ethylenediamine [5].

MATERIALS AND METHODS

Pure drug sample Aminophylline was generously gifted by Dr. Reddy's Laboratories, Hyderabad. The Formulation aminophylline tablet 100mg was purchased in a local pharmacy. All the chemicals used were of analytical grade and procured from Qualigens India Ltd., LOBA Chemicals Pvt. Ltd., Mumbai. Instruments employed for the study were Systronics Double beam UV-Visible spectrophotometer connected to computer loaded withspectra manager software UV probe was employed withspectral brand width of 1 nm and wave length accuracy of + pair of 10mm matched Quartz cells.

UV Spectrophotometric Method

Selection of Solvent

The solubility of Drug was determined in a variety of solvent as per Indian Pharmacopoeial standards.

Solubility test for the drug was carried out in polar and non -polar solvents. From the solubility studies water was selected as a solvent for the proposed method.

Preparation of Standard Stock Solution

Weigh accurately 25mg of aminophylline 25ml volumetric flask and dissolve in minimum quantity of the distilled water and made upto 25 ml with the same. The solution was observed to contain 1000 µg / ml.

Selection of λ Max

From the UV spectra 272 nm was selected as the λ_{max} of the Aminophylline.

Calibration Graph

In this method aliquots of stock solution of (25 ml of 1000µg/ml) were transferred into 100ml volumetric flask and made up to the mark with water further dilution are made upto (1-6 ml of 250 µg/ml) and transferred into 50 ml volumetric flask and made upto the mark with water. The absorbance of the different solutions of different concentrations was measured at 272 nm against blank. The calibration curve was plotted using concentration Vs absorbance. The curve obtained was linear with the concentration range of 5-30 µg /ml [6].

Validation of Proposed Method

The method was validated according to ICH guidelines in order to determine the limit of detection and limit of quatification, precision and recovery studies [7].

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

Preparation of calibration curve [8] from the serial dilutions of standards was repeated for six times. The limit of detection and the limit of quantification were calculated by using the average value of slope and standard deviation of intercept.

Quantification of Raw Material

In this method, weigh accurately 250 mg of aminophylline 100 ml volumetric flask and dissolve in minimum quantity of the water and made upto100 ml with water. The solution was observed to contain (2500 µg/ml). The standard stock solution was further diluted using water to get a concentration of 150 µg/ml, further dilution are made up to (1ml of 150µg/ml) and transferred into a six 10ml volumetric flasks and made upto the mark with water. These absorbances of the solution were measured at 272 nm. The amount of aminophylline present in the raw material was determined using slope and intercept values from calibration graph.

Quantification of Formulation

Tablet formulation (Aminophylline) containing 100 mg of aminophylline. 10 tablets was accurately weighed to find out the average weight and powdered. The tablet powder equivalent to 250 mg of aminophylline was transferred into a 100 ml volumetric flask. Then water was used for dissolve the tablet powder and sonicated for 10 minutes and made upto the volume with the same. The solution was filtered through the whatmann filter paper No:41.From the clear solution 3 ml of the solution was transferred in to a 50 ml standard flask and made upto the mark with water to produce 150 µg /ml concentration. From the above solution 1ml of the solution was transferred into a 10 ml standard flask and made upto the mark with water to produce 15 µg/ml concentration. The absorbance of the resulting solution was measured at 272 nm. The amount of present in formulation was determined. The procedure was repeated for 6 times.

Repeatability (Precision)

Repeatability was given by interday and intraday precision. The assay and recovery procedure were repeated for three times on the same day and one time on three successive days

Recovery Studies

The recovery experiments were done by separately adding known concentration of aminophylline to the pre analysed formulation. Each 250 mg equivalent of (Aminophylline) tablet powder was taken in a series of three 100ml volumetric flasks. To that (20%, 40%, 60%) of raw material were added, dissolved with water and made upto volume with water. The solutions were sonicated for 10 minutes. After sonication the solution were filtered through whatmann filter paper No.41. 3ml of the clear filtrate was taken from each standard flask and transferred into three 50ml standard flask and volume made upto with water. The absorbance of the resulting solution was measured at 272 nm against blank and the amount of aminophylline recovered from the formulation was calculated by using slope and intercept values. The procedure was repeated for three times for each concentration

RESULTS AND DISCUSSION

UV method was developed for the determination of aminophylline in pure form and in its tablet dosage form. The solubility of aminophylline was studied as per Indian Pharmacopoeia. Aminophylline was dissolved in distilled water to get a concentration of 10µg/ml. The solution was scanned in the UV region of wavelength ranging from 200-400 nm against water as the blank. The spectrum of aminophylline was shown in (figure 2). The λ max was found to be 272 nm. The absorption of the solution was measured at the selected wavelength at different time intervals. The calibration graph was plotted using concentration against absorbance and the calibration curve was shown in (figure 3).

The procedure was repeated for six times. The optical parameters like correlation co-efficient, slope, intercept, sandell's sensitivity, molar absorptivity were calculated and presented in Table 1. The correlation co-efficient value was found to be 0.9996. The calibration graph of the drug indicated that the selected concentration range of aminophylline have good linearity.

In order to ensure the specificity of the proposed method the raw material of aminophylline (15µg/ml) in distilled water was analysed at 272 nm. The procedure was repeated for six times. The percentage purity of aminophylline was calculated and it was found to be 100.30% respectively. The percentage RSD value of the drug was found to be 0.5151. The low percentage RSD value indicated that the developed method has good precision. The results of raw materials analysis are shown in Table 2.

Table 1. Optical characteristics of aminophylline by UV Method

Parameters	Method
λ-max (nm)	272
Beer's law limit (µg/ml)	5-30
Sandell's sensitivity (µg/cm20.001A.U)	0.03317
Molar absorptivity (L mol-1cm-1)	12025.86
Correlation coefficient	0.9996
Regression equation (y=mx+C)	Y=0.0402x+0.005
Slope (m)	0.0402
Intercept (C)	0.005
LOD (µg/ml)	0.0383
LOQ (µg/ml)	0.1160

Table 2. Quantification of Raw Material -Aminophylline

S.No	Expected Amount (µg/ml)*	Amount Found (µg/ml)*	Percentage Purity	Average (%)	S.D	% RSD
1	15.00	14.92	99.66	100.30	0.5167	0.5151
2	15.00	15.01	100.07			
3	15.00	15.10	100.66			
4	15.00	15.04	100.26			
5	15.00	15.17	100.13			
6	15.00	15.01	100.07			

*Mean of six observations

Table 3. Quantification of Formulation – Aminophylline

S.No	Drug Label Claim	Amount found (mg)*	(%) Purity	Average (%)	SD	% RSD
1	Aminophylline 100 mg	100.19	99.86 100.54 99.03 99.21 99.36 99.04	99.50	0.7815	0.7854
2		101.28				
3		98.18				
4		96.27				
5		100.45				
6		97.23				

*Mean of six observations

Table 4. Intraday and Interday analysis of formulation - Aminophylline

Drugs (Label Claim)	Percentage Obtained		S.D		% R.S.D	
	Intra Day	Inter Day	Intra Day	Inter Day	Intra Day	Inter Day
Aminophylline 100mg	100.66 100.70	99.86 99.36	0.1352	0.5922	0.1343	0.5926

Mean	100.51 100.65	100.54 99.92				

Fig. 1. Structure of Aminophylline

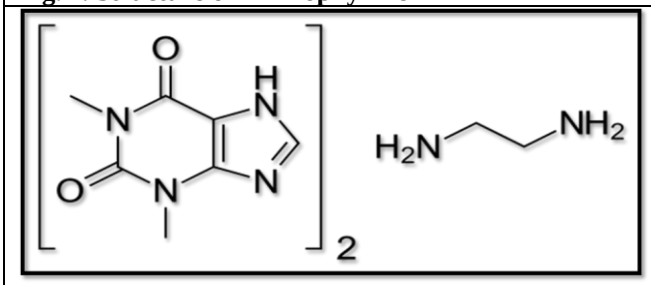


Fig. 2. UV SPECTRUM OF AMINOPHYLLINE

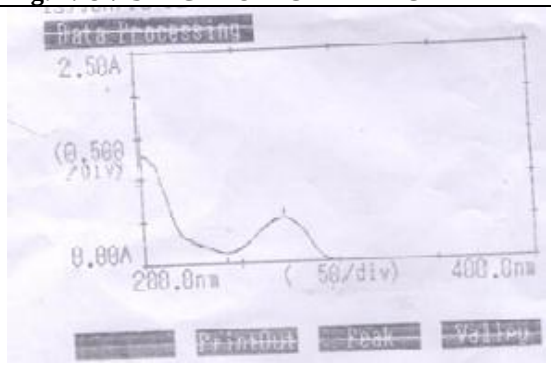
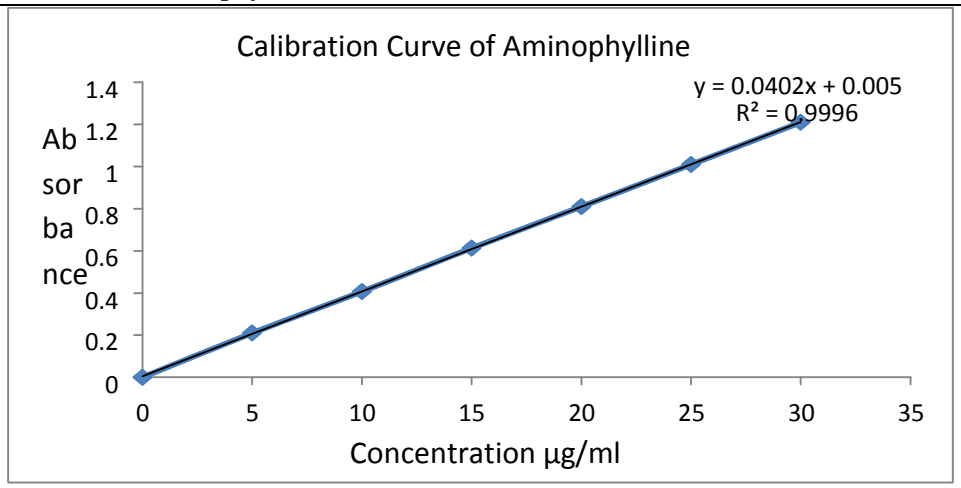


Fig. 3. Calibration Curve of Aminophylline



Aminophylline tablet (100mg) was selected for further study. The estimation of the drug was performed. Aminophylline tablet carried a label claim that each tablet contains 100 mg of aminophylline. 15 µg/ml of the drug concentration was prepared in distilled water and absorbance was measured at 272 nm. The percentage purity of aminophylline present in tablet formulation was calculated and found to be 99.50% as shown in Table 3.

The percentage RSD values of the drug were calculated and found to be 0.7854. The low percentage RSD values indicate that the developed method have good precision. To ensure the precision of the method they are carried by intraday and interday analysis. The analysis was repeated for six times. The analysis of formulation was carried out three times in the same day and one time in three consecutive days. The percentage RSD value of the intraday and interday analysis of aminophylline was found to be 0.1343% and 0.5926% respectively. The reports of analysis are shown in Table 4.

The accuracy of the method was performed by recovery studies.the recovery studies were carried out by adding different amounts (20%,40%,60%)of the pure drug to the pre analysed formulation the solutions were prepared in triplicats and the %recovery was calculated This indicated that there was no interference due to excipients added. Hence the accuracy of the method was confirmed.

SUMMARY AND CONCLUSION

A simple, rapid, precise and accurate UV METHOD was developed for the determination of aminophylline in bulk and tablet dosage form. The developed UV method for the estimation of aminophylline in the tablet dosage form and also raw material analysis are precise, accurate and simple. This method can be effectively followed for the routine analysis of aminophylline.

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