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UV- Spectrophotometric determination of Ceftazidime in pure and pharmaceutical formulation

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Abstract

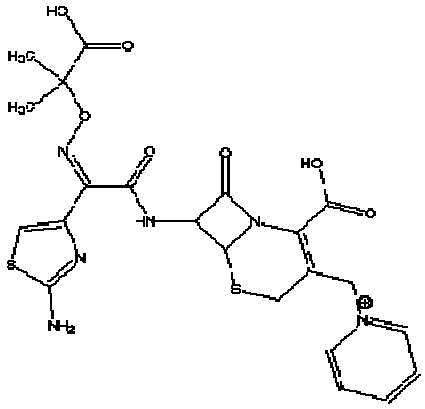
A simple sensitive spectrophotometric method in UV region has been developed for the determination of Ceftazidime in bulk dosage form. The solution of ceftazidime in 0.1N HCl shows maximum absorbance at 261nm, beer's law was obeyed in the concentration range of 2-10 µg ml^{-1}. The absorbance was found to increase linearly with increasing concentration of ceftazidime, which is corroborated by the calculated correlation coefficient value of 0.9981. The slope and intercept of the equation of the regression line are 0.0465 and 0.0007 respectively. The analysis were validated statistically and its recovery studies result of percentage shows that the method was not affected by the presence of excepients which proves suitability of the developed method for the routine estimation of ceftazidime bulk and solid dosage form. This method were extended to pharmaceutical formulations and there no interference from excepients and diluents. The proposed methods are economical and sensitive for the estimation of ceftazidime in bulk dosage form.

Key words: Ceftazidime, UV-Spectrophotometry, Estimation, Validation.

Introduction

Ceftazidime chemically known as 1-[(6R, 7R)-7-[2-(2-amino-4-thiazolyl) glyoxylamido]-2-carboxy-8-oxo-5-thia-1-azabicyclo [4.2.0.] oct- 2-en-3-yl] methyl] - pyridinium hydrochloride inner salt. Best known as an anti – bacterial and used for the treatment of biliary - tract infections

cystic fibrosis. A few HPLC methods have been reported for ceftazidime in biological fluids literature survey [17-24] reveals that there is no visible and UV methods have been reported.



The present study is to develop an accurate and reliable UV method for determination of ceftazidime in solid dosage form. Our investigation aimed to develop a simple rapid precise accurate and economical visible spectrophotometric method.

Materials and Methods

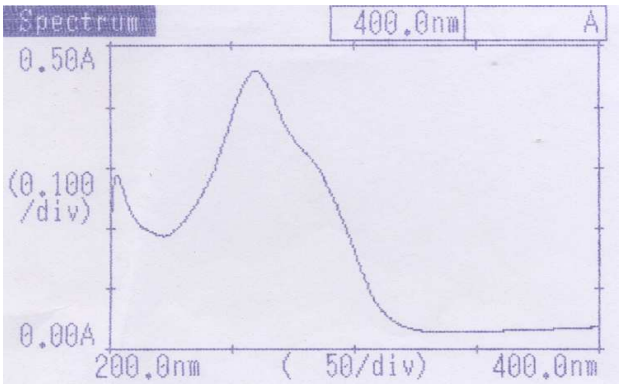
A shimadzu UV - visible spectrophotometer model 160 with matched pair of quartz cell (1.0cm path) was employed for absorption measurements [4-16]. Ceftazidime sample were obtained from KAPL Bangalore. Hydrochloric acid used was AR grade.

Preparation of standard stock solution

Ceftazidime 100 mg were accurately weighed and dissolved in 100 ml of 0.1N HCl to give stock solution (1000 μg ml^{-1}**).**Aliquots of 100 μg ml^{-1} solution were suitably diluted with 0.1N HCl to give final concentrations.

Selection of wavelengths

The 2 μg/ml of standard solution was scanned between 200-300 nm and found that the peak at 261 nm Showed maximum absorption.



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Results and Discussion

Recovery study

Recovery studies were carried out by adding a known quantity of pure drug to a free analysis formulation and the proposed method was followed. The result of analysis the recovery studies presented in table-1 .The percentage recovery values indicates that there no interference from the excepients (s) present in the formulation that developed method is found to be sensitive accurate precise and most reproducible. It can be used for the routine quality control analysis of ceftazidime bulk drug too.

Tabel-1; Analysis of Formulation

Formulation	Label claim	Amt found	%found	%RSD*	%Recovery
Form-1	1000mg	999.850	99.81	0.781	99.91

*Average of three determinations

The proposed method for estimation of ceftazidime in pharmaceutical formulation was found to be simple, accurate, economical and rapid. The interference of interfering component was neglected by selecting the proper λmax for the component of interest. The standard deviation by proposed method in ceftazidime formulation was 0.0085. The values of coefficient of variation were satisfactorily low. The method was validated to ensure accuracy and reproducibility. The recovery for ceftazidime was found to be 99.91. The recovery studies and statistical data for the method were found to be satisfactory and therefore the method can be used for routine analysis.

Tabel-2; Optical and Regression Characteristics, Precision and Accuracy of the proposed method for Ceftazidime [1-3]

Parameters	**Values**
λmax(nm)	261
Beers law limit (μg ml^{-1})	2-10 μg ml^{-1}
Molar absorptivity,(l mol^{-1} cm^{-1})	$5.210X10^{-3}$
Slope(b)	0.0465
Intercept(a)	-0.0007
Correlation coefficient(r)	0.9981
Relative standard deviation (%)	0.781

Effect of time on stability of absorbance

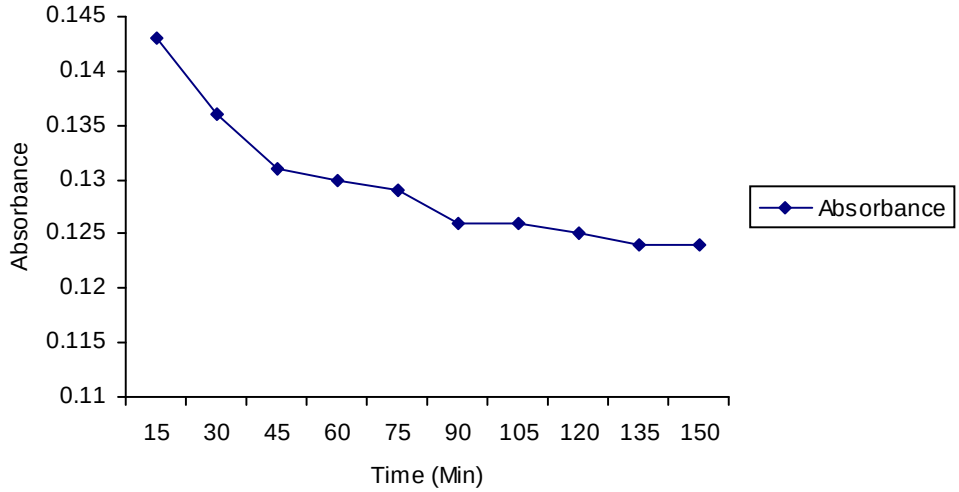
The stability of the solution was checked by measuring the absorbance at regular intervals of time. It was observed that the absorbance remained stable for a period of 150 min and then the

absorbance decreased with increase in time. (Fig.2). It was observed that the absorbance remained stable for a period of 135 minutes and then the absorbance is not change.

Table: 3 Stability studies of ceftazidime

No.	Time (min)	Absorbance at 260.5nm
1.	15	0.143
2.	30	0.136
3.	45	0.131
4.	60	0.130
5.	75	0.129
6.	90	0.126
7.	105	0.126
8.	120	0.125
9.	135	0.124
10.	150	0.124

Fig.2: Effect of time on stability of absorbance shown by ceftazidime



Quantitative estimation

Procedure

25mg of ceftazidime was accurately weighed and transferred to a clean dry 1000 ml standard flask and dissolved in 0.1N hydrochloric acid. It was shaken for few minutes and the solution was diluted to 1000 ml with same. 10ml of stock solution diluted to 100ml of 0.1N hydrochloric acid. Further result in solution gives 2.5 µg/ml concentration. The resulting solution was carried out for the quantitative estimation.

Quantitative estimation of sample no. 1

Each vial contains	-	1000 mg
Average content of 10 vials	-	1000 mg
Average content of each vial	-	1000 mg

Ceftazidime powder taken - 25 mg

No.	Volume of Filtrate (µg/ml)	Absorbance* at 260.5 nm	Conc. from Standard graph (µg/ml)	Content of Drug (µg/ml)	Average Content (µg/ml)
1.	2	0.1270	4.8473	2.4236	2.488
2.	4	0.1765	9.9157	2.4789	
3.	6	0.2979	15.382	2.5636	

Average of Three readings

Average concentration of the drugs = 2.488 µg/ml
1ml of solution contains = 2.488 µg
10ml of solution contains = 2.488 x 10
= 24.88 µg
Ceftazidime content per vial = 24.88 x 100 / 25
= 99.54%

Quantitative estimation of sample no. 2

Each vial contains - 1000 mg
Average content of 10 vials - 1000 mg
Average content of each vial - 1000 mg
Ceftazidime powder taken - 25 mg

No.	Volume of Filtrate (µg/ml)	Absorbance* at 260.5 nm	Conc. from Standard graph (µg/ml)	Content of Drug (µg/ml)	Average Content (µg/ml)
1.	2	0.1270	4.721	2.3605	2.4990
2.	4	0.1765	10.351	2.5872	
3.	6	0.2979	15.303	2.5500	

Average of Three readings

Average concentration of the drugs = 2.4990 µg/ml
1ml of solution contains = 2.4990 µgl
10ml of solution contains = 2.4990 x 10
= 24.99 µg
Ceftazidime content per vial = 24.99 x 100 / 25
= 99.96%

Accuracy of sample no.1

Weight of sample powder taken from vial = 25 mg
Weight of pure drug added = 25 mg
Total weight of the mixture = 50 mg

Weight of the mixture equivalent to
10 mg of Ceftazidime = 25 mg

No.	Volume of Filtrate (µg/ml)	Absorbance* at 260.5 nm	Conc. from Standard graph (µg/ml)	Content of Drug (µg/ml)	Average Content (µg/ml)
1.	2	0.1270	4.960	2.480	2.4880
2.	4	0.1765	10.460	2.615	
3.	6	0.2979	14.227	2.371	

Average of Three readings

Average concentration of the drugs = 2.4880 µg/ml
1ml of solution contains = 2.4880 µg
10ml of solution contains = 2.4880 x 10
= 24.88 µg
Ceftazidime content per vial = 24.88 x 100 / 25
= 99.54%

Accuracy of sample no.2

Weight of sample powder taken from vial = 25 mg
Weight of pure drug added = 25 mg
Total weight of the mixture = 50 mg
Weight of the mixture equivalent to
10 mg of Ceftazidime = 25 mg

No.	Volume of Filtrate (ml)	Absorbance* at 260.5 nm	Conc. from Standard graph (µg/ml)	Content of Drug (µg/ml)	Average Content (µg/ml)
1.	2	0.1270	5.156	2.578	2.510
2.	4	0.1765	9.724	2.431	
3.	6	0.2979	15.121	2.520	

Average of Three readings

Average concentration of the drugs = 2.510 µg/ml
1ml of solution contains = 2.510 µg
10ml of powder contains = 2.510 x 10
= 25.10 µg
Ceftazidime content per vial = 25.10 x 100 / 25
= 100.42%

Table 4: Quantitative estimation and statistical parameters of ceftazidime

Drug Code	Label Claim (mg)	Percentage Purity	Percentage Deviation	Standard Deviation	Relative Standard Deviation	Standard Error of Mean
Sample 1	25	99.54	0.46	0.0085	0.2137	0.00213
Sample 2	25	99.96	0.04	0.0159	0.3987	0.00398

Precision

Standard drug solution was prepared as per procedure given under preparation of standard curve. This parameter was validated by assaying number of aliquots of homogeneous samples of ceftazidime and estimating its validity using parameters such as standard deviation (SD) and relative standard deviation.

Table 5: Precision

S. No.	Volume of solution (ml)	Conc. of drug (µg)	Absorbance at 260.5 (nm)			Mean absorbance	Conc. form standard graph	R.S.D. (%)
1.	2	20	0.1270	0.1268	0.1273	0.1270	2.480	0.0085
2.	4	30	0.1765	0.1762	0.1768	0.1765	2.615	0.0112
3.	6	40	0.2979	0.2976	0.2981	0.2978	2.371	0.010

Conclusion

The quantitative reproducibility, precision and accuracy of the method were carried out. The results confirm the reproducibility, precision and accuracy of the method. The marketed formulations were analyzed by the proposed method and were found that there was no interference with the exicipents incorporated in the injection formulation as seen from recovery studies. The method described can be used for the estimation of injection formulation due to simplicity in preparation and cost effective. The results obtained all in close declaration and found to be satisfactory. The method can be adopted for the confirmation of ceftazidime in pure as well as for its formulation.

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