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# SPECTROPHOTOMETRIC ESTIMATION OF CEFPROZIL BY USING DIFFERENT HYDROTROPIC AGENTS

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**ABSTRACT**

Present study deals with two spectrophotometric methods, Conventional Spectrophotometric Estimation (Method I) and Area Under Curve Method (Method II) for quantitation of Cefprozil by using five different hydrotropic agents. These include Potassium acetate (6.0M), Potassium citrate (1.5M), Sodium acetate (4.0M), Sodium citrate (1.25M) and Urea (10.0M). All these agents do not show absorbance above 245 nm and hence do not interfere with absorbance of Cefprozil (λmax- 280 nm). Area under curve method was based on measurement of area under curve in the wavelength range 255 nm to 305 nm. Linearity of Cefprozil was found in the concentration range 10 to 60µg/ml by using all hydrotropic agents in both methods. Correlation coefficients were found in the range of 0.9980 to 0.9999 for Method I and 0.9986 to 0.9999 for Method II respectively for estimation of Cefprozil in all the hydrotropic agents. The mean percentage recovery found for Cefprozil with all hydrotropic agents range from 97.19 to 100.93 % (method I) and 96.00 to 100.97 % (method II). The developed methods were found to be precise for estimation of Cefprozil by using all hydrotropic agents. The results of analysis obtained by the proposed method compared very well with those of USP standard limit. Area under curve method was found more sensitive than conventional Spectrophotometric method for estimation of Cefprozil. Solubility of Cefprozil was found more in urea and limit of detection and quantitation was found lower in potassium acetate as compared to other hydrotropic agents used in estimation.

**Keywords:** Cefprozil, Hydrotropic agents, Spectrophotometric method, Area under curve method.

## INTRODUCTION

Cefprozil is chemically (6R, 7R)-7-((R)-2-amino-2-(*p*-hydroxy-phenyl) acetamido)-8-oxo -3-propenyl-5-thia-1-azabicyclo (4.2.0) oct-2-ene-2-carboxylic acid[1]. It is a semi synthetic oral second generation cephalosporin consisting of 90:10 Z/E isomeric mixture with a wide antibacterial spectrum of activity. Literature survey reveals that HPLC method for the simultaneous determination of cefprozil diasteriomers [2], HPTLC for estimation of Cefprozil, Flow injection chemiluminescent determination of Cefprozil[3], spectrophotometric determinations, and spectrofluorimetric determinations of Cefprozil have been developed. Here we have presented two different spectrophotometric methods, conventional spectrophotometric estimation and area under curve method by using various hydrotropic agents for estimation of Cefprozil in pure and tablet dosage forms. Cefprozil is poorly soluble in water. Special techniques are required to solubilize poorly water-soluble drugs. Hydrotropy is one of such technique. The term hydrotropy has been used to designate the increased solubility of various substances in water due to the presence of large amounts of additives [4]. Concentrated aqueous solutions of large number of hydrotropic agents have been employed to enhance the aqueous solubility of many poorly water soluble drugs. Hydrotropic agents which selected for this work do not interfere above 245 nm, therefore other poorly water soluble drugs can also be estimated above 245 nm by using these hydrotropic agents. Hydrotropic solutions can also be used as co-solvents[5], in solid dispersion technology[6], nanotechnology and parenteral preparations[7]. When hydrotropes are added to aqueous surfactants or

polymer solutions, they produce strong synergistic effects [8].

## MATERIALS AND METHODS

### Materials

Pharmaceutical grade Cefprozil was kindly gifted by Lupin Pharma Ltd. Bhopal, India. Tablet formulation of Cefprozil was purchased from local market. All hydrotropic agents, potassium acetate, potassium citrate, sodium acetate, sodium citrate and urea used are of analytical grade.

### Instrumentation

Shimadzu UV-2450 double beam spectrophotometer with 1 cm path length operated with Shimadzu UV-Probe software, version 2.21 was used for all spectrophotometric estimations. 1 cm matched quartz cells were used for spectrophotometric analysis. Shimadzu balance (AUW-120D) was used for all weighings. Ultrasonicator was used for ultrasonication of solutions.

### Preparation of stock solution

### Preparation of Standard solution

Accurately weighed 25 mg Cefprozil was transferred to 25 ml volumetric flask and dissolved in 5 ml (20 %v/v) solution of each hydrotropic agent separately and then sonicated for about 2 minute to solubilize the drug. The final stock solutions of Cefprozil (1000 µg/ml) in each hydrotropic agents were prepared separately by diluting above solutions up to 25 ml with distilled water.

### Sample preparation

Twenty tablets of Cefprozil were weighed and powdered. Powder equivalent to 25 mg of Cefprozil was transferred to 25 ml volumetric flask containing 5 ml (20 %v/v) of different hydrotropic agents separately and sonicated for about 5 minutes to solubilize the drug. These solutions were filtered through Whatman filter paper separately and then volumes were made up to the mark with distilled water to obtain sample solutions of 1000 µg/ml.

### Method Development

### Linearity

In conventional spectrophotometric estimation method, absorbance was noted in the concentration range of 10 µg/ml to 60 µg/ml. In area under curve method, area of spectra was noted between 255 nm to 305 nm (280 nm± 25 nm).

### Limit of detection (LOD) and limit of quantitation (LOQ)

The detection limit and quantitation limit were computed to assess quantity of analyte which can be detected and minimum quantity of analyte which can be determined quantitatively by proposed UV- Spectrophotometric methods.

### Recovery

To study the accuracy of the proposed method, recovery study was carried out by addition of known amount of standard drug in the preanalysed tablet formulation, in 50%, 100% and 150% of label claim. At each level of concentration, five determinations were performed.

## RESULT AND DISCUSSION

Proposed Spectrophotometric methods have been developed and compared for estimation of Cefprozil. Different hydrotropic agents were used for solubilization of cefprozil. Main criteria for the selection of hydrotropic agents were sufficient concentration and volume of hydrotropic agents which completely solubilize content of drug and selected hydrotropic agents do not show any interference in estimation of Cefprozil. We have used five different

hydrotropic solutions, which includes potassium acetate (6.0 M), potassium citrate (1.5 M), sodium acetate (4.0 M), sodium citrate (1.25 M) and urea (10.0 M) in distilled water. 20 %v/v solutions of these hydrotropic solutions were used to solubilize content of Cefprozil completely. Hydrotropic solutions selected for this work do not interfere above 245 nm, therefore Cefprozil (λmax -280 nm) can be estimated by using these hydrotropic agents, showed in fig. 1 and fig. 2.

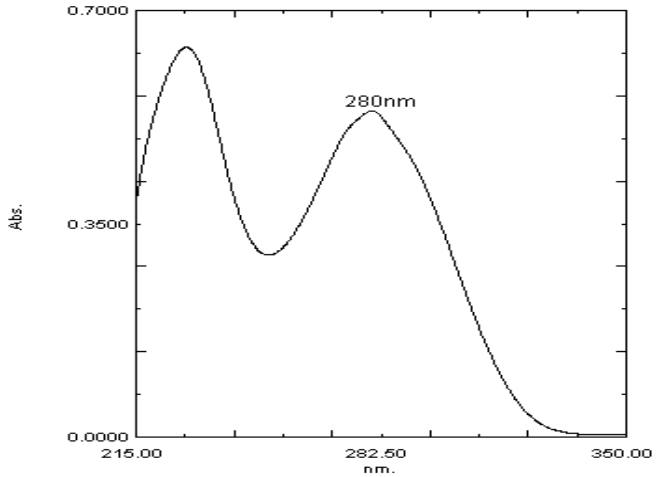


**Fig. 1: It shows spectrum of Cefprozil used sodium acetate as hydrotropic agent**

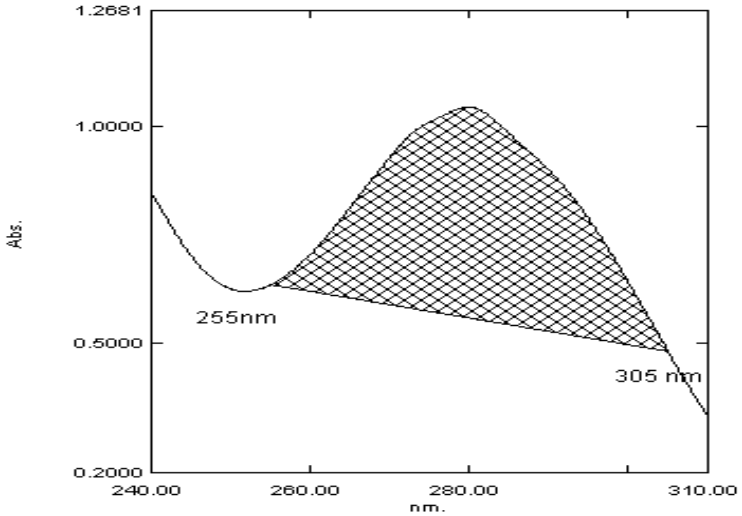


**Fig. 2: It shows Area under curve for Cefprozil in wavelength range 255 to 305 nm**

**Table 1: It shows regression equation, correlation coefficient, LOD, LOQ of Cefprozil**

| Hydrotropic Agents | Method –I | | | Method –II | | |
|---|---|---|---|---|---|---|
| | Linearity* | LOD µg/ml | LOQ µg/ml | Linearity* | LOD µg/ml | LOQ µg/ml |
| 6M Potassium Acetate | y = 0.0262x + 0.01496 $r^2$= 0.9999 | 0.62 | 1.91 | y = 0.3481x + 0.5795 $r^2$ = 0.9999 | 0.51 | 1.55 |
| 1.5M Potassium Citrate | y = 0.0265x -0.3138 $r^2$ = 0.9992 | 1.49 | 4.53 | y = 0.3501x + 0.5022 $r^2$ = 0.9992 | 1.11 | 3.37 |
| 4M Sodium Acetate | y = 0.0251x + 0.02758 $r^2$ = 0.9980 | 0.99 | 3.03 | y = 0.3352 x + 0.3777 $r^2$ = 0.9986 | 1.85 | 5.61 |
| 1.25M Sodium Citrate | y = 0.0271x -0.0039 $r^2$ = 0.9997 | 0.84 | 2.54 | y = 0.3587x – 0.420 $r^2$ = 0.9997 | 0.75 | 2.30 |
| 10M Urea | y = 0.0266x + 0.0287 $r^2$ = 0.9995 | 0.67 | 2.06 | y = 0.3599x + 0.3595 $r^2$ = 0.9997 | 0.88 | 2.69 |

* Mean n = 3

The linearity was found in concentration range of 10 to 60µg/ml for Cefprozil by both

methods is showed in Table 1. The limit of detection and quantitation was computed for Cefprozil in all hydrotropic agents and are showed in Table 1. Analysis of tablet formulation of Cefprozil was also carried out by using different hydrotropic agents; amount of Cefprozil found is reported in Table 2.

Percentage recovery was found in the range of 97.19 % to 100.97 % for Cefprozil by conventional spectrophotometric estimation and 96.00 % to 100.99 % by AUC method, depicted in Table 3, which comes under USP standard limit.

The AUC method was found more sensitive than conventional spectrophotometric estimation method. This is because, Calibration curve showed more slope and correlation coefficient very close to standard value in case of AUC method for all hydrotropic agents. Cefprozil showed more solubility in urea solution as compared to other hydrotropic solutions as it get dissolved in urea solution rapidly without sonication. Both methods showed more sensitivity for Cefprozil estimation by using potassium acetate as a hydrotropic agent. The value of LOD and LOQ found in case of potassium acetate for both methods are very low compare to other hydrotropic agents.

## Table 2: It shows result of Cefprozil in formulation

| Hydrotropic agent | Method | Label Claim/ Tablet (mg) | Amount found/ Tablet* (mg) | %Label Claim estimated* (Mean ± S.D | % Coefficient of Variation |
|---|---|---|---|---|---|
| Potassium acetate | Method –I | 250 | 244.88 | 97.95 ± 0.82 | 0.82 |
| | Method –II | 250 | 245.62 | 98.25 ± 0.77 | 0.78 |
| Potassium citrate | Method –I | 250 | 253.65 | 101.46 ± 0.93 | 0.93 |
| | Method –II | 250 | 257.72 | 103.09 ± 0.96 | 0.95 |
| Sodium acetate | Method –I | 250 | 250.07 | 100.03 ± 0.89 | 0.90 |
| | Method –II | 250 | 253.39 | 101.36 ± 0.66 | 0.66 |
| Sodium Citrate | Method –I | 250 | 249.01 | 99.61 ± 0.85 | 0.85 |
| | Method –II | 250 | 245.63 | 98.25 ± 0.93 | 0.94 |
| Urea | Method -I | 250 | 246.62 | 98.65 ± 0.71 | 0.72 |
| | Method –II | 250 | 246.02 | 98.41 ± 0.89 | 0.90 |

## Table 3: It shows results of recovery study

| Hydrotropic Agent | Method | Amount of Standard drug added % | % Label Claim estimated* (Mean ± S.D.) | % Coefficient of Variation |
|---|---|---|---|---|
| Potassium acetate | Method I | 50 | 100.97± 0.87 | 0.86 |
| | | 100 | 98.30 ± 0.30 | 0.39 |
| | | 150 | 97.48± 0.50 | 0.51 |
| | Method II | 50 | 99.66 ± 0.44 | 0.45 |
| | | 100 | 97.27 ± 0.32 | 0.33 |
| | | 150 | 96.95± 0.11 | 0.15 |
| Potassium Citrate | Method I | 50 | 100.13± 0.96 | 0.96 |
| | | 100 | 100.12± 0.57 | 0.58 |
| | | 150 | 100.36± 0.23 | 0.23 |
| | Method II | 50 | 100.77± 2.04 | 2.00 |
| | | 100 | 100.41 ± 0.47 | 0.47 |
| | | 150 | 98.84± 1.44 | 1.46 |
| Sodium acetate | Method I | 50 | 97.68± 0.78 | 0.80 |
| | | 100 | 99.90± 0.48 | 0.39 |

| | | | | |
|---|---|---|---|---|
| | | 150 | 98.65± 0.66 | 0.67 |
| | | 50 | 99.91± 0.84 | 0.84 |
| | Method II | 100 | 100.99± 0.13 | 0.13 |
| | | 150 | 99.11± 0.33 | 0.33 |
| | | 50 | 97.19 ± 1.89 | 1.95 |
| | Method I | 100 | 100.80 ± 0.28 | 0.28 |
| Sodium Citrate | | 150 | 100.28± 0.31 | 0.31 |
| | | 50 | 99.66± 0.44 | 0.44 |
| | Method II | 100 | 97.27± 0.32 | 0.33 |
| | | 150 | 96.00± 1.96 | 2.00 |
| | | 50 | 97.76± 0.86 | 0.88 |
| | Method I | 100 | 99.60 ± 0.85 | 0.85 |
| Urea | | 150 | 97.96± 0.82 | 0.83 |
| | | 50 | 97.37± 0.95 | 0.98 |
| | Method II | 100 | 97.80± 0.43 | 0.44 |
| | | 150 | 97.06± 0.73 | 0.75 |

* Mean n = 5

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