

Quantitative spectrophotometric estimation of cefadroxil using hydrotropic solubilization technique

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Hydrotrophy is one of the reliable methods to enhance aqueous solubility of poorly soluble drugs. In the present investigation, hydrotropic solution of urea (6 M) was employed as a solubilizing agent to solubilize the poorly water-soluble drug, cefadroxil, in the tablet form and determined with the help of spectrophotometric determination in ultraviolet region. In solubility determination study, it was found that there was more than 10-fold enhancement in solubility of cefadroxil in 6-M urea solution. Cefadroxil showed maximum absorption at 263 nm and obeyed Beer's law in concentration range of 10-80 µg/ml. Results of analysis were validated statistically and by recovery studies. The proposed method is new, simple, eco-friendly, economic, and accurate and can be utilized in routine analysis of cefadroxil tablets.

Key words: Famotidine, hydrotrophy, spectrophotometry, urea

INTRODUCTION

The term "hydrotrophy" has been used to designate the increase in solubility of various substances due to the presence of large amount of additives. Various hydrotropic agents have been used to enhance the aqueous solubility of a large number of drugs.^[1-13] Maheshwari^[1] has analyzed cefixime (a poorly water-soluble drug) in tablet dosage forms using urea (8.0 M), sodium acetate (4.0 M), and sodium citrate (1.25 M) as hydrotropic solubilizing agents. Maheshwari^[2] analyzed frusemide (a poorly water-soluble drug) by titrimetric analysis using hydrotropic solution of sodium benzoate (2.0 M). The same author^[3] has developed titrimetric analysis methods to analyze ketoprofen and salicylic acid. Hydrotropic solutions of sodium benzoate (2.0 M), sodium salicylate (2.0 M), and sodium acetate (2.0 M) were employed for ketoprofen. Hydrotropic solutions of urea (8.0 M), sodium citrate (1.25 M), and sodium benzoate (2.0 M) were employed in the estimation of salicylic acid. Maheshwari *et al.*^[4] used hydrotropic solution of sodium benzoate (2.0 M) as solubilizing agent to analyze a poorly water-soluble drug, ofloxacin, by spectrophotometric estimation. Maheshwari^[5] has also developed a spectrophotometric method to analyze ketoprofen in tablet dosage form using hydrotropic solution of sodium acetate (4.0 M).

MATERIALS AND METHODS

There was tremendous increase in the solubility of cefadroxil (a widely used cephalosporin antibiotics) in 6 M urea (a very economic hydrotropic agent; here used as hydrotropic agent) solution. Therefore, it was thought worthwhile to solubilize the drug with the help of urea (1.5 M) to carryout the UV analysis. Chemically, cefadroxil is 8-[2-amino-2-(4-hydroxyphenyl)-acetyl]amino-4-methyl-7-oxo-2-thia-6-azabicyclo [4.2.0]oct-4-ene-5-carboxylic acid. All chemicals and solvents used were of analytical grade. Cefadroxil tablets were purchased from market.

Preliminary solubility studies of famotidine

Solubility of cefadroxil was determined in distilled water and 6 M urea solution at $28 \pm 1^\circ\text{C}$. There was more than 10-fold enhancement in the solubility of drug in 6 M urea solution, as compared to the solubility in the distilled water.

Calibration curve: Drug (100 mg) was shaken with 20 ml of 6 M urea solution in a 100-ml volumetric flask, when drug was solubilized by shaking volume was made up to the mark by addition of distilled water, to get various standard dilutions containing 10, 20, 30, 40, 60, and 80 µg/ml of drug. Absorbances of these dilutions were noted at 263 nm against respective reagent blank.

Analysis of cefadroxil tablet by the proposed method: Tablet powder equivalent to 100 mg drug was shaken with 20 ml of 6 M urea by continuous shaking for about

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Table 1: Result of recovery studies of tablet formulations with statistical evaluation

Tablet formulation	Drug present in preanalyzed tablet powder (mg)	Spiked drug added (mg)	Percent recovery estimated* (mean \pm SD)	Percent coefficient of variation	Standard error
I.	100	20	98.21 \pm 1.022	1.121	0.142
	100	40	98.94 \pm 0.292	1.224	0.201

*n = 3

Table 2: Analysis data of cefadroxil tablet formulation with statistical evaluation

Tablet formulation	Label claim (mg/tablet)	Percent drug estimated* (mean \pm SD)	Percent coefficient of variation	Standard error
I.	500	98.87 \pm 1.402	1.214	0.912

*n = 3

10 min and volume made up to 100 ml with distilled water. The resulting solution was filtered through the Whatman filter paper no. 41, and appropriate aliquots were prepared by diluting with distilled water. Absorbances of different prepared aliquots were observed at 263 nm against reagent blanks.

Recovery studies: In preanalyzed tablet powder equivalent to 100 mg, bulk drug samples 20 and 40 mg were added as spiked concentrations; drug contents were determined by the proposed analytical method (used to analyze the tablets). The percent recoveries estimated are presented in Table 1.

RESULT AND DISCUSSION

As evident from Table 2, the percent drug estimated in commercial tablet formulation I by proposed method was 98.87 \pm 1.402. The values are very close to 100, indicating the accuracy of the proposed method. Validation of the proposed method was further confirmed statistically by low values of standard deviation, percent coefficient of variation, and standard error [Table 2].

The percent recoveries estimated ranged from 98.21 \pm 1.022 to 98.94 \pm 0.292. The values that are close to 100 indicated the accuracy of the proposed method. The values of standard deviation, percent coefficient of variation, and standard error are statistically low, and thus validate the proposed method.

CONCLUSIONS

It may be concluded that the proposed method of analysis is new, simple, cost-effective, environment-friendly, safe, accurate, and reproducible. Decided advantage is that the organic solvent is precluded, but not at the expense of accuracy. Definitely, there is further scope of 6 M urea as solubilizing agent for the UV analysis of other poorly water-soluble drugs (above 245 nm wavelength). The proposed

method can be successfully employed in the routine analysis of cefadroxil in tablet formulations.

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