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Visible Spectrophotometric Determination of Ceftriaxone Sodium in Vials

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A rapid, sensitive and simple spectrophotometric method is developed for the estimation of ceftriaxone sodium. It is based on the reaction with 3-methyl-2-benzothiazoline hydrazone hydrochloride and ferric chloride to form a green coloured chromogen with the absorption maximum at 628 nm. The colour obeyed Beer's law in the concentration range of 10-50 µg/mL. When pharmaceutical preparations were analyzed, the results obtained are in good agreement with the labelled amounts.

Key Words: Ceftriaxone sodium, Spectrophotometric determination.

INTRODUCTION

Ceftriaxone sodium (CFS), chemically known as 5-thia-1-azabicyclo [4.2.0]-oct-2-ene-2-carboxylic acid-7-[[2-amino-4-thiazolyl)(methoxyimino)acetyl]amino]-8-oxo-3-[[(1,2,5,6-tetrahydro-2-methyl-5,6-dioxo-1,24-triazin-3-yl)thio]methyl]diazonium salt, is a third generation cephalosporin[1,2] used in the management of mild to moderate infections caused due to susceptible microorganism. Many methods were reported for its determination such as spectrophotometry[3], colourimety[4], HPLC[5]. In the present work the reaction of CFS is based on the reaction with 3-methyl-2-benzothiazoline hydrazone hydrochloride (MBTH)[6] and ferric chloride to form a stable green coloured chromogen showing maximum absorption at 628 nm.

EXPERIMENTAL

All the chemicals used were of analytical grade. Spectral and absorbance measurements were made on systronics UV-Visible spectrophotometer-119 with 10 mm matched quartz cells. Solution of 3-methyl-2-benzothiazoline hydrazone hydrochloride (0.2% w/v) in distilled water and ferric chloride (0.7% w/v) in 0.5 M hydrochloric acid were prepared freshly.

Preparation of standard drug solution: A stock solution of CFS (1 mg/mL) was prepared by dissolving 100 mg of the drug in 100 mL distilled water. Working standard solutions were obtained by appropriate dilution of the stock solution. The standard drug solution of CFS was prepared by dissolving accurately weighed quantity (10 mg) in 2 mL of methanol in a 10 mL volumetric flask. About 0.5 g of zinc dust was added followed by 0.4 mL of concentrated hydrochloric acid and allowed to stand at room temperature for 1 h. The solution was then filtered using Whatmann filter paper and the residue was washed with 3 volumes of 0.5 mL of methanol The filterate was then made up to 10 mL using distilled water and shaken.

Preparation of sample solutions: A sample solution was prepared by taking an accurately weighed sample from the commercial brand vials of 10 mg were taken and diluted to get appropriate concentrations with distilled water. The sample solutions were prepared as the procedure described above.

Proposed method for CFS[7,8]: Aliquots of 1-5 mL of standard drug solution (100 µg/mL) was taken into a series of 10 mL volumetric flasks. To each flask 1.5 mL of 0.2 % w/v of MBTH was added and allowed to stand for 2 min at room temperature. About 2.0 mL of 0.7 % w/v freshly prepared ferric chloride was added and kept for 10 min. Finally the volume was made up to 10 mL using distilled water. The absorbance of the green coloured solution was measured at 628 nm against blank. The amount of CFS was calculated from the calibration graph. An accurately weighed vial powder equivalent to 10 mg of CFS was taken and the solution was prepared and analyzed as described above.

RESULTS AND DISCUSSION

The MBTH and ferric chloride undergoes oxidation reaction, on removal of electron gives highly reactive electrophile. This electrophile attacks the aromatic ring of phenolic –OH group at *o*-position to produce oxidative coupling reaction, which forms a green coloured complex. (Fig. 1). This green coloured complex shows maximum absorption at 628 nm. Recovery experiments were performed. The results are given in Table-2. Beer's law limits, molar absorptivity, Sandell's sensitivity, slope and intercept of regression analysis using least sqaure method, precision and accuracy of sample are summarized in Table-1. The results indicate that the proposed method is sensitive, accurate and precise and can be used for the routine determination of CFS in vials.

REACTION MECHANISM

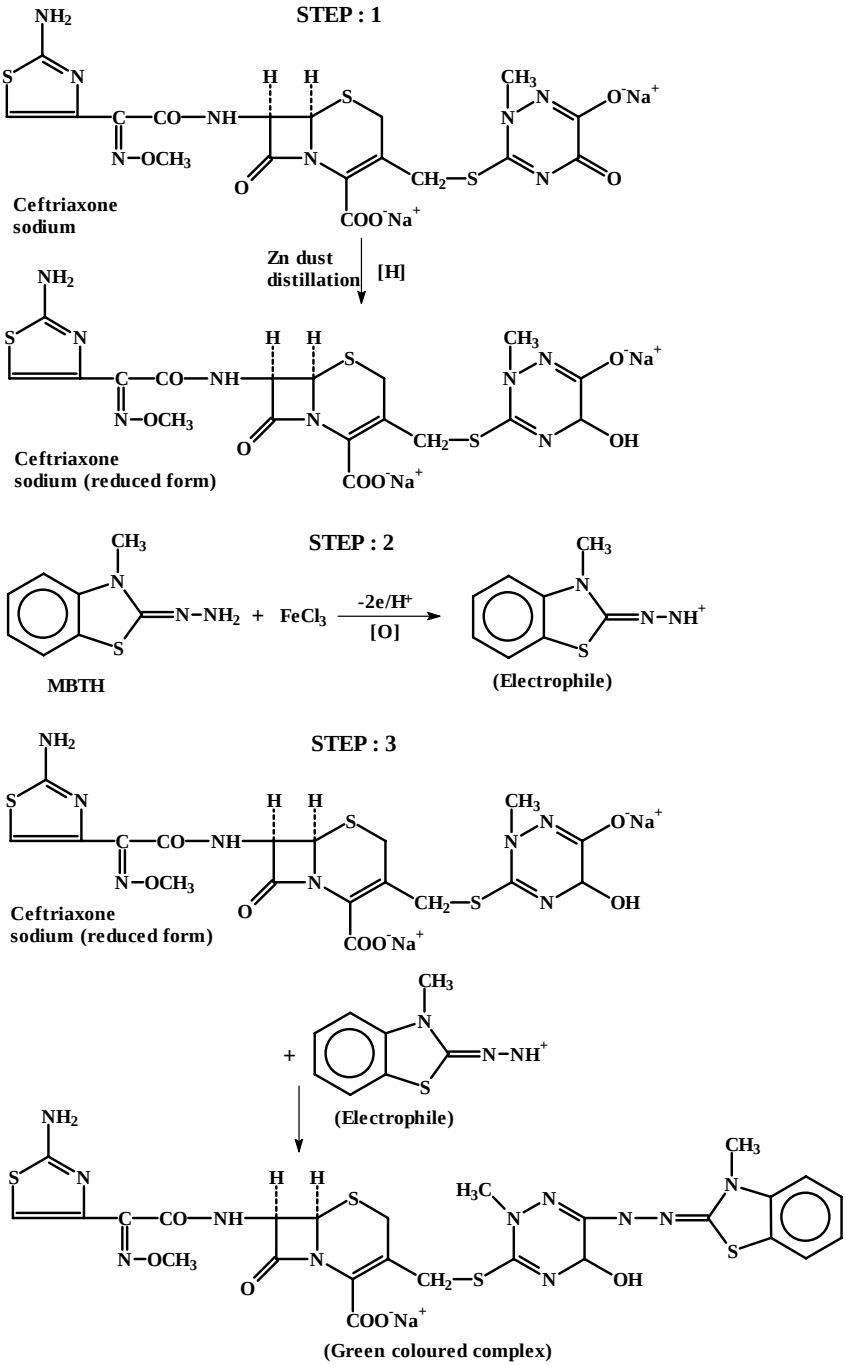

Fig. 1

TABLE-1
OPTICAL CHARACTERISTICS AND PRECISION DATA OF THE PROPOSED METHOD

Parameters	Values
λ_{max} (nm)	628
Beer's law limit (µg/mL)	10-50
Molar absorptivity (L/mol cm)	0.160×10^4
Sandell's sensitivity (µg/cm^2/0.001 absorbance unit)	0.827
Relative standard deviation (%)	2.417
Range of error (%) 0.01 % confidence limit	0.011450
Correlation co-efficient	0.997
Regression equation (Y)*	
Slope (a)	2.290×10^{-3}
Intercept (b)	2.412×10^{-3}

*Y = a+bC where C is the concentration of analyte and Y is the absorbance unit

TABLE-2
ASSAY AND RECOVERY OF CFS IN VIALS

Brand name	Amount taken (µg)	Amount obtained (µg)	Recovery by proposed method (%)
Brand : 1 Monocef (Aristo)	300	297.5	99.16 ± 0.23
Brand : 2 Oframax (Ranbaxy)	300	298.0	99.33 ± 0.15

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