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SPECTROPHOTOMETRIC METHOD FOR DETERMINATION OF CEFOPERAZONE SODIUM IN BULK AND PHARMACEUTICAL FORMULATIONS

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ABSTRACT

A simple, sensitive, rapid and accurate colorimetric method has been developed for the estimation of cefoperazone sodium in bulk and pharmaceutical dosage forms. The proposed method was based on the formation of chloroform extractable complex of cefoperazone sodium with wool fast blue. The absorbance of the extractable ion pair complex is measured at the wavelength of maximum absorbance 585 nm against the reagent blank. The results obtained with the proposed method are in good agreement with labeled amounts, when marketed pharmaceutical preparations are analyzed. Results obtained are statistically validated and found to be reproducible.

KEYWORDS: Spectrophotometry, Wool Fast Blue (WFB), cefoperazone sodium, Pharmaceutical formulation.

INTRODUCTION

Cefoperazone, chemically, (6R, 7R) – 7 – [(2R) – [[(4-Ethyl – 2,3 – dioxo – 1 – piperazinly) Carbonyl] amino] (4 hydroxy phenyl) acetyl] amino] – 3 – [[cl-methyl-1H-tetratol-5-yl) Thio] methyl] –8-oxo-5 thio – 1 azabicyclo [4.2.0] oct – 2 –ene – 2– carboxylic acid, is a broad spectrum antibiotic Cefoperazone is quite effective against a wide variety of gram positive and gram negative organisms including staphylococcus, Enterobacter, streptococcus, klebsiella and salmonella species.

The literature suggested and reported which includes, Spectophotometric method,[1-24] Electrophoresis,[25] Thin layer chromatography,[26] HPLC method,[27-29] Voltametric determination[30-32] and Spectroflurimetric[23] techniques for the quantitative estimation of cefoperazone in bulk, formulations and in biological samples.

Spectrophotometry is the technique of choice even today in the laboratories of research, hospitals and pharmaceutical industries due to its low cost and inherent simplicity. This paper describes two rapid, simple, sensitive and economical spectrophotometeric methods for the determination of cefoperazone sodium in commercial dosage forms. This method based on the formation of chloroform extractable complex of cefoperazone sodium with wool fast blue. The ion association complex is a special form of molecular complex resulting from two components extractable into organic solvents from aqueous phase at suitable pH. One component is a chromogen (wool fast blue) processing charge (Cationic or anionic in nature) & so insoluble in organic solvents. The other is colorless, processing opposite charge to that of chromogen. The authors attempted to design a precise, inexpensive colorimetric method for estimation, which could be applied to analyze cefoperazone in pure and pharmaceutical dosage form and will be helpful to the pharmaceutical industry.

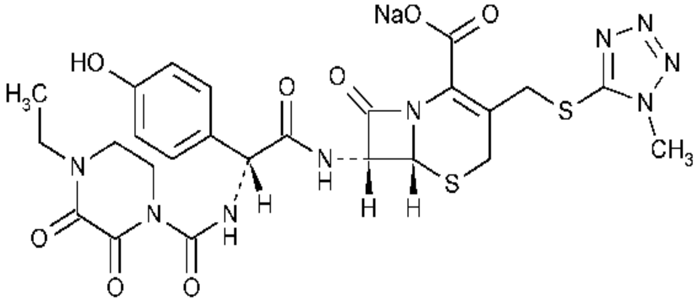

Figure 1: Chemical structure of Cefoperazone sodium

MATERIALS AND METHODS

Instrument

All measurement were done on Milton Roy 1001spectrophotometer by using 10 mm matched quartz cuvettes.

Materials

All chemicals used are of A.R. grade and were purchased from S.D. fine chemicals and LOBA-Chemi, Mumbai. Doubled distilled water were used for preparation of solutions. Wool fast blue solution (0.2%) was prepared in distilled water, freshly prepared. Buffer solutions of required pH were prepared by mixing appropriate volumes of glycine, sodium chloride and 0.1M Hydrochloric acid.

Preparation of standard stock solution: Standard solution of cefoperazone sodium was prepared by dissolving 100 mg of cefoperazone sodium in 100 mL of distilled water. From this a working concentration of 100 µg/ml was prepared for the proposed method.

Assay procedures

Aliquots of standard drug solution of cefoperazone sodium 0.5 – 2.5 ml were taken and transferred into a series of 100 ml of separating funnels. To each funnel 2 ml of 0.2% wool fast blue was added. Reaction mixture was shaken gently for 5 min. Then 10 ml of chloroform was added to each of them. The contents are shaken thoroughly for 5 min and allowed to stand, so as to separate the aqueous and chloroform layer. Colored chloroform layer was separated out and absorbance was measured at 585 nm against reagent blank. Calibration curve was prepared from absorbance values so obtained (fig 2).

Assay of pharmaceutical Formulations

An accurately weighed amount of injection powder from the vial equivalent to 100 mg of cefoperazone sodium, was transferred into a 100 ml volumetric flask containing few ml of distilled water. The volume was made up to the mark with distilled water, shaken well, and filtered through an ordinary filter paper. The concentration of the resulting solution was found to be 1 mg / ml. The sample solution was analyzed in the same way as mentioned in the calibration curve.

Validation

Accuracy of the proposed methods was carried as on the basis of recovery studies. It is performed by the standard addition method. Recovery studies were performed by adding standard drug at different levels to the pre-analyzed tablets powder and the proposed method was followed. From the amount of the drug estimated, the percentage recovery was calculated. The results of the analysis are shown in table 2.

RESULTS AND DISCUSSION

The proposed method was validated statistically and by recovery studies. The molar absorptivity and Sandell’s sensitivity values show the sensitivity of methods while the precision was confirmed by the %RSD (relative standard deviation). Assay results of recovery studies are given in table 2. Results are in good agreement with labeled value. The reproducibility, repeatability and accuracy of this method were found to be good, which is evidenced by low standard deviation.

The regression analysis using method of least squares was made for the slope (b), intercept (a) and correlation (r) obtained from different concentrations and results are summarized in table 1. The optical characteristics such as absorption maxima, Beer's law limits, molar absorptivity, Sandell's sensitivity and percent relative standard deviation were calculated and the results are summarized in Table 1. The optimum conditions for color development have been established by varying the parameters one at a time and keeping the other parameters fixed and observing the effect of product on the absorbance of the colored species. These studies revealed that the common excipients and other additives such as starch, talc, lactose and magnesium stearate, that are usually present in tablet dosage forms, did not interfere at their regularly added levels orated in the procedure.

Table 1: Optical Characteristics of the Proposed Method

parameters	**Proposed method**
Wavelength (nm)	585
Beer's limits, mcg/ml	50-250
Sandell's , sensitivity, (µg cm^{-2})	0.0178
Molar absorptivity, (L $mol-^{1}$ $cm-^{1}$)	$1.8x10^{3}$
Regression equation, Y^{*}	Y= 0.0046x+0.0023
Correlation coefficient, (r)	0.9999
Intercept (a)	0023
Slope (b)	0.0046

Table 2: Assay and Recovery of Cefoperazone Sodium in Tablet Formulations

Formulations (Injection)	**Labeled amount**	***Amount found (mg±S.D)**	**% Recovery**	**% RSD**	***t value**
1	500	500.2±0.52	99.9	0.1048	0.8528
2	500	500.06±0.5	100.4	0.0999	0.2683

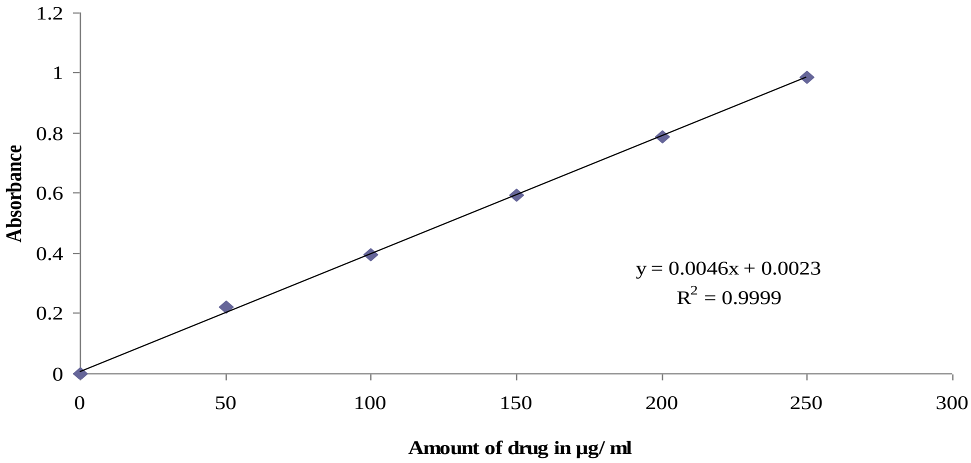

Fig.2: Calibration curve of Cefoperazone sodium

CONCLUSION

It could be concluded that the developed method for estimation of Cefoperazone sodium in pharmaceutical dosage forms and in bulk is simple, sensitive, relatively precise and economical. The proposed methods are used for the routine analysis of the drugs in the quality control.

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