

# Spectrophotometric Method for the Determination of Cefoperazone Sodium in Pharmaceutical Formulations

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**A new simple and sensitive spectrophotometric method was developed on the basis of a colour reaction of cefoperazone sodium with Folin Ciocalteu's phenol reagent in presence of sodium carbonate, and it is stable for 20 min. The method is based on the formation of blue coloured chromophore that has an absorption maxima at 668 nm and obeys Beer's law in the concentration range of 8/40 µg/ml. Results of the analysis were validated statistically and by recovery studies. The method was found to be suitable for routine determination of cefoperazone sodium.**

Cefoperazone sodium is a third-generation semisynthetic antibiotic that is used in the treatment of mild to moderate infections caused by susceptible microorganisms<sup>1</sup>. It is official in USP<sup>2</sup>. Chemically, cefoperazone sodium is 7 [R{2-(4-ethyl-2,3-dioxopiperazin-1-yl)carboxamide}-2-(4-hydroxyphenyl)acetamide}-3-[1-methyl-1H-tetrazol-5-ylthiomethyl]]-3-cephem-4carboxylate<sup>3,4</sup>. Reported method of analysis included colorimetry<sup>5</sup>. The aim of present investigation was to develop an improved spectrophotometric method with greater precision and

accuracy. The proposed method is mainly based on the reaction of cefoperazone sodium with Folin Ciocalteu's phenol reagent in presence of sodium carbonate, which gives blue colour chromophore that has an absorption maxima at 668 nm. Pure cefoperazone sodium was obtained from Orchid Chemicals and Pharmaceuticals, Chennai.

A Shimadzu-1601 UV/Vis spectrophotometer with 1 cm matched quartz cells was used for all absorbance measurements. All other chemicals used were of Analar grade. Sodium carbonate (20% w/v) and Folin Ciocalteu's phenol reagent and water (1:2) was prepared. Stock

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**TABLE 1: ESTIMATION OF CEFOPERAZONE SODIUM IN PHARMACEUTICAL FORMULATIONS**

| Pharmaceutical formulations                                | Labeled amount<br>mg/vial | Amount found<br>(mg*) | Recovery studies     |                      |            |
|--|---------------------------|-----------------------|----------------------|----------------------|------------|
|  |                           |                       | Amount added<br>(mg) | Amount found<br>(mg) | Recovery % |
| Cefomycin<br>Injection from Zydu<br>Cadilahealth Care Ltd. | 1000                      | 990                   | 2                    | 1.98                 | 99.0       |
| Myticef Injection from<br>Panacea Biotech Ltd.             | 1000                      | 992                   | 2                    | 2.01                 | 100.5      |

\*Average of six observations

solution of cefoperazone sodium was prepared by dissolving 100 mg of the drug in 100 ml of distilled water. The final concentration of cefoperazone sodium was brought to 100 µg/ml with distilled water. Into a series of 10 ml volumetric flasks, 0.8, 1.6 to 4.0 ml of cefoperazone sodium solution (100 µg/ml) was pipetted separately, and to each flask, 1ml of Folin Ciocalteu's phenol reagent solution and 2 ml of 20% w/v sodium carbonate solution was added and kept aside for 20 min. The final volume was made up to 10 ml with distilled water. The absorbance of the blue colour developed was measured at 668 nm against the reagent blank.

Injection power equivalent to 100 mg of cefoperazone sodium was weighed accurately and transferred into a 100 ml volumetric flask and made up to volume with distilled water and filtered. Four millilitre of the filtrate was treated with 1 ml of Folin Ciocalteu's phenol reagent solution and 2 ml of 20% w/v sodium carbonate solution and kept aside for 20 min. The final volume was made up to 10 ml with distilled water. The absorbance was measured at 668 nm against reagent blank. Mixtures containing cefoperazone sodium and common excipients such as lactose, talc, methyl cellulose, magnesium stearate, and starch were prepared. A portion of mixture equivalent to 100 mg of cefoperazone sodium was weighed accurately and dissolved in 100 ml of distilled water, and the solution was treated as described above. The effect of different concentrations and volumes of reagents (Folin Ciocalteu's phenol reagent and sodium carbonate) were studied at 668 nm for a fixed concentration (40 µg/ml).

To ensure the accuracy and reproducibility of the results obtained, 2 mg of cefoperazone sodium reference was added to previously analysed injection powder and the solution so obtained was treated as described above. Absorbance of the coloured solution (40 µg/ml) was measured at 668 nm at intervals of 5 min, up to 30 min, to investigate the stability of colour. Temperature of the reaction, quantity, concentration and addition of various reagents were optimised after several experiments. The

optimum quantity of Folin Ciocalteu's phenol reagent solution and sodium carbonate solution were found to be 1 and 2 ml (20% w/v), respectively. The optimum temperature was found to be  $37 \pm 0.5^\circ$ .

The optical characters such as Beer's law limits 8-40 µg/ml, molar absorptivity  $11.28 \text{ (l/mol/cm)} \times 10^3$ , Sandell's sensitivity  $1.481 \text{ µg/cm}^2/0.001$  absorbance unit were found. Precision was determined by analysing six replicate samples containing a known amount of cefoperazone sodium, and the results showed a standard deviation of 0.1288. Percentage recovery experiments revealed good accuracy of the data (Table 1). It was found that it is necessary to separate soluble excipients present in various marketed injection powders before analysis, since the results of analysis were always reproducible and equivalent to the labelled content of the preparations.

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