Development and Application of Validated Spectrophotometric Method for Estimation of Cetirizine Di-Hydrochloride (CD) in Bulk Drug and Tablet Dosage Form

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Abstract: In the present research work development and validation of a simple, sensitive, rapid, accurate, precise and economical UV Spectrophotometric method for the estimation of cetirizine di-hydrochloride in bulk and pharmaceutical dosage form was done based on the measurement of absorption maxima at 231.40 nm. In this method the simple uv spectrum of cetirizine di-hydrochloride in 0.1 N NaOH was obtained which exhibits absorption maxima (λmax) at 231.40 nm and linearity range was found to be 5-30 µg/ml (r² < 1). The proposed method was validated for its accuracy, precision, specificity, ruggedness and robustness. No interference was found from tablet excipients at the selected wavelength and assay conditions.

Keywords: Cetirizine Di-hydrochloride, methanol, 0.1N NaOH, UV-spectrophotometry.

INTRODUCTION

Cetirizine Di-hydrochloride (CD) chemically is (±)-2-[4-[(4-chlorophenyl) phenyl methyl]-1-piperazinyl] ethoxy] acetic acid[1,2,3,4]. It is a second generation H₁ receptor antagonists used in the symptomatic treatment of various immediate hypersensitivity reactions and allergic diseases. CD competitively inhibits the action of histamine on tissue containing H₁ receptors and most useful in acute types of allergy and symptoms of seasonal rhinitis and conjunctivitis. CD is rapidly absorbed after oral administration and undergoes metabolism in the liver. The metabolite produced has negligible antihistaminic activity[5,6,7]. Literature review reveals number of analytical methods for quantitative determination of CD alone or in combination with other drugs. Some of these methods include spectrophotometry [8,9], RP-HPLC [10] and TLC [11]. The aim of the present work to develop simple, precise, selective and economical instrumental spectrophotometric method for estimation of CD.

Fig. 1: Structure of Cetirizine di-hydrochloride
EXPERIMENTAL

Materials and Methods

The spectrophotometric measurements were carried out by using a Shimadzu UV/Vis spectrophotometer 1800 double beam with a fixed slit width (2 mm) and 1 cm matched quartz cell.

Reagents

Cetirizine di-hydrochloride was obtained as a gift sample from SunPharma Pvt. Ltd., Vadodara, Gujarat. The solution of 0.1 N NaOH was prepared in double distilled water as per IP 1996 procedure (1 mg/ml).

Standart solutions

Standard stock solution of CD was prepared in methanol. Suitable aliquot of standard stock solution was diluted with 0.1 N NaOH to obtain solution of 10 μg/ml. This solution was scanned in the range of 200-400 nm in 1 cm cell against 0.1 N NaOH as blank. The UV spectrum obtained exhibits absorption maxima (λmax) at 231.40 nm. Suitable aliquots of standard stock solution of CD were diluted with 0.1 N NaOH to obtain concentration range of 5-30 g/ml, the absorbance of each of the solutions were measured against solvent blank at 231.40 nm. A calibration curve was constructed by plotting drug concentration versus absorbance. The calibration curve was found to be linear in the concentration range of 5-30 μg/ml. Statistical data for calibration curve is depicted in Table 1.

Table 1: Statistical Data Of Calibration Curve

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength (nm)</td>
<td>231.40 nm</td>
</tr>
<tr>
<td>Beer’s law limit</td>
<td>5-30 g/mL</td>
</tr>
<tr>
<td>A (1%, 1cm)</td>
<td>300.7766</td>
</tr>
<tr>
<td>Regression equation</td>
<td>Y=0.028x + 0.0186</td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.9988</td>
</tr>
<tr>
<td>LOD</td>
<td>0.12143</td>
</tr>
<tr>
<td>LOQ</td>
<td>0.36786</td>
</tr>
</tbody>
</table>

Y=mx+c; where x is the concentration of drug in μg/ml, y is the amplitude at specified wavelength, m is the slope and c is the intercept.

Analysis of tablet formulation

Twenty tablets were weighed and crushed to fine powder, average weight was determined. An accurately weighed quantity of tablet powder equivalent to 10 mg of CD was transferred to 10 ml volumetric flask and dissolved by sonications with sufficient quantity of methanol, volume was made up to mark with methanol. The solution was then filtered through Whatmann filter paper No.1. A 2.5 ml portion of the filtrate was further diluted with methanol in a 25 ml volumetric flask. From this solution appropriate dilutions were made with 0.1 N NaOH to obtain the concentration of 10 μg/ml and amount of CD was determined from the calibration curve. Five replicate estimations were done in similar way.
Validation

Developed method was validated statistically in terms of linearity, precision, accuracy, LOD and LOQ.

Linearity

The Linearity of the method was established by measurement of varying concentration versus absorbance. CD was found to be linear in the range of 5-30 ug/ml ($r^2=0.9988$). Regression line showed excellent linearity relationship between absorbance and concentration of CD. Result of linearity studies are shown in Table 3.

Precision

Precision was studied by analyzing five replicates of sample solutions and concentrations were calculated results are shown in Table 3.

Accuracy

Accuracy of the method was ascertained on the basis of recovery studies, carried out by standard addition method in which pre-analyzed samples were taken and standard drug was added at three different levels (80%, 100% and 120% of the test concentration). the % recovery ±SD lies in the range of 100.81±0.444. Results are depicted in Table 2.

### Table 2 Recovery Study Data

<table>
<thead>
<tr>
<th>Level of standard addition(%)</th>
<th>% Recovery ±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>99.625±0.254</td>
</tr>
<tr>
<td>100</td>
<td>102.0±0.327</td>
</tr>
<tr>
<td>120</td>
<td>100.83±0.753</td>
</tr>
</tbody>
</table>

Results are mean of three determinations, SD is standard deviation

### Table 3. Results Of Validation Studies Of Proposed Method

<table>
<thead>
<tr>
<th>Validation parameters</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearity</td>
<td>$R^2=0.9988$</td>
</tr>
<tr>
<td>Precision ( % Label claim ± SD,n=5)</td>
<td>99.68±0.143</td>
</tr>
<tr>
<td>Ruggedness(%Label claim,n=3)</td>
<td></td>
</tr>
<tr>
<td>Intraday</td>
<td>101.92</td>
</tr>
<tr>
<td>Interday</td>
<td>100.69</td>
</tr>
<tr>
<td>Different analyst</td>
<td>99.15</td>
</tr>
<tr>
<td>Specificity</td>
<td>specific</td>
</tr>
</tbody>
</table>

n is number of determinations, SD is standard deviation
Ruggedness

Ruggedness was established by carrying out experiment at different conditions like intra-day, inter-day and by different analyst.

Limit of Detection and Quantitation

The LOD and LOQ of Cetirizine di-hydrochloride were estimated from the standard deviation of the response and the slope of the calibration curve by using following formula.

$$LOD = 3.3 \times \frac{\sigma}{S}$$
$$LOQ = 10 \times \frac{\sigma}{S}$$

Where $\sigma$ = the standard deviation of the response
$S$ = the slope of the calibration curve

LOD and LOQ were found to be 0.00012143 g / ml[0.12143 mg/ml] and 0.00036786 g / mL [ 0.36786 mg/mL] respectively. And results are indicated in Table 1.

![Fig.2 Calibration curve for Cetirizine dihydrochloride using 0.1N NaOH](image)

**Table 4. Result Of Analysis Of Commercial Formulation**

<table>
<thead>
<tr>
<th>Drug</th>
<th>% Label claim (mg)</th>
<th>±SD*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cetirizine dihydrochloride</td>
<td>100.12</td>
<td>0.5613</td>
</tr>
</tbody>
</table>

Mean of three determination.*SD is standard deviation

Results And Discussion

The absorption maxima at 231.40 ($\lambda_{max}$) was selected for analysis of drug in 0.1N NaOH. Linearity was observed in the range 5-30ug/mL ($r^2=0.9988$) the amount of drug estimated by the proposed method was in good agreement with the label claim. The proposed method was validated. The accuracy of the method was assessed by recovery studies at three different levels. Recovery experiments indicated the absence of interference from commonly encountered additives. The method was found to be precise as indicated by the repeatability, inter-day, intra-day analysis, showing %RSD less than 2. The results did not show any statistical difference between operators suggesting that method developed was rugged. The results of accuracy and precision are shown in Table 2 and Table 3. All statistical data proves validity of the method and can be used for routine analysis of pharmaceutical formulation containing single drug.
References

2. Indian Pharmacopoeia, Government of India, Ministry of Health and Family Welfare,

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