DEVELOPMENT AND VALIDATION OF UV SPECTROSCOPY METHOD FOR THE ESTIMATION OF FAROPENEM SODIUM IN BULK AND DOSAGE FORM

Dhaval N Darji*, D G Desai, Aarti Zanwar, Ashim Kumar Sen and A K Seth
Department of Pharmacy, Sumandeep Vidyapeeth, Pipariya, Waghodia, Vadodara-391760, Gujarat, India

ABSTRACT
The simple, precise, accurate and economical UV Spectrophotometric methods have been developed and validated for the routine estimation of Faropenem Sodium in bulk drug and Pharmaceutical dosage form. The drug shows maximum absorption at 306nm and obeyed Beer-Lambert’s law in the concentration range of 3-15 μg/ml at 306nm. The drug showed linearity in the concentration range of 3-15 μg/ml. The linear regression equations were calculated to be y=0.0014x+0.005(R²=0.998) at 306nm. The results of estimation of marketed tablet formulations were found to be 98%. The % recovery was found to be 98.9-99.13. The intraday and inter day assay was within 2%, which indicates accuracy and reliability of the method as well as noninterference from excipients. So these method can be used for the routine quality analysis.

Keywords: Faropenem Sodium, water, UV Spectrophotometric, calibration curve, Validation parameter.

INTRODUCTION
Faropenem Sodium Monosodium (5R,6S)-6-[(1R)-1-hydroxyethyl]-7-oxo-3-[(2R)-tetrahydrofuran-2-yl]-4-thia-1-azabicyclo[3.2.0]hept-2-ene-2-carboxylate hemipentahydrate.

Figure 1
Structure of Faropenem Sodium

Faropenem Sodium is a sodium salt of novel β-lactam antimicrobial with a pane (furanem) structure used to treat bacterial sinusitis, pneumonia, bronchitis and skin infections. Faropenem Sodium occurs as white to light yellow, crystals or crystalline...
powder. It is freely soluble in water and in methanol, slightly soluble in ethanol. Literature survey revealed that only HPLC and Visible Spectrophotometric methods was reported for the assay of Faropenem. To the best of our knowledge, there is no UV Visible Spectrophotometric method has been published so far. Hence we have made an attempt to develop and validate a simple, economic, rapid and accurate method.

EXPERIMENTAL SECTION

Materials and methods:

A UV method was developed for Faropenem Sodium in bulk and pharmaceutical formulation in water.

Reagents and chemicals:

Faropenem Sodium: pure drugs and Distilled Water as solvents.

Stock solutions:

Preparation of standard stock solution of Faropenem Sodium: (1000 μg/ml).

Stock solution of Faropenem Sodium was prepared by weighing accurately 100mg of Faropenem Sodium in to a 100ml volumetric flask and dissolved with water to give a conc. of 1mg/ml.

Preparation of working standard solution of Faropenem Sodium: (100μg/ml).

The working solution of Faropenem Sodium was prepared by further diluting the stock solution suitably with water to get a conc. of 100 μg / ml.

Instrument:

All the experiments were carried out on SIMADZU UV-VIS 1700 spectrophotometer using 1cm matched quartz cuvettes.

Determination of λmax.

An absorption maximum or λmax is the wavelength at which maximum absorption takes place.

- λmax of Faropenem Sodium in distilled water:

The solution of Faropenem sodium were suitably diluted with water and subjected for determination of λmax given in figure 2.
Calibration curve of samples:
From the working standard 0.3, 0.6, 0.9, 1.2 and 1.5 ml of drug solution were placed in 5 different 10 ml volumetric flasks and volume was made up to the mark with water and their absorbance was measured against corresponding reagent blank at 306 nm and result are recorded in table no. 1 and figure no. 3. Linear response of drug over a range of 3-15 g/ml of the conc.

**TABLE 1: ABSORBANCE OF DIFFERENT CONC. OF FAROPENEM SODIUM OBEYING BEER’S LAW**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Concentration of drug taken (100 µg/ml)</th>
<th>Concentration Range (µg/ml) in 10 ml</th>
<th>Absorbance At 306 nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.3 ml</td>
<td>3 µg</td>
<td>0.046</td>
</tr>
<tr>
<td>2</td>
<td>0.6 ml</td>
<td>6 µg</td>
<td>0.09</td>
</tr>
<tr>
<td>3</td>
<td>0.9 ml</td>
<td>9 µg</td>
<td>0.135</td>
</tr>
<tr>
<td>4</td>
<td>1.2 ml</td>
<td>12 µg</td>
<td>0.171</td>
</tr>
<tr>
<td>5</td>
<td>1.5 ml</td>
<td>15 µg</td>
<td>0.215</td>
</tr>
</tbody>
</table>
Stability of sample:
The sample of 9 g/ml drug solution was prepared by suitable dilution with diluents and absorbance were taken at 306 nm against the blank. The stability of sample was found to be more than 10 hrs. As shown following Table no.2 and figure 4.

TABLE 2: STABILITY OF SAMPLE

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Concentration of drug solution (µg/ml)</th>
<th>Time (min)</th>
<th>Absorbance at 306 nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>0</td>
<td>0.135</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>30</td>
<td>0.135</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>60</td>
<td>0.134</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>90</td>
<td>0.133</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>120</td>
<td>0.133</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>240</td>
<td>0.132</td>
</tr>
<tr>
<td>7</td>
<td>9</td>
<td>360</td>
<td>0.130</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>480</td>
<td>0.129</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>600</td>
<td>0.128</td>
</tr>
</tbody>
</table>
Analysis of Formulation:
Faropenem Sodium was procured from the local market as tablets of strength 200 mg and marketed with brand name of Duonem 200 and it was manufactured in India by Cadila Healthcare limited, Moraiya, Tal. Sanand, Ahmdabad.

Preparation of solution:
20 tablets were weighed and crushed properly using a mortar and pestle. Then powder weight equivalent to 10mg was weighed and transferred to 100ml of volumetric flask and dissolved in water and filter through whatmann filter paper in to another 100ml volumetric flask and make up to mark with same diluents which gives the solution of 100µg/ml conc., further dilution were performed to get a concentration of 10 g/ml. % Faropenem Sodium was calculated in table 3.

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Actual conc. Of Faropenem sodium (µg/ml)</th>
<th>Amount obtained of Faropenem Sodium (µg/ml)</th>
<th>% Faropenem Sodium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tablet</td>
<td>10</td>
<td>9.8</td>
<td>98%</td>
</tr>
</tbody>
</table>

Validation parameter:
1. Linearity
A linear relationship should be evaluated across the range of the analytical procedure. It was demonstrated directly on the drug substance (by dilution of a standard stock solution)
and using the proposed procedure. This method obeys the beer-lambert’s law in the concentration range of 3-15 µg/ml. As given in fig no. 3.

2. Accuracy

Accuracy was established across the specified range of the analytical procedure. Accuracy is the closeness of the test results obtained by the method to the true value. Recovery studies were carried out by addition of standard drug to the sample at 3 different concentration levels taking into consideration percentage purity of added bulk drug samples. The results of determination of accuracy are given in table 4.

<table>
<thead>
<tr>
<th>TABLE 4: DETERMINATION OF ACCURACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amt. of sample Faropenem Sodium (µg/ml)</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

3. Intra and inter day precision:

Variation of results within the day (intraday), variation of results between days (inter day) were analyzed. Intraday precision was determined by analyzing Faropenem sodium for three times in the same day at 306 nm.

Inter day precision was determined by analyzing the drug different day for three days at 306 nm. Precision data for Faropenem Sodium at 306 nm is given in table 5.

<table>
<thead>
<tr>
<th>TABLE 5: PRECISION DATA FOR FEROPENEM SODIUM AT 306 NM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>10 µg/ml</td>
</tr>
<tr>
<td>10 µg/ml</td>
</tr>
<tr>
<td>10 µg/ml</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Std. Dev.</td>
</tr>
<tr>
<td>%RSD</td>
</tr>
</tbody>
</table>
4. Limit of detection (LOD) & limit of quantification (LOQ):
The limit of detection and quantification of the drugs were calculated with the standard
deviation and slop. Its value described in table 6.
\[
\text{LOD} = \frac{3.3\sigma}{S}
\]
\[
\text{LOQ} = \frac{10\sigma}{S}
\]
Where, \(\sigma\) = the standard deviation of the response
\(S\) = the slope of the calibration curve

\begin{table}[h]
\begin{tabular}{|c|c|}
\hline
LOD & LOQ \\
\hline
0.13 & 0.41 \\
\hline
\end{tabular}
\end{table}

RESULTS AND DISCUSSION
In the method Faropenem Sodium was estimated by using ultraviolet spectroscopic
method. The method obeys beer’s lamberts law in the concentration range of 3-15 g/ml
and its wavelength of detection was 306nm. Finally recovery studies were undertaken.
The quantitative parameters for determination of Faropenem Sodium in bulk and
pharmaceutical dosage form are listed in table 7.

\begin{table}[h]
\begin{tabular}{|c|c|c|c|}
\hline
Parameter & Result \\
\hline
\(\lambda_{\text{max}}\) (nm) & 306 \\
\text{Beer’s law limits ( g/ml)} & 3-15 \\
\text{Regression equation (y=bc+a)} & \text{Y=0.014x+0.005} \\
\text{Slope (b)} & 0.014 \\
\text{Intercept (a)} & 0.005 \\
\text{Correlation coefficient (r)} & 0.998 \\
\text{Accuracy (% recovery)} & 99-99.13 \\
\text{Precision (%) } & 0.141 \text{ (intra day)} \\
& 0.138 \text{ (inter day)} \\
\text{LOD ( g/ml)} & 0.13 \\
\text{LOQ ( g/ml)} & 0.41 \\
\text{%Drug found in tablet formulation} & 98 \\
\hline
\end{tabular}
\end{table}
CONCLUSION

The proposed method is simple, selective and sensitive. The obtained and statistical parameters for determination of Faropenem Sodium that the proposed UV spectrophotometry method by is simple, accurate, fast and precise. The method showed acceptable linearity and accuracy. The proposed method is highly sensitive; therefore it could be used easily for the routine analysis of pure drugs and their tablet formulations.

Acknowledgement

The author wishes to thanks mates who helped me lot for my work. And how can I forget staff of Department of pharmacy, Sumanddeep vidhyapeeth, Pipriya, Vadodara who suggest me in all way.

REFERENCES

8. Sun Ya-Xin, Zhao Li-Mei, Qiu Feng and He Xiao-Jing, Chin J New Drugs Clin Remed., 2007-10.

For Correspondence:
Dhaval N Darji
Email: dhaval_1705@yahoo.co.in