Validated UV-Visible Spectrophotometric Method for the Estimation of Fenofibrate in Pure and Pharmaceutical Formulation Using MBTH Reagent

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ABSTRACT

A simple, sensitive and reproducible UV visible spectrophotometric method has been developed for the quantitative determination of fenofibrate in bulk drug and pharmaceutical dosage forms using MBTH reagent. The method is based on the measurement of absorbance of fenofibrate in methanol (0.5% MBTH in 0.5% HCl and 1% FeCl₃ in 0.5% HCl) at 596 nm. Beer’s law is obeyed over the linear range 2-5µg/ml of fenofibrate for the method with apparent molar absorptivity value of 1909.5905 L mol⁻¹ cm⁻¹. The method was validated in accordance with the current ICH guidelines. The precision results, expressed by reproducibility (RSD ≤ 1.7%) and repeatability (RSD ≤ 1.5%), were satisfactory. The accuracy is also satisfactory (RSD ≤ 0.200532%). The result demonstrated that the proposed method is accurate, precise and reproducible.

Keywords: Fenofibrate, UV visible spectrophotometry, MBTH, molar absorptivity.

INTRODUCTION

Fenofibrate which is chemically propan-2-yl 2-{4-[(4-chlorophenyl) carbonyl] phenoxy}-methyl propanoate. It is mainly used to reduce cholesterol levels in patients at risk of cardiovascular disease. Like other fibrates, it reduces both low-density lipoprotein (LDL) and very low density lipoprotein (VLDL) levels, as well as increasing high density lipoprotein (HDL) levels and reducing triglycerides levels. It also appears to have a beneficial effect on the insulin resistance featured by the metabolic syndrome.  

MATERIALS AND METHODS

A SHIMADZU model PHARMASPEC-1800 UV-Vis spectrophotometer with 1.0 cm matched cells was used for the electronic spectral measurements. Fenofibrate and all other chemicals used were analytical reagent grade (AR grade). Methanol is used as solvent in all experimental purpose. Fenofibrate pure drug (certified to be 99.76%) was kindly provided by Lupin pharmaceuticals ltd., India. as a gift sample. FINATE-160 (160 mg fenofibrate) were manufactured by FRANCO INDIAN Remedies Pvt. Ltd., India and purchased.

Solutions

An accurately weighed quantity of 10 mg Fenofibrate was transferred into 100 ml volumetric flask with methanol and sonicated. The volume was made up to the mark with methanol. Aliquots of this standard stock solution (SSS) were transferred to 10 ml volumetric flask (in different concentrations) and to this 2.5ml of 0.5% MBTH and 2.5ml of 1% ferric chloride (both in 0.5% HCl) were added. Then
the solutions are made up to the mark with methanol and kept for 20 minutes to form a blue-green complex and scanned over visible range of 400-800 nm. An overlay spectrum of drug was drawn out and selected the wavelength 596 nm for the analysis at which drug showed maximum absorbance (Fig. 1).

Procedure
For calibration curve; (study of Beer’s- Lambert’s law)
From SSS 0.2 ml-0.5ml were pipetted out and transferred to 10 ml standard flask and then 2.5 ml of 0.5 % MBTH in 0.5% HCl, 2.5 ml 1% FeCl₃ in 0.5% HCl were added to each flask and then the volume is made up with methanol and kept as such for 20 minutes to form a blue-green complex and scanned at 596 nm (Fig. 2 and Table 1). Absorbance plotted against concentration and calibration graph were recorded.

For absorptivity study
From the SSS, a solution of 2µg/ml concentration was prepared. Absorbance of such five of fenofibrate standard solution measured and results of absorptivity study drawn out by A1% 1cm (Table 2).

Estimation of fenofibrate in tablet formulation sample
Ten tablets were weighed accurately and powdered. Powder equivalent to 10 mg (label claim -160 mg) was taken and transferred to 100 ml volumetric flask and dissolved in methanol, sonicated for 10 minutes, filtered and further diluted to get final concentration 100µg/ml of fenofibrate (label claim basis). From the above solution 0.2 ml-0.5ml were pipetted out and transferred to 10 ml standard flask and then 2.5 ml of 0.5 % MBTH in 0.5% HCl, 2.5 ml 1% FeCl₃ in 0.5% HCl were added to each flask and then the volume is made up with methanol and kept as such for 20 minutes to form a blue-green complex and scanned at 596 nm (Table 3).

RESULT AND DISCUSSION
The method was accurate, simple, rapid, reliable, sensitive and reproducible. The wavelength 596nm was selected which showed good linearity between the concentrations.

Validation of analytical data

Table 2: Absorptivity (1%, 1cm) values of Fenofibrate at 596 nm

<table>
<thead>
<tr>
<th>S. No</th>
<th>Conc. (µg/ml)</th>
<th>Abs. at 596 nm</th>
<th>%RSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.0002004</td>
<td>0.379</td>
<td>1.7</td>
</tr>
<tr>
<td>2.</td>
<td>0.0002005</td>
<td>0.386</td>
<td>2.02</td>
</tr>
<tr>
<td>3.</td>
<td>0.0002003</td>
<td>0.378</td>
<td>2.04</td>
</tr>
<tr>
<td>4.</td>
<td>0.0002009</td>
<td>0.389</td>
<td>2.07</td>
</tr>
<tr>
<td>5.</td>
<td>0.0002004</td>
<td>0.379</td>
<td>2.03</td>
</tr>
</tbody>
</table>

Table 3: Estimation of Fenofibrate in tablet formulation

<table>
<thead>
<tr>
<th>S. No</th>
<th>Wt. Of tablet powder taken mg (label claim 160mg)</th>
<th>Abs. at 596 nm</th>
<th>Amount of drug per tablet (mg)</th>
<th>Purity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.045</td>
<td>0.382</td>
<td>0.1598</td>
<td>99.91</td>
</tr>
<tr>
<td>2.</td>
<td>0.0451</td>
<td>0.385</td>
<td>0.1607</td>
<td>100.47</td>
</tr>
<tr>
<td>3.</td>
<td>0.0442</td>
<td>0.380</td>
<td>0.1618</td>
<td>101.18</td>
</tr>
<tr>
<td>4.</td>
<td>0.0446</td>
<td>0.384</td>
<td>0.1621</td>
<td>101.33</td>
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<tr>
<td>5.</td>
<td>0.044</td>
<td>0.381</td>
<td>0.1630</td>
<td>101.91</td>
</tr>
</tbody>
</table>

RESULT AND DISCUSSION
The method was accurate, simple, rapid, reliable, sensitive and reproducible. The wavelength 596nm was selected which showed good linearity between the concentrations.

Validation of analytical data
method was found to be 0.998 of fenofibrate was found to be linear.
Ruggedness of the proposed method was carried out for 3 different analysts. The result did not show any considerable statistical difference suggesting that the method developed was rugged.
The stability study was carried out and dug was found to be stable between 20 to 35 minutes.

Validation parameters complies the applied spectrophotometric methods of analysis and were found to be simple, sensitive, accurate and satisfactory capable for determination of fenofibrate in tablet formulation with reproducible specific results. The linear concentration range of preordain elaborated method were observed wider. Thus, proposed UV-VIS spectrophotometric method is applicable for the quality control and routine analysis and may also proposed for determination from biological fluid other solid dosage form containing same drugs.

REFERENCES
7. ICH Harmonised Tripartite Guideline; Validation of Analytical Procedures: Text and Methodology; Q2 (R1).

Fig. 1: Overlay spectra of Fenofibrate

Fig. 2: Plot of Beer’s Lambert’s law for Fenofibrate at 596 nm