Article

A facile UV spectrophotometric estimation of quetiapine fumarate in pharmaceutical dosage form

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ABSTRACT

A simple rapid, accurate, precise and reproducible validated UV spectrophotometric method was developed for the determination of Quetiapine fumarate. The absorption maximum of the drug was found to be 237 nm by using Ethanol: 1N sodium hydroxide (1:1) as a solvent. It obeys the beer’s law in the range of 75-175 µg/ml. The precision of the method was found within limit (RSD = 2%). The analysis of the formulation showed good result in the concentration range of 102.42% to 103.24%. The mean percentage recovery was found to be 99.42%. This shows the adaptability of the method for routine estimation of Quetiapine fumarate in tablet dosage form. Quetiapine fumarate is soluble in Methanol, Ethanol, 0.1N HCl, and Water, but the λmax of Quetiapine fumarate in above solvents is 207-215. Normally the solvent peak appears in the region of 200 to 220, so it may interfere the analysis, in order to avoid that extended conjugation Bathochromic shift method was followed by increasing the polarity of the solvent.

KEY WORDS: Quetiapine fumarate, Bathochromic shift, Validation

INTRODUCTION:

Quetiapine fumarate is a typical antipsychotic drug which is used to treat psychosis associated with Parkinson’s disease & schizophrenia. An acute manic episode associated with bipolar disorder is also treated by Quetiapine fumarate1. It is chemically called 2-[2-(4-dibenzo[b,f][1,4]thiazepin-11-yl-1-piperazinyl)ethoxy] ethanol hemi fumarate with formula C_{29}H_{33}N_{3}O_{10}S and molecular weight of 615.66. It is white or yellowish white in colour which is completely soluble in methanol and moderately soluble in water. The drugs therapeutic activity is mediated through a combination dopamine type 2 (D2) and serotonin type 2 (5HT2) receptor antagonisms.

A rapid and economical way for determining a new analytical methods or procedures for the drug is in high demand. However, methods have been reported for estimation by High performance liquid chromatography (HPLC), HPTLC, Spectrophotometric method\textsuperscript{4,5} and capillary zone electrophoresis method (CZE)\textsuperscript{6}. High performance liquid chromatography – electro spray mass spectrometry method\textsuperscript{7}, Gas chromatography-mass spectroscopy(GC-MS)\textsuperscript{8}, liquid chromatography – mass spectroscopy ( LC-MS)\textsuperscript{9} was revealed by literature survey.

Fig.no.1: Quetiapine Fumarate Chemical Structure

MATERIALS AND METHODS:

Instruments

The spectrophotometric measurements were carried out using a Perkin Elmer Lambda 25 Uv/Vis spectrophotometer with 1 cm matched quartz cell.

Materials:

Quetiapine fumarate was obtained as gift sample from Orchid healthcare private ltd. Ethanol AR grade and 1N NaOH was used as solvent throughout the experimentation. Quetiapine fumarate tablet was procured from the local market.

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Methods:

Preparation of standard solution:
50 mg of pure Quetiapine fumarate was accurately weighed and transferred to 50ml of volumetric flask. Drug was dissolved in Ethanol: 1N NaOH (1:1) and volume was made up to 50ml. The concentration of drug was 1mg/ml. 1 ml of this solution was taken in a 10ml volumetric flask and volume was made up to the mark with Ethanol:1N NaOH. The concentration of Quetiapine fumarate (100 µg/ml) was obtained. The absorbance was measured at 237nm.

Preparation of sample solution:
20 Tablets were procured from local market and average weight was determined. The powder equivalent to 50mg of Quetiapine fumarate was weighed accurately and dissolved in 50ml of Ethanol: 1N NaOH (1:1), shaken for ten minutes and filtered. 1ml of this solution was taken in a 10ml volumetric flask and volume was made up to the mark with methanol. The concentration of Quetiapine fumarate (100 µg/ml) was obtained. The absorbance was measured at 237nm. The spectrum is shown in fig no.2. The values are tabulated in table no.1

Validation of an analytical method:

Linearity:
Analysis, which was calculated by Least Square method and the drug, was linear in the concentration range of 75-175 µg/ml. Calibration standard was prepared by spiking required volume of working standard solution into different 10 ml volumetric flasks and volume made with methanol to yield concentrations of 75, 100, 125, 150, and 175µg/ml. The resulting absorbance of the drug was measured. Calibration curve was plotted between absorbance of drug against concentration of the drug. These results shown there was an excellent correlation between absorbance and analyte concentration. The linearity graph and table is presented in Fig no.3 and Table no.2

Precision:
100µg/ml standard solution was prepared & 6 consecutive values of absorbance was measured. Standard deviation (S.D) and relative standard deviations (R.S.D) are calculated using appropriate formula. The limit is not more than 2 %. The result were shown in table no.3

Recovery:
20 Tablets were procured from local market and average weight was determined. The powder equivalent to 50mg of Quetiapine fumarate was weighed accurately and taken in 3 separate 50 ml volumetric flask. To this 25mg, 50mg and 75mg pure drug was added (for 50%, 100% and 150% recovery). 50ml of Ethanol: 1N NaOH (1:1) was added to make up the volume, shaken for ten minutes and filtered. 1ml of this solution was taken in a 100ml volumetric flask and volume was made up to the mark with methanol. The strength of Quetiapine fumarate 100 µg/ml was obtained. 1ml of this solution was diluted in 10ml volumetric flask until the mark with Ethanol: 1N NaOH (1:1) and absorbance was measured at 237nm. The procedure was carried out for 3 times. The result were shown in table no.4

Results and discussions:

Table no.1: Assay of Quetiapine fumarate

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Drug</th>
<th>Amount claimed (mg/tablet)</th>
<th>Amount found (mg/tablet)</th>
<th>Mean (mg)</th>
<th>Mean recovery (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Quetiapine fumarate</td>
<td>50</td>
<td>51.62</td>
<td>51.46</td>
<td>102.92%</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>50</td>
<td>51.55</td>
<td>51.46</td>
<td>102.92%</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>50</td>
<td>51.21</td>
<td>51.46</td>
<td>102.92%</td>
</tr>
</tbody>
</table>

Table no.2: Linearity of Quetiapine fumarate

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Concentration (x) (µg/ml)</th>
<th>Absorbance (y)</th>
<th>x²</th>
<th>y²</th>
<th>Xy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>75</td>
<td>0.4385</td>
<td>5625</td>
<td>0.1922</td>
<td>32.8875</td>
</tr>
<tr>
<td>2.</td>
<td>100</td>
<td>0.5538</td>
<td>10000</td>
<td>0.3066</td>
<td>55.38</td>
</tr>
<tr>
<td>3.</td>
<td>125</td>
<td>0.6930</td>
<td>15625</td>
<td>0.4802</td>
<td>86.625</td>
</tr>
<tr>
<td>4.</td>
<td>150</td>
<td>0.8180</td>
<td>22500</td>
<td>0.6691</td>
<td>122.7</td>
</tr>
<tr>
<td>5.</td>
<td>175</td>
<td>0.9490</td>
<td>30625</td>
<td>0.9006</td>
<td>166.075</td>
</tr>
</tbody>
</table>

Total: $\text{ex} = 625$, $\text{ey} = 3.4523$, $\text{ex}^2 = 84375$, $\text{ey}^2 = 2.5487$, $\text{exy} = 463.6675$

$r^2 = 0.998582$, Slope = 0.005141, Intercept = 0.05156

Fig no.3: Linearity graph of Quetiapine fumarate
LOD (Limit of Detection):
LOD = 3 × SD / Slope
LOD = 3 × 0.00091 = 0.5310 µg/ml

LOQ (Limit of Quantification)
LOQ = 10 × SD / Slope
LOQ = 10 × 0.00091 = 1.7700 µg/ml

Table no.3: precision study of Quetiapine fumarate

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Concentration</th>
<th>Absorbance</th>
<th>Mean (x)</th>
<th>S.D</th>
<th>R.S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.5647</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>0.5685</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>0.5736</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>6µg/ml</td>
<td>0.5771</td>
<td>0.57345</td>
<td>0.00091</td>
<td>0.1586</td>
</tr>
<tr>
<td>5.</td>
<td>0.5780</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>0.5788</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

S.D = Standard deviation,  R.S.D = Relative standard deviation

Table no.4: Recovery study of Quetiapine fumarate

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Concentration</th>
<th>Amount added(mg)</th>
<th>Amount found(µg/ml)</th>
<th>Percentage Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>125µg/ml</td>
<td>25</td>
<td>123.971</td>
<td>99.17</td>
</tr>
<tr>
<td>2.</td>
<td>150µg/ml</td>
<td>50</td>
<td>148.34</td>
<td>98.89</td>
</tr>
<tr>
<td>3.</td>
<td>175µg/ml</td>
<td>75</td>
<td>175.36</td>
<td>100.20</td>
</tr>
</tbody>
</table>

CONCLUSION:
Bathochromic shift was achieved by adding the alkali like (NaOH) along with organic solvent like ethanol it is having capability to extend the $\lambda_{max}$ to above 230nm. It will help to get absorbance of sample and standard alone without any interferences of solvent. The developed spectrophotometric method is found to be simple, precise, specific, and accurate and can be used for routine analysis of Quetiapine fumarate. The developed method was validated as per ICH guidelines.

REFERENCES:


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