Method development and validation for estimation of rufinamide in tablet dosage forms by RP-HPLC

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Abstract
A simple, precise, rapid and reproducible stability indicating RP -HPLC method was developed and validated for the determination of Rufinamide in pharmaceutical dosage forms. Chromatography was performed on a C18 (ODS) Acetonitrile: water: Triethylamine buffer pH4.6: Methanol (70:20:10 v/v) was used as mobile phase and flow rate was adjusted to 0.8 ml/ min. The detection was carried out at 292 nm using analytical Tech. UV-Visible detector SpD-10AVP. The obtained calibration curve was linear in the concentration range of 10–50 ug/ ml. The limit of detection and quantification was found to be 1.056 ug/ml and 3.09 □ g/ml respectively.

Key words: Rufinamide, Reverse phase -HPLC, PDA, and Tablet dosage forms.

Introduction
Rufinamide is a triazole derivative structurally unrelated to currently market antiepileptic drug. It’s practically insoluble in water, slightly soluble in tetrahydrofuran, in methanol, and very slightly soluble in ethanol and in acetonitrile. 

Instrumentation and analytical conditions
Waters-2695 sophisticated equipment was used for this separation process and mobile phase connecting with 2487 quaternary pump. The Analytical column C18 was used and operated at 27 □c Temperature and mobile phase contains Acetonitrile: Triethylamine buffer pH4.6: Methanol (70:20:10 % v/v) was used at a flow rate of 1ml/ min. The diluents was freshly prepared and degassed by sonicating for 5 min before use. The maximum absorbance of Rufinamide was found at 243nm.

Stock solutions
Standard stock solution of 1000ug/ ml of Rufinamide was prepared freshly by accurately weighing 25mg of Rufinamide into 25ml volumetric flask.

The above solution was used for further diluted with mobile phase in 10ml volumetric flask to obtain five working standards in the concentration of 10-50 ug/ ml respectively.

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Fig. 1: Chemical Structure of Rufinamide

Literature survey revealed that numerous methods have been reported for estimation of Rufinamide in pharmaceutical formulations. Present study involves the development of HPLC method using simple mobile phase which is sensitive and rapid for quantification of Rufinamide in tablet dosage forms as well as subsequent validation of developed method according to ICH guide lines. The important features and novelty of the proposed method included sonication of sample at ambient temperature treatment with sonication of small amount of powder sample at ambient temperature.
ug/ ml of Rufinamide. All the solutions were prepared in triplicates. The calibration curve was plotted with the six concentrations of the 10-50 ug/ ml working standard solutions.

Assay of Tablet formulations
The contents of twenty commercial tablets (labeled concentration 400 mg of Rufinamide were weighed and their mean mass was determined. After grinding the tablets into a fine powder in a glass mortar, an accurately weighed quantity of the tablet powder equivalent to 25 mg of Rufinamide was quantitatively transfer into a 25 ml volumetric flask with about 20 ml of phosphate buffer pH 4.0. 1.5 ml aliquot was transferred into a 10 ml volumetric flask. The theoretical Rufinamide concentration after dilution was 30 g/ml (100% of Rufinamide).

Validation procedure
The proposed method validation was demonstrated that the method is suitable for its quality control dosage forms purpose as it is stated in ICH guidelines. Standard plots were constructed with six concentrations in the range of 10 - 50 ug/ ml of Rufinamide prepared in triplicates to test linearity. The peak area of Rufinamide was plotted against the concentration to obtain the calibration graph. Repeatability was calculated from six replicate injections of freshly prepared Rufinamide test solution in the same equipment at a concentration of 100% of the intended test concentration value on the same day. The analyzing Rufinamide at three different levels in pure solutions using three preparations for each level. The results were expressed as the percentage of Rufinamide recovered in the samples.

Results and Discussion
Optimization
Selection of the detection wavelength: The UV spectra of Rufinamide in Acetonitrile: Triethylamine buffer pH4.6: Methanol (70:20:10 v/v) mixtures of phosphate buffer and Acetonitrile in the region between 200 and 400 nm. It shows that at 292 nm, Rufinamide have maximum absorbance. Hence max of Rufinamide in mobile phase was selected as an optimum detection wavelength for the quantification of Rufinamide.

Chromatographic Conditions
Optimized Method Parameters:
Optimized Conditions:
Mobile phase ratio: Acetonitrile: Triethylamine buffer pH4.6: Methanol (70:20:10)
Column: ODS C_{18} (4.6x250 mm) 5µ
Column temp.: 27°C
Wavelength: 243nm
Flow rate: 0.8 ml/min
Injection vol.: 10µl
Run time: 5 minutes

Fig. 2: Rufinamide Optimization of chromatogram

Validation of methods
Range and Linearity: Six point’s calibration graphs were constructed covering a concentration range 10-50 ug/ ml (Three independent determinations were performed at each concentration. Linear relationships between the of peak area signal of Rufinamide & the corresponding drug concentration was observed as shown in Fig. 3. The linearity values was (r²) 0.9999 shown below

Fig. 3: Calibration Graph of Rufinamide

Precision
The validated method was applied for the assay of commercial tablets containing 4 mg of Rufinamide. Sample was analyzed for six times after extracting the drug similar procedure and assay sample preparation of the experimental section for showing that the content of Rufinamide in tablet formulations confirmed to the content requirements (95 - 105%) of the label claim.

For the intermediate precision a study was carried out by the same analyst working on the same day and on three consecutive days (n=3) indicated a R.S.D. of 0.0455 and 0.03995% respectively.

Accuracy
The data for accuracy were expressed in terms of percentage recoveries of Rufinamide in the real samples. (Table 4) The average recovery of Rufinamide in real sample were within the range of 99.60 and
100.05%. Mean % R.S.D. was 0.6069%, satisfying the acceptance criteria for the study.

### Table 1: Accuracy study for Rufinamide (n = 9)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Percentage</th>
<th>% recovery</th>
<th>Mean ± S.D</th>
<th>% RSD</th>
<th>S.E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50%</td>
<td>99.60</td>
<td>99.05±0.6211</td>
<td>0.72</td>
<td>69</td>
</tr>
<tr>
<td>2</td>
<td>100%</td>
<td>100.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>150%</td>
<td>99.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Mean of three observations

### System suitability

All system suitability parameters were represented below Table 2.

### Table 2: Summary for RP-HPLC Method

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Acceptance criteria</th>
<th>Results obtained For Rufinamide</th>
</tr>
</thead>
<tbody>
<tr>
<td>System suitability</td>
<td>Total plates NLT 2000</td>
<td>5342</td>
</tr>
<tr>
<td></td>
<td>Tailing factor NMT 2</td>
<td>1.09</td>
</tr>
<tr>
<td></td>
<td>Retention time</td>
<td>2.41</td>
</tr>
<tr>
<td>Precision</td>
<td>%RSD NLT 2</td>
<td>0.77</td>
</tr>
<tr>
<td>Linearity</td>
<td>Correlation Coefficient</td>
<td>0.9997</td>
</tr>
<tr>
<td>Accuracy</td>
<td>% Recovery</td>
<td>100.34%</td>
</tr>
<tr>
<td>Limit of detection</td>
<td></td>
<td>1.32µg/ml</td>
</tr>
<tr>
<td>LOQ</td>
<td></td>
<td>3.02µg/ml</td>
</tr>
</tbody>
</table>

The proposed method accurate, reproducibility and validation parameters for different parameters and let us to the conclusion that it could be used for the rapid and reliable determination of Rufinamide in tablet formulation.

### Forced Degradation Studies

#### Sample Preparations to Perform Forced Degradation Studies

**Acid degradation:** Accurately weighed 10mg of equivalent weight of Rufinamide sample into a 10ml clean dry volumetric flask and added about 3mL of 0.1N HCl.

Further pipetted 0.3 ml of above stock solution into a 10ml volumetric flask (it contains Rufinamide) and diluted up to the mark with diluent.

**Alkaline degradation**

Accurately weighed 10 mg equivalent weight of Rufinamide sample into a 10mL clean dry volumetric flask and added about 1 mL of 0.1N NaOH.

Further pipetted 0.3ml of above stock solution into a 10ml volumetric flask (it contains Rufinamide) and diluted up to the mark with diluent.

**Peroxide degradation**

Accurately weighed 10 mg equivalent weight of Rufinamide sample into a 10mL clean dry volumetric flask and added about 3mL of Hydrogen peroxide solution and kept side for 3hours and made the volume up to mark by using Diluent and sonicated to dissolve it completely.

Further pipetted 0.3ml of above stock solution into a 10ml volumetric flask (it contains Rufinamide) and diluted up to the mark with diluents Fig. 5.
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**Thermal degradation**

Accurately weighed 10 mg equivalent weight of Rufinamide sample into a 10mL clean dry volumetric flask and exposed to heat at 80-90ºc for 3 hours and then made the volume up to mark by using Diluent and sonicated to dissolve it completely.

Further pipetted 0.3ml of above stock solution into a 10ml volumetric flask (it contains Rufinamide) and diluted up to the mark with diluent. Fig. 6.

**Photolytic degradation**

Accurately weighed 10 mg equivalent weight of Rufinamide sample into a 10mL clean dry volumetric flask and exposed to sunlight for 3 hours and then made the volume up to mark by using Diluent and sonicated to dissolve it completely.

Further pipetted 0.3ml of above stock solution into a 10ml volumetric flask (it contains Rufinamide) and diluted up to the mark with diluent. Fig. 7

**Table 3: Results for degradation studies**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Type of degradation</th>
<th>Concentration of sample (µg/ml)</th>
<th>Area of sample</th>
<th>Assay content (% w/w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acid (0.1N HCl)</td>
<td>30 µg/ml</td>
<td>1206721</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>Base (0.1N NaOH)</td>
<td>30 µg/ml</td>
<td>1214352</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>Peroxide (3% H₂O₂)</td>
<td>30 µg/ml</td>
<td>1145269</td>
<td>94%</td>
</tr>
<tr>
<td>4</td>
<td>Thermal (at 60º c)</td>
<td>30 µg/ml</td>
<td>1195615</td>
<td>99%</td>
</tr>
<tr>
<td>5</td>
<td>Photolytic (sunlight)</td>
<td>30 µg/ml</td>
<td>1185917</td>
<td>98%</td>
</tr>
</tbody>
</table>

**Summary and Conclusion**

RP-HPLC method was developed for estimation of Rufinamide in bulk and Pharmaceutical dosage form. The separation was achieved on ODS C18 (4.6×250mm) 5µ containing the mobile phase mixture of Acetonitrile: Triethylamine buffer pH4.6: Methanol (70:20:10).
Conclusion
The proposed work was specific, accurate, rapid and economical for estimation of Rufinamide in bulk and in its Pharmaceutical dosage form. The sample recoveries in all formulations were in good agreement with their respective Label Claims and the % RSD values were with in 2 and the method was found to be precise. This method can be used for routine determination of Rufinamide in bulk and in Pharmaceutical dosage forms.

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References