DEVELOPMENT AND VALIDATION OF RP-HPLC METHOD FOR ESTIMATION OF LOSARTAN POTASSIUM IN PHARMACEUTICAL DOSAGE FORM

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ABSTRACT
Losartan potassium is the first of a unique class of oral antihypertensive agents referred to as angiotensin II receptor antagonists used to treat high blood pressure (hypertension). It's also used to lower the risk of stroke in some patients with heart disease. A simple, selective, precise, accurate and cost effective reverse phase HPLC method has been developed and validated for estimation of Losartan potassium in extended release tablet dosage form. In the chromatographic conditions, Hypersil ODS C18, 4.6×150 mm, 5 μm stationary phase with mobile phase consisting of Triethylamine solution (0.5%) pH 2.4 and acetonitrile 65:35 (v/v) was used at a flow rate of 1.0 mL/min. and column temperature was maintained at 30°C. Losartan potassium was detected at 225 nm. The chromatographic procedure separated Losartan potassium and potential interfering peaks in an analysis time of 5.0 min. with Losartan potassium eluting at about 2.7 min. The assay method was found linear in the concentration range of 0.05-100 μg/ml with a correlation coefficient of 0.9999. The percentage recovery of assay was found between 100.1 and 101.2. The developed method was validated with respect to specificity, linearity, accuracy, precision, sensitivity, robustness and solution stability as per ICH guidelines. The proposed method can be used for routine analysis of Losartan potassium formulations in quality control laboratories.

KEY WORDS
Losartan, HPLC, Validation, Dissolution, Extended Release

INTRODUCTION:
Losartan potassium, 2-butyl-4-chloro-1-[[2’(1H-tetrazol-5-yl)[1,1’-biphenyl]-4-yl[methyl]-1Himidazol-5-methanol monopotassium salt (Fig. 1), is the first member of a new class of nonpeptide angiotensin II receptor antagonist1,2. It reduces effectively hypertension by suppressing the effects of angiotensin II at its receptors, thereby blocking the renin-angiotensin system3,4. Losartan has been demonstrated to be superior to previous peptide receptor antagonists and angiotensin converting enzyme (ACE) inhibitors because of its enhanced specificity, selectivity, and tolerability5. Currently, losartan potassium is marketed alone or combined with hydrochlorothiazide.

Reverse Phase HPLC:
In this chromatographic technique, the stationary phase is non-polar and the mobile phase is polar, non-polar compounds are retained for longer periods as they have more affinity towards the stationary phase. Hence, polar compounds travel faster and are eluted first.3
Steps involved in development of RP-HPLC method:

Selection of chromatographic method:
The proper selection of methods depends upon the nature of the sample (ionic or ionisable or neutral molecule) its molecular weight and stability. The drug selected is polar and ionic hence reversed phase chromatography was used because of its simplicity and suitability.4

Selection of stationary phase:
Matching the polarity of sample and stationary phase and using a mobile phase of different polarity achieve a successful separation.5

Selection of mobile phase:
Reverse phase bonded packing, when used in conjunction with highly polar solvents; approach is ideal and is a universal system for liquid chromatography. Mobile phase may be either single liquid or combination of liquids, which are compatible with sample, column and instrument.6

Selection of suitable detector:
Detector is the eye of HPLC system that measures the compounds after their separation on the column. There are basically two types of detectors-the bulk property detectors and solute property detectors. Detectors, in order of their popularity are UV, fluorescent, conductivity, polarimeter and refractive index detectors. UV detector is the first choice because of its convenience and applicability in case of most of the samples. The latest versions of equipment's are available with photo diode-array detectors (PAD or DAD).

Method optimization:
During the optimization stage, the initial sets of conditions that have evolved from the first stages of development are improved or maximized in terms of resolution and shape, plate Counts asymmetry, capacity, elution time, detection limits, limit of quantization, and overall ability to quantify the specific analyte of interest.

The literature reports many analytical methods for the quantitation of losartan in tablets using HPLC7–11. These methods employ mobile phases with buffer solutions and the separation of losartan degradants was not achieved with isocratic methods. In the current work we have made an attempt to develop simple, robust, cost effective and high throughput analytical method for the determination of Losartan potassium in tablet dosage form. The method uses UV detection with a run time of 5 min. The method has several advantages like simple mobile phase, low injection volume, less run time over the reported methods. The developed method was successfully validated as per ICH guidelines12–14 and can be used in routine quality control analysis.

MATERIALS AND METHODS

Drug profile of Losartan

![Structure of Losartan](image)

**IUPAC Name:** 2-butyl-4-chloro-1-[[2′(1H-tetrazol-5-yl)]1,1′-biphenyl]-4-yl)methyl]-1Himidazole-5-methanol monopotassium salt

**Chemical formula:** C22H22ClKN6O

**Molecular weight:** 461.007

**Description:** White to pinkish crystals or purplish-tan powder.

**Solubility:** Soluble in water, soluble in organic solvents such as ethanol, DMSO, and dimethyl formamide.

**Category:** Angiotensin II receptor antagonist

**λ** max: 225 nm
Drugs Used:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Drugs</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Losartan potassium</td>
<td>Hetero Drugs Ltd</td>
</tr>
<tr>
<td>2</td>
<td>New formulation ER 50 mg tablets</td>
<td>Unichem Ltd</td>
</tr>
</tbody>
</table>

Reagents Used:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Chemicals</th>
<th>Manufacturer name</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water</td>
<td>Merck</td>
<td>HPLC</td>
</tr>
<tr>
<td>2</td>
<td>Methanol</td>
<td>Merck</td>
<td>HPLC</td>
</tr>
<tr>
<td>3</td>
<td>Acetonitrile</td>
<td>Merck</td>
<td>HPLC</td>
</tr>
<tr>
<td>4</td>
<td>Triethylamine</td>
<td>Merck</td>
<td>HPLC</td>
</tr>
</tbody>
</table>

Equipment and Apparatus Used:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Instrument Name</th>
<th>Model Number</th>
<th>Software</th>
<th>Manufactures Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HPLC</td>
<td>Alliance UV-Visible</td>
<td>Empower</td>
<td>Waters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>detector-2487</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>U.V Double beam</td>
<td>SL 210</td>
<td>-</td>
<td>ELICO</td>
</tr>
<tr>
<td></td>
<td>spectrophotometer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Digital weighing balance</td>
<td>BL-200H</td>
<td>-</td>
<td>SHIMADZU</td>
</tr>
<tr>
<td></td>
<td>(Sensitivity 5 mg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>PH-meter</td>
<td>LI-120</td>
<td>-</td>
<td>ELICO</td>
</tr>
<tr>
<td>5</td>
<td>Sonicator</td>
<td>3305013</td>
<td>-</td>
<td>SISCO</td>
</tr>
</tbody>
</table>

Preparation of mobile phase:

A combination of mobile phase containing Triethylamine solution (0.5%) pH 2.4 and acetonitrile 65:35 (v/v) was mixed and degassed in ultrasonic water for 5 minutes finally filtered through 0.45 μm membrane filter. This prepared solution was used as mobile phase.

Diluent:

Water and acetonitrile in the ratio of 50:50 (v/v) was used as diluent

Preparation of standard solution: (0.05 mg/ml)

Accurately weighed 25 mg of Losartan potassium working standard into a 50 mL volumetric flask, added 25 mL of diluent, mixed to dissolve and made up the volume with diluent. From the standard stock solution, standard solution was prepared to contain, 50 μg/ml of Losartan potassium.

Preparation of sample solution: (0.05 mg/ml)

20 tablets were crushed to powder, weighed and transferred the tablet powder equivalent to 50 mg of Losartan potassium into 250 mL volumetric flask added 70 mL of diluent, sonicated for 10 minutes and diluted to volume with diluent. Filtered the solution through 0.45 μ nylon filter. An aliquot portion of the filtrate was further diluted to get final concentration of 50 μg/ml with diluent.

Wavelength selection:

About 0.25 mg/mL of Losartan potassium solution was accurately prepared by dissolving the active in water. The Losartan solution was scanned in the 200-400 nm UV regions. The wavelength maximum

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(λ<sub>max</sub>) was observed at 225 nm and this wavelength was adopted for absorbance measurement.

**Optimized chromatographic conditions:**

- **Column:** Hypersil ODS C18, 4.6×150 mm, 5 μm
- **Column temperature:** 30°C.
- **Wave length:** 225nm
- **Mobile phase ratio:** Triethylamine solution (0.5%) pH 2.4 and acetonitrile 65:35 (v/v)
- **Flow rate:** 1.0 min/ml
- **Injection volume:** 20 µl
- **Run time:** 5 minutes

**Validation of developed RP-HPLC method:**

As per the International conference on harmonization (ICH) guidelines the method validation parameters such as linearity, precision, accuracy, system suitability, limit of detection and limit of quantitation were optimized.

**Assay**

Sample and standard solutions were into the chromatographic system and measured the area for Losartan and calculated the % assay by using the below formula.

**Calculation:**

\[
\text{Assay} \% = \left( \frac{\text{sample area}}{\text{Standard area}} \times \frac{\text{dilution sample}}{\text{dilution of standard}} \right) \times \frac{P}{100} \times \frac{\text{Avg.wt}}{\text{LC}} \times 100
\]

Where :

- Avg.wt = average weight of tablets
- P = percentage purity of working standard
- LC = label claim of Losartan potassium mg/ml

**RESULTS AND DISCUSSION:**

**Optimized method:**

It was performed on Hypersil ODS C18, 4.6×150 mm, 5 μm with a mobile phase composition of triethylamine solution (0.5%) pH 2.4 and acetonitrile 65:35 (v/v) at a flow rate of 1.0 min/ml. 20µl of sample was injected and the run time was 5 minutes.

![Chromatogram showing blank preparation (mobile phase)](image-url)
Fig. 3: Chromatogram of Losartan potassium standard peak

Linearity:
25, 37.5, 50, 60, 75µg/ml was injected into the chromatographic system and peak area was measured. Plotted a graph of peak area versus concentration (on X-axis concentration and Y-axis peak area) and the correlation coefficient was calculated.

Acceptance criteria:
Correlation coefficient should be not less than 0.999.

Table 4: Showing the results for the linearity

<table>
<thead>
<tr>
<th>Conc. (µg/ml)</th>
<th>RT</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>2.527</td>
<td>1102148</td>
</tr>
<tr>
<td>37.5</td>
<td>2.523</td>
<td>1650299</td>
</tr>
<tr>
<td>50</td>
<td>2.524</td>
<td>2204968</td>
</tr>
<tr>
<td>60</td>
<td>2.522</td>
<td>2753639</td>
</tr>
<tr>
<td>75</td>
<td>2.523</td>
<td>3302058</td>
</tr>
</tbody>
</table>

Coefficient of correlation($R^2$) 0.9999

Precision:
The standard solution (0.05 mg/ml) was injected for five times and measured the area for all five injections in HPLC. The % RSD for the area of five replicate injections was found to be within the specified limits.

Acceptance criteria:
The %RSD for the area of five standard injections results should not be more than 2.

Table 5: Showing the results for Precision

<table>
<thead>
<tr>
<th>S. No</th>
<th>Conc. (µg/ml)</th>
<th>RT</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>2.522</td>
<td>2301563</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>2.553</td>
<td>2301492</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>2.546</td>
<td>2301925</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>2.535</td>
<td>2301636</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>2.545</td>
<td>2301968</td>
</tr>
</tbody>
</table>

Mean 2301717
S.D 216.31
% RSD 0.01
Accuracy:
The standard solution of concentration 25, 50 and 75 µg/ml were injected into chromatographic system. Calculate the amount found and amount added for Losartan calculated the individual % recovery and mean % recovery values.

Acceptance criteria:
The % recovery for each level should be between 98.0 to 102.0%.

Table 6: Showing Accuracy results for Losartan potassium

<table>
<thead>
<tr>
<th>S. No</th>
<th>Conc(µg/ml)</th>
<th>Average area</th>
<th>Amount added (mg)</th>
<th>Amount found (mg)</th>
<th>% Recovery</th>
<th>Mean% recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td>1112116</td>
<td>2.5</td>
<td>2.502</td>
<td>100.1%</td>
<td>100.1%</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>2201546</td>
<td>5</td>
<td>5.06</td>
<td>101.2%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>3209069</td>
<td>7.5</td>
<td>7.506</td>
<td>100.1%</td>
<td></td>
</tr>
</tbody>
</table>

System suitability:
The standard I solution was injected one time and standard II solution was injected 5 times.

Table 7: Showing System Suitability results for Losartan potassium

<table>
<thead>
<tr>
<th>S. No</th>
<th>Flow rate (ml/min)</th>
<th>System suitability results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>USP Plate Count</td>
</tr>
<tr>
<td>1</td>
<td>0.8</td>
<td>7679</td>
</tr>
<tr>
<td>2</td>
<td>1.0</td>
<td>7865</td>
</tr>
<tr>
<td>3</td>
<td>1.2</td>
<td>7969</td>
</tr>
</tbody>
</table>

Limit of detection (LOD)
From the above preparation 1ml of solution is transferred to 10ml of volumetric flask and the volume made with the diluents.

Table. No.8. Showing results for Limit of Detection

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>y-Intercept</th>
<th>Slope(s)</th>
<th>LOD(µg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Losartan</td>
<td>1250</td>
<td>5.49*10³</td>
<td>2.79</td>
</tr>
</tbody>
</table>

Limit of quantitation (LOQ)
From the above preparation 0.5ml of solution is transferred to 10ml of volumetric flask and the volume made with the diluent.

Table. No.9. Showing results for Limit of Quantitation

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>y-Intercept</th>
<th>Slope(s)</th>
<th>LOQ(µg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Losartan potassium</td>
<td>1250</td>
<td>5.49*10³</td>
<td>8.33</td>
</tr>
</tbody>
</table>

Assay:
The developed and validated method was applied to the determination of Losartan in marketed tablets containing 100 mg of drug per tablet. Three injections of sample were injected into chromatographic system. Assay % was calculated by using the formula mentioned above and it was found to be 99.8%.
Table 10: Showing the results of assay

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name</th>
<th>Rt</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Losartan potassium</td>
<td>2.548</td>
<td>2301243</td>
</tr>
<tr>
<td>2</td>
<td>Losartan potassium</td>
<td>2.581</td>
<td>2301792</td>
</tr>
<tr>
<td>3</td>
<td>Losartan potassium</td>
<td>2.024</td>
<td>2309596</td>
</tr>
</tbody>
</table>

Conclusion:
A simple, rapid, accurate and precise RP-HPLC method was developed for the determination of Losartan potassium in pure form and in tablets. The analytical conditions and solvent system developed provided a good separation for Losartan potassium with in a short analysis time. The method was validated and demonstrated a wide linear dynamic range, a good precision and accuracy. Thus, the method can be proposed for routine analysis laboratories and for quality control.

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References:


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