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STABILITY INDICATING RP-UPLC METHOD DEVELOPMENT AND VALIDATION OF EBASTINE & MONTELUKAST IN TABLET DOSAGE FORM

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Abstract
A robust, rapid, and stability-indicating reverse-phase ultra-performance liquid chromatographic (RP-UPLC) method was developed and validated for the simultaneous quantification of Ebastine and Montelukast in tablet dosage forms. Chromatographic separation was achieved on a suitable UPLC column using a gradient/optimized isocratic mobile phase composed of aqueous buffer and organic solvent, delivered at a controlled flow rate. Detection was carried out using a UV/PDA detector at an optimized wavelength, providing well-resolved, symmetrical peaks with short retention times for both analytes. . The developed RP-UPLC method is simple, fast, reliable, and suitable for routine quality control analysis as well as stability testing of combined tablet formulations containing Ebastine and Montelukast.

Keywords:
RP-UPLC, Stability-indicating method, Ebastine, Montelukast, Method validation, Forced degradation, Tablet dosage form, ICH guidelines

Introduction
Allergic disorders such as allergic rhinitis and chronic urticaria are among the most common conditions affecting global populations, often requiring combination therapy for effective symptom control. Ebastine, a second-generation H1-receptor antagonist, is widely prescribed for the relief of allergic symptoms due to its prolonged action and minimal sedative effects. Montelukast, on the other hand, is a selective leukotriene receptor antagonist that inhibits cysteinylleukotrienes, thereby reducing inflammation and bronchoconstriction associated with asthma and allergic rhinitis. The combination of these two drugs offers a synergistic therapeutic effect, improving patient compliance and clinical outcomes. (1)
Reverse-phase ultra-performance liquid chromatography (RP-UPLC) has emerged as a powerful analytical technique due to its high resolution, speed, sensitivity, and reduced solvent consumption compared to conventional HPLC methods.
Such methods are critical for assessing drug stability under various stress conditions and are required during drug development and regulatory approval processes. According to International Council for Harmonisation guidelines, method validation parameters such as accuracy, precision, specificity, linearity, robustness, and sensitivity must be thoroughly evaluated.[2]
Combination therapy has become an important strategy in the management of allergic and respiratory disorders, as it targets multiple pathways involved in disease progression. Ebastine acts by selectively blocking peripheral histamine H1 receptors, thereby reducing symptoms such as sneezing, itching, and rhinorrhea. In contrast, Montelukast inhibits leukotriene-mediated effects, including airway edema, smooth muscle contraction, and inflammation.
Ensuring the quality, safety, and efficacy of such combination products requires precise and reliable analytical techniques.These advantages make RP-UPLC particularly suitable for high-throughput pharmaceutical analysis and routine quality control.[12]

Rationale for Combination Therapy
The combination of Ebastine and Montelukast is clinically justified based on their complementary pharmacological actions in the management of allergic and respiratory disorders. Using these agents together allows for a broader and more effective control of symptoms compared to monotherapy.

Key Justifications:

- **Dual Mechanism of Action:**Ebastine blocks histamine H1 receptors, reducing immediate allergic responses such as sneezing and itching, while Montelukast inhibits leukotriene receptors, controlling inflammation and bronchoconstriction. This dual action targets both early and late phases of allergic reactions.
- **Enhanced Therapeutic Efficacy:**The combination provides superior symptom relief in conditions like allergic rhinitis and asthma-associated allergies by addressing multiple inflammatory mediators simultaneously.[23]
- **Improved Patient Compliance:**Delivering both drugs in a single tablet reduces pill burden, making it easier for patients to adhere to treatment regimens.
- **Synergistic Effect:**The pharmacological actions complement each other, often resulting in improved clinical outcomes without significantly increasing adverse effects.
- **Suitability for Chronic Use:**The combination is generally well tolerated and suitable for long-term management of chronic allergic conditions.

Overall, this combination therapy represents a rational and effective approach for managing complex allergic conditions, thereby justifying the need for a reliable analytical method for its simultaneous estimation in pharmaceutical dosage forms.

Need for Analytical Method Development
The growing use of fixed-dose combinations containing Ebastine and Montelukast necessitates the development of a reliable and efficient analytical method for their simultaneous estimation in tablet dosage forms. Accurate analytical techniques are essential to ensure the quality, safety, and efficacy of pharmaceutical products.

Key Reasons:

- **Simultaneous Estimation of Multiple Components:** Combination formulations require methods capable of quantifying both active pharmaceutical ingredients in a single run without mutual interference.[17]
- **Presence of Excipients and Impurities:** Tablet formulations contain various inactive ingredients that may interfere with analysis, making it necessary to develop a highly selective method.
- **Quality Control Requirements:** Routine analysis in pharmaceutical industries demands methods that are simple, precise, accurate, and suitable for high-throughput testing.
- **Cost and Efficiency Considerations:** Modern analytical methods aim to reduce solvent consumption and analysis time, making the process more economical and environmentally friendly.[19]
- **Support for Stability Studies:** Analytical methods are essential for conducting forced degradation and stability studies to determine shelf life and storage conditions.

Overall, the development of a robust, rapid, and stability-indicating RP-UPLC method is crucial for ensuring the consistent quality and regulatory acceptance of combined tablet formulations containing Ebastine and Montelukast.

Advantages of RP-UPLC Technique
Reverse-phase ultra-performance liquid chromatography (RP-UPLC) has become a preferred analytical technique in pharmaceutical analysis due to its superior performance over conventional HPLC methods. It is particularly useful for the simultaneous estimation of drugs like Ebastine and Montelukast in combined dosage forms.

Key Advantages:

- **High Resolution and Better Separation:** RP-UPLC uses columns packed with very small particle sizes, resulting in sharper peaks and improved separation of analytes, impurities, and degradation products.

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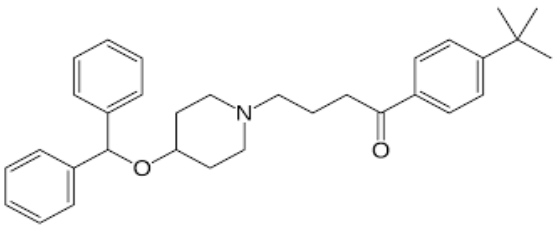
- **Reduced Solvent Consumption:** Lower flow rates and shorter run times lead to minimal use of organic solvents, making the method more cost-effective and environmentally friendly.[37]
- **Better Peak Shape and Symmetry:** Reduced band broadening leads to well-defined, symmetrical peaks, improving quantification accuracy.
- **High Throughput Capability:** Shorter analysis cycles allow multiple samples to be analyzed in less time, which is advantageous for routine quality control laboratories.
- **Reduced Sample Volume Requirement:** Only a small amount of sample is needed for analysis, which is beneficial when dealing with limited or expensive substances.

Overall, RP-UPLC provides a powerful, efficient, and reliable platform for pharmaceutical analysis, making it highly suitable for method development and validation of combined drug formulations.[31]

Drug Profile[1]

I.Chemical Properties:	
Structure	 **Fig. No.3**
CAS Registry No	90729-43-4
IUPAC Name	**4-(4-benzhydryloxy-1-piperidyl)-1-(4-tert-butylphenyl)butan-1-one**
Mole. Formula	C32H39NO2
Molecular Weight	g/mol
II. Physical Properties:	
Melting Point	**80-82°C**
Appearance	Appearance: **White to almost white powder to crystal**; Melting Point: 85 - 89 °C; Warnings: Light sensitive! Storage Temp: Store at 2 - 8 °C.
Solubility	Ebastine is soluble in organic solvents such as ethanol, DMSO, and dimethyl formamide (DMF). The solubility of ebastine in ethanol and DMSO is approximately 2 mg/ml and approximately 25 mg/ml in DMF. Ebastine is a histamine H1 receptor antagonist and prodrug form of carebastine (Item No. 23076).
III. Predicted Properties	
pKa	Acidic pka is6.8 and most basic pka is 8.19

I. Pharmacology

Mechanism of Action:

Ebastine, a piperidine derivative, is a long-acting, nonsedating, second-generation histamine receptor antagonist that binds preferentially to peripheral H1 receptors . It is metabolised to active metabolite, carebastine. It has antihistaminic, antiallergic activity and prevents histamine-induced bronchoconstriction.

II. Pharmacokinetics

A. Absorption: Ebastine is **absorbed rapidly after oral administration**, but undergoes extensive first-pass metabolism to its active metabolite, carebastine

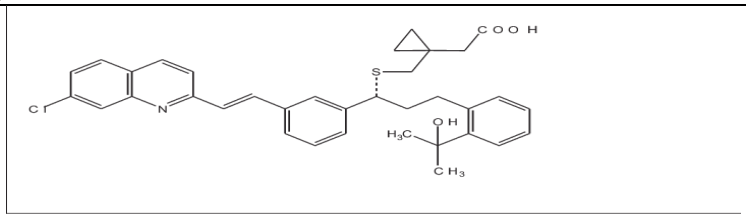
B.Distribution: After a single dose of ebastine 10 mg, the apparent volume of distribution of carebastine was reported to range from 90-143 I which is indicative of extensive distribution throughout the body[22]

C. Metabolism: Ebastine undergoes extensive metabolism to form desalkyebastine and Hydroxyebastine .Hydroxyebastine is subsequently metabolized to carebastine.

III. Pharmacodynamics:

- **Urinary Glucose Excretion and Urinary Volume:** The clearance of ebastine was 4.8 l/h after a single dose of 10 mg (26). Urinary excretion accounts for 66% of the elimination of the administered dosage, principally in the form of conjugated metabolites (31), and the terminal elimination half-life ($t_{1/2;}$) of carebastine is generally 16–25 h (23, 32)

Table No.5: Drug Profile - Montelukast

I. Chemical Properties:	
Structure	 **Fig. no. 4**
CAS Registry No	151767-02-1
IUPAC Name	**(E,Z)-2-(1-((1-(3-(2-(7-Chloroquinolin-2-yl)vinyl)phenyl)-3-(2-(2-hydroxypropan-2yl)phenyl)propylthio)methyl)cyclopropyl)acetic acid**
Mole. Formula	$C_{35}H_{35}ClNO_3S.Na$
Molecular Weight	608,17 g.mol-1
II.Physical Properties:	
Melting Point	**115 °C(dec.)**
Appearance	white to off-white powder.
Solubility	Montelukast (sodium salt) has a solubility of approximately 0.15 mg/ml in a 1:9 solution of ethanol:PBS (pH 7.2) using this method. We do not recommend storing the aqueous solution for more than one day.
III.Predicted Properties	
pKa	The pKa estimation of Montelukast Sodium was done by utilizing UV-Visible spectrophotometric strategy and Partition coefficient was evaluated utilizing HPLC technique. Experimental estimation value of pKa1 of Montelukast Sodium was found to be 3.3 and pKa2 of Montelukast Sodium was found to be 4.4.

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I. Pharmacology

Mechanism of Action: Montelukast causes inhibition of airway cysteinyl leukotriene receptors as demonstrated by the ability to inhibit bronchoconstriction due to inhaled LTD4 in asthmatics. Doses as low as 5 mg cause substantial blockage of LTD4-induced bronchoconstriction.

II. Pharmacokinetics

a. **Absorption:**Montelukast is quickly absorbed following oral administration. After the 10 mg film-coated tablet is administered to fasted adults, the mean peak montelukast plasma concentration (C max) is achieved in 3 to 4 hours (T max).

b. Distribution: Montelukast is approximately 99% bound to plasma proteins. Metabolism: Montelukast is primarily metabolized by the liver. At clinically relevant concentrations, CYP2C8 appears to play a major role in the metabolism of montelukast.[6]

c. Metabolism:Montelukast is extensively metabolized. In studies with therapeutic doses, plasma concentrations of metabolites of montelukast are undetectable at steady state in adults and pediatric patients. The plasma clearance of montelukast averages 45 mL/min in healthy adults.

III. Pharmacodynamics:

- **Urinary Glucose Excretion and Urinary Volume**

Following an oral dose of radiolabeled montelukast, 86% of the radioactivity was recovered in 5-day fecal collections and <0.2% was recovered in urine. Coupled with estimates of montelukast oral bioavailability, this indicates that montelukast and its metabolites are excreted almost exclusively via the bile.[35]

Instruments and Equipment:

For UV method: Absorbance measurements were made on UV-Visible spectrometer Jasco (Japan) V – 730 with band width of 1.5 and 1mm quartz cell was used as sample holder. For weighing electronic balance belonging to Metller Toledo model ME204 was used.

For UPLC method: Electronics Balance of Denver, Ultrasonicator of BVK enterprises, pH meter of BVK enterprises, India. UV-VIS spectrophotometer PG InstrumentsT60 with special bandwidth of 2mm and 10 mm and matched quartz cells integrated with UV win 6 Software was used for measuring absorbances of Ebastine and Montelukast solutions.

IR Studies: The sample received from the company was checked by carrying out IR studies. An IR spectrum of Ebastine and Montelukasat was recorded in KBr pellets on Shimadzu IR Affinity-1. (21)

Materials and Reagents:

Table No.6: Active Pharmaceutical Ingredients supplier

API	Supplier	% Purity
Ebastine	Ajanta Pharma. Pvt. Ltd.	99.96
Montelukast	Ajanta Pharma. Pvt. Ltd.	99.93

Table No.7: List of Chemicals Used for Ebastine&Montelukast

Sr.No.	Chemical/Solvent	Make	Grade
1.	Ultrapure distilled water	Elga water systems distillation plant	HPLC grade
2.	Acetonitrile	AjantaPharma, Pvt.,Ltd	HPLC grade
3.	Methanol	Ajanta Pharma, Pvt.,Ltd	Spectroscopy & HPLC grade
4.	OPA	fortune Pharma, Pvt.,Ltd	HPLC grade
5.	Sodium Hydroxide	Alembic Pharma, Pvt.,Ltd	AR grade
6.	Hydrochloric Acid	Alembic Pharma, Pvt.,Ltd	AR grade
7.	Hydrogen Peroxide (6%)	Qualigens	AR grade

TableNo.8:lists of apparatus/instruments used[11]

Sr. No.	Name of Intsrument	Company	Model
1.	Weighing Balance	Sortorious	BSA224S-CW
2.	Soniactor	PCIanalyticals	NA
3.	HPLC	Agilent	1200 infinity series
4.	UV-Visible spectrophotometer	Jasco	V-630

TableNo.9:Detailsof HPLC instrument

Sr.No.	Partof instrument	Information
1	System	HPLCAgilentgradient system
2	Modelno	HPLC 1200 infinity series
3	Company	Agilenttechnologies,India
4	Pump	P-1200
5	Column	Shim pack C18 (4.6mm x 250mm,Particlesize:5µm)
6	Detector	DAD-1200
7	Software	OpenLab.,DesignExpert.

EXPERIMENTAL METHODS

a. Solubility Studies: These studies were carried out with a view to find an ideal solvent in which the drug was completely soluble and stable. Various solvents were tried for checking solubility of Ebastine and Montelukast. From solubility studies it was concluded that the drug is freely soluble in methanol. So methanol was selected for further analysis. [25]

b. Selection of Analytical Wavelength: Stock solution of drug was prepared in methanol and UV spectrum of 10 µg/ml solution of Ebastine and Montelukast was taken.

IV. Analysis of the In-house tablet formulation: The tablets of Ebastine and Montelukastare purchase by market. The quantity of each ingredient was calculated & weighed for 20 tablets.The absorbance for the drug was measured at 225 nm and concentrations in the samples were determined using UV-visible spectroscopy system under the same conditions using linear regression equation. [27]

RP-UPLC Analysis

Optimization of RP- UPLC method: Initially different single phase mobile phases used such as:

1. **Methanol**
2. **Methanol: Acetonitrile**
3. **Acetonitrile: Methanol**
4. **Acetonitrile: 0.1% OPA (Ortho Phosphoric Acid)**
5. **Methanol: Distilled water 50:50 v/v**
6. **Acetate Buffer: Methanol 50:50 v/v**

Then trials were performed, different concentrations were tried in order to determine the best conditions for the effective separation of Ebastine and Montelukast. The mobile phase consisting of Acetate buffer : Methanol (50:5 0v/v) at with 1 ml/min as flow rate was optimized as it was found to give best system suitability parameters. [28]

Standard solutions and calibration graphs:

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Preparation of Standard Solution: Diluent: Based upon the solubility of the drugs, diluents were selected, Acetate Buffer and Methanol taken in the ratio of 50:50.

Preparation of Standard Stock Solutions: Accurately Weighed and transferred 20 mg of Ebastine and 10 mg of Montelukast working Standards into a 10ml clean dry volumetric flask, add 3/4th volume of diluent, sonicated for 5 minutes and make up to the final volume with diluents. 2.5 ml from the above two stock solutions was taken into a 10ml volumetric flask and made up to 10 ml and the final concentration of Ebastine is 500 µg/mL and 250 µg/mL is of Montelukast.

Preparation of Standard Working Solutions (100% Solution):

1ml from each stock solution was pipetted out, taken into a 10ml volumetric flask, and made up with diluent. (7.5µg/ml Ertugliflozin of and 50µg/ml of Sitagliptin).[13]

Preparation of Sample Stock Solutions: Took 5 tablets weighed accurately and the average weight of each tablet was calculated. One tablet's worth of weight was put into a 10 ml volumetric flask, 5 ml of diluents were added, and the mixture was then sonicated for 25 minutes before being made up with diluent and filtered through HPLC filters (containing 50 g/ml of Ebastine and 1000 g/ml of Montelukast).

Preparation of Sample Working Solutions (100% Solution): 0.5ml of filtered sample stock solution was transferred to 10ml volumetric flask and made up with diluents (7.5µg/ml Optimization of Mobile Phase Strength

Based on drug solubility, stability and suitability of drug in different solvents, various mobile phases and compositions were tried to get a good resolution and sharp peak. The standard solution containing drugs were run in different mobile phases.[12]

Preparation of Mobile Phase A(pH 5.5 Acetate buffer):

Dissolve 3.85g of ammonium acetate in 1000 ml water, add 1 ml of Triethylamine, and adjust pH 5.5 with diluted glacial acetic acid. Mobile phase was filtered through 0.45µm membrane filter and degassed by sonication for 20 min.

A Standard solutions of Ebastine (50µg/mL) and Montelukast (25µg/mL) were injected into the RP-RP-UPLC system and run in different solvent systems. Different mobile phases systems like Acetate buffer and Methanol were initially tried in the isocratic mode in order to determine the bestconditions.

Chromatographic Conditions: The isocratic flow rate of the mobile phase was maintained at 1.0 mL/min and the analysis was carried out at an ambient column temperature at 30°C. The injection volume was 10µl. The eluted sample was monitored at 260 nm, and the run time was 6 min.

Stress degradation studies of bulk drug:

Stress degradation studies were carried under conditions of acid, base, neutral hydrolysis, oxidation and photolysis. For each study, two samples were prepared (Blank and of Ebastine and Montelukast). The blank subjected to stress in the same manner as the drug solution.

Alkaline hydrolysis:

To 1 ml of stock solution **Ebastine and Montelukast**, 1 ml of 2N sodium hydroxide was added and refluxed for 30 min at 60°C. The resultant solution was diluted to obtain 7.5µg/ml & 50µg/ml solution and 10µl were injected into the system and the chromatograms were recorded to assess the stability of sample.

Acidic hydrolysis:

To 1 ml of stock solution Ebastine and Montelukast, 1ml of 2N Hydrochloric acid was added and refluxed for 30min at 60°C. The resultant solution was diluted to obtain 7.5µg/ml & 50µg/ml solution and 10µl solutions were injected into the system and the chromatograms were recorded to assess the stability of sample.[5]

Oxidation:

To 1 ml of stock solution of Ebastine and Montelukast, 1 ml of 20%hydrogen peroxide (H_2O_2) was added separately. At 60°C, the solution was maintained for 30minutes. For UPLC study, the resultant solution was diluted to obtain 7.5µg/ml & 50µg/ml solution and 10µl were injected into the system and the chromatograms were recorded to assess the stability of sample.

Neutral hydrolysis:

Stresstestingunder neutral conditions was studied by refluxingthe drug in water for 6hrs at a temperature of 60º.FortheHPLCstudy,theresultantsolutionwasdiluted to 7.5µg/ml & 50µg/ml solution, and 10µlwere injected into the system. The chromatogramswere recorded to assess the stability of the sample

Photo-degradation studies:

The standard drug solution placed in oven at 105°C for 6h to study dry heat degradation.

The final solution was diluted to 7.5 g/ml and 50g/ml for UPLC research and 10 l were injected into the system. Chromatograms were recorded to determine the sample's stability

Validation of RP-UPLC:

A. Linearity and Range:

Linearity of the method was studied by injecting concentrations of the drug prepared in the mobile phase in the range of 10-90 µg/ml for Ebastine and Montelukast. The peak areas were plotted against the corresponding concentrations to obtain the calibration curves. [27]

B. Precision:

Precision of the method was verified by repeatability and intermediate precision studies.

Repeatability:

The repeatability of sample application and measurement of peak area for active compounds were expressed in terms of % RSD (relative standard deviation). Repeatability studies were performed by analyses of concentration of 10 µg/ml of Ebastine and Maontelukast for RP-UPLC on the same day.

Interday precision:

Intraday precision was determined by analyzing 20, 60, 90 µg/ml concentration of drug three times on the same day with specific time interval. Similarly inter day precision was determined by analyzing 20, 60, 90 µg/ml concentration of drug three times a day on different days.[33]

C. Limit of detection (LOD) and limit of quantitation (LOQ):

The standard deviation of Y-intercept and slope of the calibration curves were used to calculate the LOD and LOQ for the drug using the following formulae.

$$LOD = 3.3*(S)/s$$

$$LOQ = 10*(S)/s$$

Where,

S= Standard Deviation and

s=Slope of the line

D. Robustness:

To evaluate robustness of UPLC method, few parameters were deliberately varied. The parameters included variation of flow rate, wavelength in the mobile phase and pH of mobile phase.

E. Specificity:

Tablet was analyzed to determine the specificity of the optimized method in the presence of impurities and excipients.

F. Accuracy:

For UPLC method recovery studies was carried out by spiking known amount of standard drug corresponding to 80, 100 and 120% w/w of label claim had been added to marketed drug sample (Standard addition method). At each level of the amount six determinations were performed and the results obtained were compared with expected results. (35)

CONCLUSIONS

In present work, Stability indicating RP-UPLC method for the estimation of Ebastine and Montelukast were developed and validated as per ICH guidelines. The standard deviation and % RSD (<2 %) is within limit, indicating high degree of precision of the methods. The results of the recovery studies performed show the high degree of accuracy of the proposed methods. Hence, it can be concluded that the developed methods are simple, accurate and precise, reproducible and economic and hence, can be employed successfully for the estimation of Ebastine and Montelukastsimultaneasly in pharmaceutical formulation.

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References:

1. Rana, N. S., Rajesh, K. S., Patel, N. N., Patel, P. R., Limbachiya, U., & Pasha, T. Y. (2013). Development and validation of an RP-HPLC method for the simultaneous estimation of montelukast sodium and ebastine in tablet dosage form. Indian Journal of Pharmaceutical Sciences, 75(5), 599.PMid:24403662, PMCid:PMC3877523
2. Singh, R. M., Saini, P. K., Mathur, S. C., Singh, G. N., &Lal, B. (2010). Development and validation of an RP-HPLC method for estimation of montelukast sodium in bulk and in tablet dosage form. Indian Journal of Pharmaceutical Sciences, 72(2), 235.https://doi.org/10.4103/0250-474X.65023 ,PMid:20838530 , PMCid:PMC2929785
3. Yadav, O. M., & Jain, H. K. (2014). RP-HPLC Method Development and Validation for Simultaneous Estimation of Phenylephrine Hydrochloride and Ebastine in Tablet Dosage Form. International Journal of Pharmacy and Pharmaceutical Sciences, 6(8), 466-470.
4. Savsani, J. J., Goti, P. P., & Patel, P. B. (2012). Development and validation of simultaneous equation method for estimation of ebastine and montelukast sodium in combined tablet dosage form. Der Pharmacia Sinica, 3(6), 690-698.
5. Shrikrishna, B., &Nisharani, R. (2015). Analytical Method Development and Validation for Simultaneous Estimation of Montelukast and Ebastine by HPLC. Research Journal of Pharmacy and Technology, 8(1), 1. https://doi.org/10.5958/0974-360X.2015.00001.3
6. Singh, K., Bagga, P., Shakya, P., Kumar, A., Khalid, M., Akhtar, J., &Arif, M. (2015). Validated UV Spectroscopic Method for Estimation of Montelukast Sodium. International Journal of Pharmaceutical Sciences and Research, 6(11), 4728-4732.
7. Thakor K. A, Pasha, T. Y., Patel P. U., Chauhan R. J., Patel N. H. (2014). Development and validation of analytical method for simultaneous estimation of ebastine and phenylephrine hydrochloride in tablet dosage form. International Bulletin of Drug Research, 4(7): 16-40, 2014.
8. . ICH Harmonised Tripartite Guideline, validation of analytical procedures: Text methodology, Q2 (R1) (2005). International Conference on Harmonization, Geneva, pp: 1-13.
9. Rohan. S. Wagh*, R.A. Hajare1, Anand Tated1 and Anil V. Chandewar1 Asbsorption correction method and simultaneous equation method for the simultaneous estimation of ebastine and phenylephrine hydrochloride in bulk and in combined tablet dosage form.
10. Love Kumar Soni*, TamannaNarsinghani, CharuSaxena. Development and validation of UVspectrophotometric assay protocol for simultaneous estimation of ebastine and phenylephrine hydrochloride in tablet dosage form using simultaneous equation method.
11. S. L. Prabu,1 C. Dinesh Kumar,2 A. Shirwaikar,* and Annie Shirwaikar2 Determination of Ebastine in Pharmaceutical Formulations by HPLC Fawzia Ibrahim,1 Mohie Khaled Sharaf El- Din,1 Manal Ibrahim Eid,1 and Mary Elias Kamel Wahba1 Validated stability indicating liquid chromatographic determination of ebastine in pharmaceuticals after pre column derivatization: Application to tablets and content uniformity testing Simone G. Cardoso, Felipe K. Hurtado, AlineRavanello, Fibele A. Lanzanova and Clarice M. B. Rolim Development and Validation of a StabilityIndicating LC Method for Determination of Ebastine in Tablet and Syrup Skoog, DA, West DM, Holler FJ, Crouch SR. Fundamentals of Analytical chemistry, 8th ed. United States of America: Thomson Brooks/Cole; 2002.
12. ICH QIA (R2). Stability Testing of New Drug Substances and Products. 2003 8. Snyder LR, Kirkland JJ, Glajch JI. Practical HPLC Method Development. 2nd ed.; 1997.
13. ICH, Q2B.Validation of Analytical Procedure: Methodology. International Conference on Harmonization, IFPMA, Geneva, 2005.
14. Validation of Analytical Procedure: Methodology, ICH Harmonized Tripartite Guidelines. 1996. p. 1-8.
15. Anonymous, In-process Revision. Pharmacopeial Forum; 2010. p. 36.
16. The Merck Index. 14th ed. New Jersey: Merck Research laboratories; 2006. p. 591, 1081.
17. Rang HP, Dale MM, Ritter JN, Moore PK. Pharmacology. 6th ed. Edinburgh, New York: Churchill Livingstone; 2008. p. 361-3.
18. Satoskar RS, Bhandarkar SD. Pharmacology and Pharmacotherapeutics. 20th ed. Mumbai: Popular Prakashan; 2008. p. 357-8.
19. Tripathi KD. Essential of Medical Pharmacology. 6th ed. New Delhi: Jaypee Brothers Ltd.; 2008. p. 222-3.
20. Indian Pharmacopoiea, Vol. 2. New Delhi: Controller of Publication, Govt. of India, Ministry of Health and Family Welfare; 2010. p. 1704-6.
21. British Pharmacopoiea, Vol 1. London: HMSO Publication; 2009. p. 735.
22. Patel DJ, Patel SA, Patel SK. Simultaneous determination of montelukast sodium and bambuterol hydrochloride in tablet dosage form by ultraviolet spectrophotometry (Dual wavelength method). Int J Pharm Biol Res 2010;1:71-5.
23. Pawar V, Pai1 S, Rao GK. Development and validation of UV spectrophotometric method for simultaneous estimation of montelukast sodium and bambuterol hydrochloride in bulk and tablet dosage formulation. Jordan J Pharm Sci 2008;1:152-8.
24. Kamyar P, Zahra MK, Alireza G, Mahmoud RS, Hossein A. Spectrophotometric Determination of CetrizineAndMontelukast In Prepared Formulations. Int J Pharm PharmSci 2011;3:128-30.
25. Chavda RS, Vaghela JP, Patel PB, Shah JS. UV spectrophotometic methods for simultaneous estimation of montelukast sodium and desloratadinein combined tablet dosage form. Inventi Rapid: Pharm Analysis and Quality Assurance; 2012. p. 412-6.
26. Patil S, Pore YV, Kuchekar BS, Mane A, Khire VG. Determination of montelukast sodium and bambuterol hydrochloride in tablets using RP-HPLC. Indian J Pharm Sci 2009;71:58-61.
27. Ravisankar M, Uthirapathy S, Thangadurai A, Dhanapal K. simultaneous estimation of fexofenadine hydrocloride and montelukast sodium in bulk drug and marketed formulation by RP-HPLC method. Int Res J Pharm 2012;3:356-9.
28. Eswarudua MM, Junapudia S, Charya TN. RP-HPLC method development and validation for simultaneous estimation of montelukast sodium and levocetirizinedihydrochloride in tablet dosage form. Int J Pharm World Res 2011;2:1-18.
29. Radhakrishna T, Narasaraju A, Ramakrishna M, Satyanarayana A. Simultaneous determination of montelukast and loratadine by HPLC and derivative spectrophotometric methods. J Pharm Biomed Anal 2003;31:359-68.
30. Kang W, Liu KH, Ryu JY, Shin JG. Simultaneous determination of ebastine and its three metabolites in plasma using liquid chromatography-tandem mass spectrometry. J Chromatogr B AnalytTechnol Biomed Life Sci 2004;813:75-80.
31. Suparna ST, Snehal JM, Atul SR, Ajinkya RN, Lohidasan S, Kakasaheb RM. Method development and validation for the simultaneous determination of fexofenadine hydrochloride and montelukast sodium in drug formulation using normal phase high-performance thin-layer chromatography. Anal Chem 2012, Article ID 924185, 7 pages.
32. Rathore AS, Sathiyanarayanan L, Mahadik KR. Development of validated HPLC and HPTLC methods for simultaneous determination of levocetirizinedihydrochloride and montelukast sodium in bulk drug and pharmaceutical dosage form. Pharm Anal Acta 2010;1:106-11.
33. Rote A, Niphade V. Determination of montelukast sodium and levocetirizinedihydrochloride in combined tablet dosage form by HPTLC and first-derivative spectrophotometry. J LiqChromatogrRelatTechnol 2011;34:155-67.
34. ICH, Q2 (R1): Validation of Analytical Procedures: Text and Methodology, Geneva; 2005.
35. Mahapatra DK, Bharti SK, 2017. Handbook of Research on Medicinal Chemistry: Innovations and Methodologies. 1st ed., New Jersey, Apple Academic Press. pp. 135-136.
36. Mahapatra DK, Bharti SK, 2019. Medicinal Chemistry with Pharmaceutical Product Development. 1st ed., New Jersey, Apple Academic Press. pp. 241-242.
37. Mahapatra DK, Bharti SK, 2016. Drug Design. 1st ed., New Delhi, Tara Publications Private Limited. pp. 81-83.
38. Rana NS, Rajesh KS, Patel NN, et al, 2013. Derivative Spectrophotometric method for simultaneous estimation of Montelukast sodium and Ebastine in bulk and their combined tablet dosage form. Asian J Res Chem. 6(3):232-235.
39. Rana NS, Rajesh KS, Patel NN, et al, 2013. Development and validation of RP-HPLC method for the simultaneous estimation of montelukast sodium and ebastine in tablet dosage form. Indian J Pharm Sci. 75(5):599-602.
40. Sakur AA, Nashed D, Noureldin I, 2021. Novel Pencil Graphite electrode for the Determination of Montelukast sodium in its pure and Pharmaceutical Dosage Forms. Res J Pharm Technol. 14(3):1279-1283.