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Review Article

ANALYTICAL METHODS FOR ESTIMATION OF MEBEVERINE IN PHARMACEUTICAL DOSAGE FORMS – A REVIEW

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ABSTRACT

Mebeverine is an antispasmodic drug that is claimed to act directly on the colonic muscle and is virtually free of systemic adverse reactions. It has been used to treat irritable bowel syndrome, but its therapeutic effect is poor. Mebeverine exhibits the classical property of pH- dependent hydrolysis which is invariably associated with the ester functional group. Thus, neutral solutions of mebeverine are quite stable, but at ambient temperature the drug degrades in either 0.5 M HCL and 0.1 M NaOH. Half-lives of 90 and 0.2 days respectively were measured in these systems. This review highlights different analytical methods such as chromatography, spectroscopy, and hyphenated techniques of Mebeverine hydrochloride. These techniques are either explored for the quantification, detection of metabolite and also for stability-studies of the Mebeverine hydrochloride. The present studies revealed that HPLC techniques along with spectroscopic have been most widely explored for the analysis. The brief review may provide information to the researchers who are working in the area of analytical research of Mebeverine hydrochloride.

Keywords: Mebeverine hydrochloride, Analytical methods, HPLC, HPTLC, LCMS, GCMS, UPLC, TLC, UV-Spectroscopy, Infra-red spectroscopy, NMR Spectroscopy.

INTRODUCTION

AIM

The aim of our review article is to compile all the available information on the analytical determination of Mebeverine hydrochloride in different pharmaceutical dosage forms.

Analytical development

The purpose of analytical development is to establish the identity, purity, physical characteristics, and potency of drugs, including the drug's bioavailability and stability.

Analytical development helps to understand the process of showing that analytical procedures are adequate for the purpose of assessing drugs, and particularly the active pharmaceutical ingredient (API).

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Steps for analytical development:

1. Purpose of Analytical Method Development In the pharmaceutical industry, analytical method development gives important information on the potency of a drug, the drugs' bioavailability, the drugs stability and also its effects. In the very first step, the purpose of conducting any Analytical Method Development is established.
2. Highlighting of Steps In the second step of Analytical Method Development, the steps involved in the development are recorded in a laboratory book.
3. Characterization of the Analyte In this step, both the biological and chemical properties in addition to the physical properties of the analyte is collected. After that, the analyte is obtained and stored according to its specific requirements. The methods for analysis

are then recorded with an example being the chromatography technique which employs different methods such as the High-Performance Liquid Chromatography.

4. Definition of Requirements for the method development of the analysis are done and recorded. All the materials, reagents and instruments are procured those are required for the analysis of the sample.
5. Review of Literature and Previous Methods All literature information related to the specific analyte e.g., a specific drug is assessed for any biological, chemical and chemical properties regarding the analyte. Reference is then made from journals, books and any other publications.
6. Choosing an Analytical Method From the information obtained from the literature during the literature review, a specific methodology is modified to cater for accurate output and also because methods change with the requirements of the analyte. If there are no previous methods in the literature being reviewed regarding the analyte, the procedure goes on uninterrupted.
7. Setting up of Instruments Appropriate instruments for the analytical method development are set up in the laboratory by each of the instruments standard operating procedures. Standard Operating Procedures usually abbreviated as SOP's are a set of instructions or steps to aid in performing a specific procedure in a laboratory set up. They are usual\ly universal and standardized for ease of use in any laboratory set up.
8. Optimization of the Method in carrying out the optimization of the analytical method, parameters is changed individually depending on the arising interests. Optimization of an analytical method is done in reference to a systematic and procedural plan while making sure to critically follow all the documented steps.
9. Analytical Figures of Merit Documentation, Documentation of the analytical figures of merit decided upon is done. These analytical figures of merit include quantification limits, detection limits, analysis time frame, operational costs and sample preparation.
10. Development Method Evaluation the resultant product of analysis should give a desirable result as expected in the identification of the analyte.
11. Sample Estimation, Quantitative Demonstration and Analysis of Samples Estimation of an analyte with an example being a drug in a matrix sample containing the analyte is done here.

Analytical techniques

Analytical technique is a method that is used to determine a chemical or physical property of a chemical substance, chemical element, or mixture. There are a wide variety of techniques used for analysis, from simple weighing to advanced techniques using highly specialized instrumentation.

A. SPECTROSCOPY

- Visible Spectroscopy
- Ultraviolet Spectroscopy
- Fluorimetry
- Nephelometry
- Turbidimetry
- Atomic Absorption Spectroscopy
- Infra-Red Spectroscopy
- NMR Spectroscopy
- ESR Spectroscopy
- Mass Spectroscopy

B. CHROMATOGRAPHY

- Column Chromatography
- Ion-Exchange Chromatography
- Gel-Permeation (Molecular Sieve) Chromatography
- Affinity Chromatography
- Paper Chromatography
- Thin-Layer Chromatography
- Gas Chromatography
- Dye-Ligand Chromatography
- Hydrophobic Interaction Chromatography
- Pseudo-affinity Chromatography
- High-Pressure Liquid Chromatography (HPLC)

C. ELECTROCHEMICAL METHODS OF ANALYSIS

- Potentiometric Electrodes
- Colorimetric Methods
- Voltammetry
- Polarography
- Stripping Voltammetry
- Hydrodynamic Voltammetry
- Amperometry

D. ELECTROPHORETIC METHODS

1. Capillary Electrophoresis (CE)
2. Slab Electrophoresis
3. Gel Electrophoresis
4. Paper Electrophoresis
5. Immuno-electrophoresis
6. Zone Electrophoresis
7. Iso-electric focusing.

DRUG PROFILE

Description

Nomenclature

Chemical Names

✦ (N-Ethyl-N-(4-methoxy-a-methylphenethyl)-N-(4 veratroyloxybutyl) ammonium chloride

✦ 4-[Ethy l (p-methoxy-a-methy lphenethy1)-amino]-butyl; 3,4-dimethoxybenzoate hydrochlorid

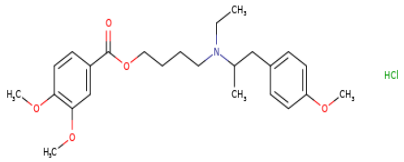
✦ (RS)-4-[Ethyl-4-methoxy-a-methylphenethyl amino] butyl veratrate hydrochloride

Proprietary Names

Colofac, Dusphapasmin, Duspatal, Duspatalin(e)

Molecular Formula: C25H36ClNO5

Structure



Molecular weight: 429.55 (fiee base)
466.0 (hydrochloride salt)

Appearance

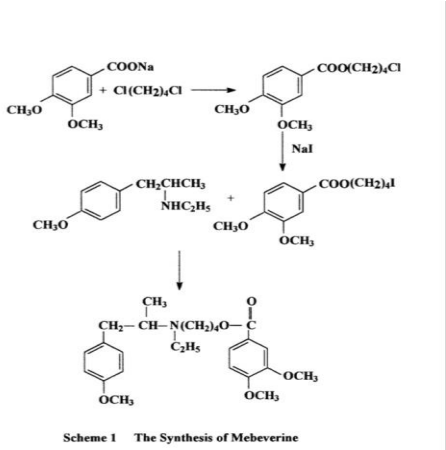
Mebeverine hydrochloride is a white to off-white crystalline powder

Uses and Application

Mebeverine hydrochloride has an antispasmodic action on smooth muscle, and is used in the treatment of abdominal pain and spasm associated with gastrointestinal disorders such as mucous colitis

Methods of preparation

An overview of the synthesis of mebeverine is provided in below. The compound is prepared by reacting sodium 3, 4-dimethoxybenzoate with dichlorobutane to form a chloroester, which is in turn transformed to the corresponding iodide on heating with NaI in methyl ethyl ketone. The alkylation of 2-ethylamino-3-p-methoxyphenylpropane with iodoester leads to mebeverine.



Scheme 1 The Synthesis of Mebeverine

ANALYTICAL DETERMINATION

1. **High Performance Liquid Chromatography (HPLC):**
HPLC is the advanced analytical technique in the pharmaceutical analysis, which is predominantly used in pharmaceutical industries [7-8] for the large variety of samples. It is the method of choice for determining the purity of new drug candidates, monitoring changes or scale-ups of synthetic procedures, evaluating new formulations, and scrutinizing quality control of final drug products.

2. **Ultra-Violet spectroscopy:**
UV-Vis spectroscopy is an analytical technique that measures the amount of discrete wavelengths of UV or visible light that are absorbed by or transmitted through a sample in comparison to a reference or blank sample.

3. **Infra-red Spectroscopy**
Infrared Spectroscopy is the analysis of infrared light interacting with a molecule. This can be analyzed in three ways by measuring absorption, emission and reflection. The main use of this technique is in organic and inorganic chemistry. It is used by chemists to determine functional groups in molecules.

4. **Nuclear Magnetic Resonance Spectroscopy**
Nuclear magnetic resonance (NMR) spectroscopy is the study of molecules by recording the interaction of radiofrequency (Rf) electromagnetic radiations with the nuclei of molecules placed in a strong magnetic field.

5. **Thin-Layer Chromatography (TLC):**
Thin-layer chromatography is a chromatography technique used to separate non-volatile mixtures. Thin-layer chromatography is performed on a sheet of an inert substrate such as glass, plastic, or aluminium foil, which is coated with a thin layer of adsorbent material, usually silica gel, aluminium oxide, or cellulose.

6. **High Performance Thin-Layer Chromatography (HPTLC):**
High performance thin layer chromatography (HPTLC) is a sophisticated instrumental technique based on the full capabilities of thin layer chromatography. The advantages of automation, scanning, full optimization, selective detection principle, minimum sample preparation, hyphenation, etc.

7. **Liquid Chromatography-Mass Spectroscopy (LC-MS):**
Liquid chromatography–mass spectrometry (LC–MS) is an analytical chemistry technique that combines the physical separation capabilities of

liquid chromatography (or HPLC) with the mass analysis capabilities of mass spectrometry (MS).

8. **UltraPerformance Liquid Chromatography (UPLC):**
   Ultra Performance Liquid Chromatography (UPLC) is the newest technology in liquid chromatography based analysis. UPLC is the upgrade high performance liquid chromatography with high pressures, outstanding in both peak resolution and sensitivity.
9. **Gas Chromatography-Mass Spectrometry (GC-MS)**
   Gas chromatography–mass spectrometry (GC-MS) is an analytical method that combines the features of gas-chromatography and mass spectrometry to identify different substances within a test sample.
10. **Paper chromatography**
    Paper chromatography, in analytical chemistry, technique for separating dissolved chemical substances by taking advantage of their different rates of migration across sheets of paper. It is an inexpensive but powerful analytical tool that requires very small quantities of material.

Table 1: High Performance Liquid Chromatography (HPLC):

S.NO.	STATIONERY PHASE	MOBILE PHASE	FLOW RATE AND METHOD OF DETECTION	RESULTS	REFERENCES
1	Bondapak 125 a $C_{18(10\mu m)}$	Acetonitrile - water(1:1) pH :2.9 with phosphoric acid(85%)	1.7ml/min UV At 205nm	Rt-3.9min Accuracy-99.80% to100.13% LOD-500ng/mL LOQ-120 ng/mL	N.Sultana *et al*.[13]
2	column (250mm×4.6mm i.d 10µm particle size)used as a chiralcel OD column	n-hexane,isopr isopropyl alcohol and triethylamine (90:9.9:0.1)v/v/v	1mL/min, UV at 263 nm.	R_t-(11-14mins) LOD:0.05 µg/ml LOQ:0.1µg/ml Runtime:18mins	MA Radwan,HH Abdine *et al*.[14]
3	column, 250mm X 4.6mm,i.d,5µm particle size.Column C_{18}	Acetonitrile and 0.01M dihydrogen phosphate buffer (45:55) PH-4.0	1.0ml/min, Fluorescence - detection at Excitation:300nm Emission: 365nm	R_t-5 min, LOD-0.85µg/ml LOQ-2.57 µg/ml	ML Walash MM KH Sharaf El din *et al* [15]
4	$_{Symmetry}$ C_{185}µm column(4.6mm×150mm)	50mM,KH2Po4,Aceto Acetonitrile Tetrahydrofuran THF(63:35:2) v/v/v	1ml/min, UV at 263nm.	R_t-4.45min, LOD-0.2µg/ml LOQ-1µg/ml	E.Souri *et al*[16]
5	BDS Hypersil phenyl column(4.5mm×250mm , 5µm particle size)	Acetonitrile: 0.1M Potassium dihydrogen phosphate TEA (35:65:0.2)(v/v/v).	1ml/min UV at 260nm	R_t-6.9mins LOD-0.67µg/ml LOQ-2.04µg/ml Accuracy -98.17%	RN El-shaheny,FF Belal *et al*.[17]
6	C_{18} column, (4.6mm X 250 mm, 5µm particle size.)	Methnol and water (90:10) v/v	0.9mL/min UV detection at 265nm.	R_t-3.9min, Accuracy-99.2% LOD-14.6µg/mL LOQ-44.3µg/mL	Akbar Syed *et al*.[18]
7	C_{18}G(250mm×4.6 mm)5µm particle size	Triethyl-ammonium phosphate Buffer, Acetonitrile(60:40)	1.0 ml/min UV detection at 240nm.	R_t-5.8min, Accuracy 98%-102% LOD-91.67µg/ml LOQ-277.81µg/ml	S.Srikanth *et al*.[19]
8	RP cyano column, 5	Acetonitrile and	1.4ml/min	R_t- 6.62min	IA

	µm particle size(250mm×4.6mm)	water-(70:30v/v) PH-7.0	UV detection at 221nm.	LOD:1.117µg/ml LOQ:3.386µg/ml	Naguib,M.AAbdelkawy *et al*.[20]
9	Brownlee sphere-5(octylsilyl) 220×4.6mm i.d,5 µm particle size (Perkin Elmer)	Acetonitrile - 0.05M, disodium hydrogen phosphate - triethylamine (50:50:0.2 v/v/v)	1.5 mL/min UV at 247nm.	R_t-4.70min, LOD-0.36µg/mL.	RS Haggag, RA Shaalan *et al*.[21]
10	RP C12 Column (150 mm × 4.6 mm, 4 µm Particle size)	Methanol : Milli Q water : acetic acid (40:59:1 V/V/V)	1.5 ml/min UV at 263 nm	Rt- 3.8 min LOD:0.05 ng/ml LOQ:0.5 ng/ml Accuracy: 100.23	S.Blagbrough,MS Elmasry *et al*.[22]
11	C_{18}Column (3.9×300mm), 10µm Bondapak column	0.05 M ammonium acetate buffer and Acetonitrile (45% V/V) PH=5.2	1.0 ml/min UVat 263nm.	R_t-8.8 min LOD-5ng/ml LOQ- 5ng/ml	N.H Foda *et al*.[23]
12	X-bridge C_{18}column (150mm×4.6mm i.d 3.5µm particle size.)	Acetonitrile (0.025M): Potassium hydrogen phosphate (1:1) pH -4.3	15mL/min UV at 230nm	R_t-6.7min LOD-0.011µg/mL LOQ-0.035µg/mL	Ehab Emam *et al*.[24]
13	Kineten C_{18}column (150 X 4.6mm,) 5µm particle size.	15mM Ammonium Acetate and methanol (30:70 (v/v))	1.0 mL/min UV at 230nm.	R_t-3.346min LOD-0.005µg/mL LOQ-0.016µg/mL	Marella Vijaya Lakshmi *et al*.[25]
14	C_{18} column (150mm×4.6mm 5µm particlesize.	0.005Mpotassium buffer:1% triethylamine: methanol pH=3	1.0mL/min UV at 260 nm	R_t-7.56 min LOD-0.3µg/mL LOQ-0.90µg/mL.	R.M Youssef *et al*.[26]

Table 2: Ultra-Violet spectroscopy

S. NO.	Detection wavelength	Solvent	Linearity range	LOD LOQ	References
1	246 nm	0.1 N NaOH+ dis.H2O/Ethanol	12.5-200µg/ml	Lod:0.4µg/ml Loq:1.3µg/ml	S Naveed,N Waheed *et al*.[27]
2	263.7 nm	0.1 M HCl	4-40µg/ml	Lod:0.7µg/ml	SIM Zayed *et al*.[28]
3	263 nm	Ethanol(95%)	20-50µg/ml	Lod:0.1µg/ml Loq:0.3µg/ml	M Madhu *et al*.[29]
4	260 nm	Triethyl-ammonium Phosphate	10-40µg/ml	Lod:0.3µg/ml Loq:0.9µg/ml	K.Rajitha *et al*. [30]
5	260 nm	0.1 N HCl	5-15µg/ml	Lod:0.5µg/ml Loq:1.7µg/ml	Parag S.Mahadik *et al*. [31]
6	234.8 nm	Methanol (100µg/ml)	5-81µg/ml	Lod:0.1µg/ml Loq:0.3µg/ml	AA Othman,RI Bagary *et al*. [32]
7	396 nm	Chloroform	2-25µg/ml	Lod:0.2µg/ml	Abdulbari Mahdi,Zainab Abas *et al*. [33]

LOD – Limit of detection.
***LOQ -- Limit of quantification**

Table 3. Infra-red Spectroscopy.

S. NO.	Wavenumber/ Frequency (cm^{-1})	Assignment/ Group	Reference
1	3025-2860 2480-2360 1715 1600,1510,1450 1265-1 130 1020 950-750	Aromatic and aliphatic C-H Stretchings N+-H Stretching C = 0 Stretching C = C Stretchings Asymmetrical C-0-C and C-0 Stretchings Symmetrical C-0-C Stretching A number of bands due to substituted benzene rings	James Swarbrick [34]
2	2550 1266,1715	N+-H Microspheres (1:1:0.5)& Microspheres (2:1:0.5)	S.Omar *et al*. [35]
3	3099-3439 2934 1658,1562 1072 1153	O-H C-H C=O & C= C C- N P- O	JGJ Almukhtar *et al*.[36]

Table 4. Nuclear Magnetic Resonance Spectroscopy

S. NO.	Wavenumber(cm -1)	Group	Reference
1	2945 1717 1265,1221 2119 766 499	CH(aliphatic) C=O(ester) C-O(ether) CN (C-S)symmetry δNCS	MS Elmasry *et al*. [37]

Table 5. Thin-Layer Chromatography (TLC):

S. NO.	Derivatization Agent	Stationery phase Mobile phase Detection method	Retardation factor (R_f)	Reference
1	Shimadzu dual wavelength flying spot scanner model CS-9000	Silica gel GF254 plates Ethanol:diethy ether:triethyl triethylamine (70:30:1 v/v/v) UV at wavelength 262nm	0.45	EI Klalily *et al*.[38]
2	Camag TLC scanner 3 S/N 130319 with wincats software	silica gel 60F254 Hexane:acetone:Trieth Triethylamine (7:3:0.6 v/v/v) A Camag TLC scanner in reflectance-absorbance mode 254 nm	0.61	JA De Shutter *et al*.[39]
3	Camag TLC scanner with wincats software	Silica gel 60F254 Ethyl acetate:methanol(8:4 v/v) Camag TLC scanner at 222 nm	0.26 ± 0.02	Christine Kamal nessim *et al*.[40]

Table 6. High Performance Thin-Layer Chromatography (HPTLC):

S. NO.	Stationery phase Mobile phase	Detection	Results	Reference
1	Silica gel HPTLC F_{254}plates Ethanol:methylene chloride:triethylamine(7:3:0.2 v/v/v)	CAMAG TLC scanner lll at 221 nm	Rf=0.617 ± 0.01 r=0.9994 Lod:0.04 µg/band Loq:0.2µg/band Co-efficient:0.024	IA Naguib,M Abdelkawy *et al*.[41]
2	Silicagel precoated 60 GF_{254}plates Ethyl acetate:methanol(8:4 v/v)	CAMAG TLC scanner lll at 222	Rf=0.26± 0.02 r=0.99995	Christine Kamal nessim *et al*.[40]

		nm		
3	Silica gel plates Chloroform:methnol:ammonia (9.5:0.5:0.1 v/v/v)	CAMAG TLC scanner lll at 220 nm	Rf= 0.72 ± 0.02 Lod:50 ng/spot Loq:200 ng/spot r=0.9995	D Patel *et al*.[41]

***LOD – Limit of Detection, LOQ - Limit of quantification, Rf - Retardation factor**

Table 7. Liquid Chromatography-Mass Spectroscopy (LC-MS):

S. NO.	Internal Standard	Stationary phase, Mobile phase.	Results	Reference
1	Mebeverine	SP:RP column(250×4.6mm,5µm) MP:Acetonitrile:water(85:15 v/v) PH=3.5	Flow rate: 1.2ml/min Lod:0.15µg/ml Loq:0.5µg/ml Linearity:0.52-150µg/ml Accuracy:<98	Sagar Suman panda *et al*. [42]

***LOQ – Limit of Quantitation, MRM – Multiple Ion Monitoring, Ezmos – Esomeprazole.**

Table 8. UltraPerformance Liquid Chromatography (UPLC):

S. NO.	Sample	Description	Detection	Reference
1	Bulk substance and tablet dosage form	Column:(Waters Acquity C_{18}50mm×2.1mm,1.7µ Particle size) Mobile phase:0.1% Orthophosphoric acid & acetonitrile Flow rate:0.40ml/min, Run time:6.5 min	UV detection at 225 nm	V.Srinivasan, H.Sivaramakrishnan *et al*. [43]

*** UV – Ultra – Violet.**

Table 9. Gas Chromatography-Mass Spectrometry (GC-MS)

S. No.	Stationery phase	Carrier gas	Results	Reference
1.	Column was a 25m×0.2mm i.d, fused silica capillary column coated with 0.33µm cross-linked methyl silicone gum	Helium(Alfax,N55) Column head pressure:97kPa	Lod:5ng/ml Scanned range:40-400 amu at 1.5 ms/a.m.u Mass spectra obtained at 70eV	J Kristinsson *et al*.[44]
2.	Column was a HP ultra 2(30m×0.20mm,0.11µm film thickness)	Helium Column head pressure:138 kPa	Lod:0.5ng/ml Loq:2ng/ml Accuracy:10-200 ng/ml Mass spectra obtained at 70eV with SIM at m/z 216.0	Linda J Tulich etal.[45]
3	VF-624 Capillary column (60m×0.32mm,1.80µm)	Helium	Flow rate:2ml/min Linearity range:1.90µg/ml -7.5µg/ml Lod:0.28µg/ml Loq:0.85µg/ml Run time:7.91min SIM at m/z 63.0	Mannem Durga Babu *et al*.[46]
4	Column HP capillary (12m×0.2mm i.d,) cross linked methyl silicone,330nm film thickness	Helium	Flow rate:1ml/min Lod:300 ng/ml Ionization energy 70eV at EI mode	T Kraemer *et al*.[47]

***LOD – Limits of Detection, LOQ – Limit of Quantification, SIM – Selected Ion Monitoring, EI– Electron impact Ionization**

Table 10. Paper chromatography

S.No	Paper	Solvent	Location Reagent	Results	Reference
1	Whatman sheet(14×6mm)	4.8 g citric acid +water:n-butanol(130:870 v/v)	Iodoplatinate spray	Run time:5 hrs Rf:0.77	E.G.C. Clarke *et al*.[48]

***Rf - Retardation factor**

DISCUSSION AND REPORT:

In this review article we have investigated the analytical techniques used in the determination of different pharmaceutical dosage forms Also we discussed about the drug profile of the drug Mebeverine hydrochloride and its analytical methods of determination in different pharmaceutical dosage forms. The main objective of this review is to compile the recent literatures on of Mebeverine hydrochloride on its analytical methods of determination in different pharmaceutical dosage forms.

From the various surveys about the drug Mebeverine hydrochloride on its analytical methods of determination in different pharmaceutical dosage forms.We have concluded that the analytical development plays a vital role in the development of various pharmaceutical dosage forms. Mebeverine hydrochloride the drug used as proton pump inhibitor in the treatment of ulcer patients as an antiulcer agent and is available in limited pharmaceutical dosage forms (i.e. tablets).

As the formulation of Mebeverine hydrochloride in different formulation is still under development, the analytical determination of Mebeverine hydrochloride and its metabolites has taken a keen interest of various scientist and researchers to develop a simple and efficient analytical method for the determination of Mebeverine hydrochloride in pharmaceutical dosage forms. According to our information collected from different articles we came to a conclusion that the chromatographic techniques (HPLC/LC-MS – Both Normal Phase and Reverse Phase) has produced efficient results in the determination of Mebeverine hydrochloride. The HPLC/LC-MS is the most preferably used methods in the determination of Mebeverine hydrochloride as well.

The HPLC/LC-MS method and UV spectroscopy method were developed and validated for the analysis of Mebeverine hydrochloride in pharmaceutical preparations were found to be reliable, simple, fast, true and precise. Statistically compared, the HPLC/LC-MS method is more precise and accurate than the UV method. Because both recommended methods are specific, simple, fast, precise and accurate, they can be successfully applied for routine quality control analysis in pharmaceutical dosage forms of Mebeverine hydrochloride.

The Infra-Red spectroscopy and Nuclear Magnetic Resonance spectroscopy gives details about the bonding between the atoms and its wavenumbers are also discussed. The scientists and research scholars had done efficient work on the Mebeverine hydrochloride.

CONCLUSION:

The present review discussed about different analytical approach employed for the assessment of Mebeverine hydrochloride. Profuse examination have been accomplished including HPLC, TLC, HPTLC, UPLC,UV/Vis-Spectroscopy, Infra-Red spectroscopy, NMR spectroscopy, LC-MS, GC-Msand Paper chromatography for evaluation of Mebeverine hydrochloride in bulk and in its combination with other drugs for pharmaceutical formulations and also biological fluids.

Liquid chromatography with UV detection has been found to be most studied for estimation of Mebeverine hydrochloride in bulk as well as pharmaceutical dosage forms, while hyphenated LC-MS methods reported for determination of Mebeverine hydrochloride and its metabolite in plasma and other biological fluids. Few chromatography approaches like stability indicating HPLC, HPTLC, UPLC, and TLC are also reported. Few simple UV spectrophotometric methods may be used for routine analysis of Mebeverine hydrochloride alone and in combination with other drugs. These compiled data may of use or research for further studies in analysis of Mebeverine hydrochloride.

REFERENCE

1. Dr. S. Ravi Sankar, The text book of pharmaceutical Analysis, 5th Edition, Rx Publications 267 A/3, West Car Street, Tirunelveli – 627 006, India.
2. Rameshwar S. Cheke, Rohan R. Narkhede, Sachin D. sginde, Dr. Vaibav S. Adhao, Instrumental Method Of Analysis, Pee Vee publication.
3. Website: https://www.contractpharma.com/issues/2000 03/view features/formulation-development/
4. Website:https://www.malvernpanalytical.com/en/industries/pharmaceuticals/pharmaceutical-formulation-development/
5. Pre-formulation and product development ; Uttam Kumar Mandal; Chapter • January 2015; Pg.No;2.1-2.19
6. Website:https://www.sofpromed.com/an-introduction-to-analytical-method-development-and-validation-in-early-phase-clinical-trials

7. Website:https://www.pharmaguideline.com/2017/09/steps-for-analytical-method-development.html
8. Website: https://en.wikipedia.org/wiki/Analytical_technique
9. Ozlem Coskun, Separation techniques: Chromatography, North Clin Istanbul; 2016;3(2):156–60
10. Website:https://chem.libretexts.org/Courses/Northeastern_University/11%3AElectrochemical_Methods/11.S%3A_Electrochemical_Methods_(Summary)
11. The Pharmaceuticai Codex, XI ed., The Pharmaceutical Press, London, 1979
12. Analytical profile of drug substance and excipients -volume 25 (Mebeverine hydrochloride)Mahasen A. Radwan', Nagwa H. Foda2, and Omar A. A1 Deeb'
13. A new RP-HPLC method for analysis of mebeverine hydrochloride in raw materials and Table.M Saeed Arayne, Najma Sultana, Farhan Ahmed Siddiqui. Pak J Pharm Sci 18 (2), 11-4, 2005
14. A validated chiral HPLC method for the determination of mebeverine HCl enantiomers in pharmaceutical dosage forms and spiked rat plasma.Mahasen A Radwan, Heba H Abdine, Hassan Y Aboul-Enein.Biomedical chromatography 20 (2), 211-216, 2006
15. Simultaneous determination of sulpiride and mebeverine by HPLC method using fluorescence detection: application to real human plasma.Mohamed I Walash, Mohie M Kh Sharaf El-din, Nahed M El-Enany, Manal I Eid, Shereen M Shalan.Chemistry Central Journal 6 (1), 1-12, 2012
16. A stability indicating HPLC method for determination of mebeverine in the presence of its degradation products and kinetic study of its degradation in oxidative condition.E Souri, A Negahban Aghdami, N Adib.Research in pharmaceutical sciences 9 (3), 199, 2014
17. Simultaneous HPLC determination of chlordiazepoxide and mebeverine HCl in the presence of their degradation products and impurities.Rania N El-Shaheny, Fathalla F Belal.Journal of Chemistry 2015, 2015
18. Development and Validation of Mebeverine Hydrochloride Assay by RP-HPLC Method.Akbar Syed, Shaik Haroon Rasheed, Shaik Afroz, Syeda Wasfiya Noor, Syeda Saniya Fatima, MD Muzaffar-ur-Rehman.International Journal of Pharmaceutical Sciences and Nanotechnology 11 (5), 4239-4243, 2018
19. Support vector regression and artificial neural network models for stability indicating analysis of mebeverine hydrochloride and sulpiride mixtures in pharmaceutical.Ibrahim A Naguib, Hany W Darwish.Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy 86, 515-526, 2012
20. Development and validation of stability indicating HPLC and HPTLC methods for determination of sulpiride and mebeverine hydrochloride in combination.Ibrahim A Naguib, Mohammed Abdelkawy.European journal of medicinal chemistry 45 (9), 3719-3725, 2010
21. Validated HPLC determination of the two fixed dose combinations (chlordiazepoxide hydrochloride and mebeverine hydrochloride; carvedilol and hydrochlorothiazide) in their tablets.Rim S Haggag, Rasha A Shaalan, Tarek S Belal.Journal of AOAC International 93 (4), 1192-1200, 2010
22. Quantitative HPLC analysis of mebeverine, mesalazine, sulphasalazine and dispersible aspirin stored in a Venalink monitored dosage system with co-prescribed medicines.Manal S Elmasry, Ian S Blagbrough, Michael G Rowan, Hanaa M Saleh, Afaf Aboul Kheir, Philip J Rogers.Journal of pharmaceutical and biomedical analysis 54 (4), 646-652, 2011
23. Quantitative analysis of mebeverine in dosage forms by HPLC.O Al-Deeb, BM Al-Hadiya, NH Foda.Chromatographia 44 (7), 427-430, 1997
24. Development and application of a novel, dual-mode gradient, stability-indicating HPLC-DAD method for the simultaneous determination and purity assessment of mebeverine.Mokhtar Mabrouk, Hamed El-Fatatry, Ismail Hewala, Ehab Emam.Journal of pharmaceutical and biomedical analysis 83, 249-259, 2013
25. Core/shell poly (ethylene oxide)/Eudragit fibers for site-specific release.Dong Jia, Yanshan Gao, Gareth R Williams.International journal of pharmaceutics 523 (1), 376-385, 2017
26. Development of gradient HPLC-DAD method for assay of ternary mixture containing amebicide and analgesic drugs.RM Youssef.Acta Chromatographica 26 (1), 67-80, 2014
27. Method development of mebeverine hydrochloride by using UV spectrophotometric method.Safila Naveed, Nimra Waheed, Safeena Nazeer, Hina Rehman.International Journal of Applied Science-Research and Review 2 (1), 001-005, 2015
28. Simultaneous determination of mebeverine hydrochloride and sulpiride using the first derivatives of ratio spectra and chemometric methods.SIM Zayed.Analytical sciences 21 (8), 985-989, 2005
29. Determination of Certain Antispasmodic Drugs As Single Ingredient, Mebeverine Hydrochloride, and in Two Component Mixtures, Mebeverine Hydrochloride–Sulpiride and Isopropamide.Sonia T Hassib, Bahia A Moussa, Hanaa A Hashim, Asmaa A El-Zaher.Spectroscopy letters 35 (1), 43-61, 2002
30. UV spectrophotometric method development and validation for the simultaneous quantitative estimation of mebeverine hydrochloride and chlordiazepoxide in capsules.K Rajitha, N Lakshmi Prasanna, G Vasundhara, R Naveen Kumar, A Ashok Kumar.International journal of pharmacy and pharmaceutical sciences, 345-349, 2014

31. Method development and validation of Mebeverine HCl in bulk drugs by using spectrophotometric method.Parag S Mahadik, GP Senthilkumar.Research Journal of Pharmacy and Technology 9 (9), 1407, 2016
32. Development and Validation of Spectrophotometric Methods for Simultaneous Determination of Mebeverine Hydrochloride and Chlordiazepoxide In Bulk and In Dosage Form.AA Othman, RI Bagary, EF Elkady, MM El-Kerdawy.Pharm Anal Acta 7 (8), 2006
33. Spectrophotometric Determination of Mebeverine hydrochloride in pharmaceutical preparation via Ion Association Reaction.Abdulbari Mahdi, Zainab Abas.Journal of Physics: Conference Series 1032 (1), 012064, 2018
34. Clark's Isolation and Identification of Drugs, 2"d ed., The Pharmaceutical Press, London, 1986, p 720.
35. Colon-specific drug delivery for mebeverine hydrochloride.Samia Omar, Basmah Aldosari, Hanan Refai, Omaimah Al Gohary.Journal of drug targeting 15 (10), 691-700, 2007
36. Preparation characterization and application of Chitosan nanoparticles as drug carrier.Jubran G Jabbar Almukhtar, Faiq F Karam.Journal of Physics: Conference Series 1664 (1), 012071, 2020
37. Conductometric and spectroscopic determination of mebeverine hydrochloride and the solubility products of its ion recognition species.Marwa S Elazazy, Manal S Elmasry, Wafaa S Hassan.Int. J. Electrochem. Sci 7, 9781-9794, 2012
38. Application of first-derivative UV-spectrophotometry, TLC-densitometry and liquid chromatography for the simultaneous determination of mebeverine hydrochloride and sulpiride.Abdel Fattah M El Walily, Alaa El Gindy, Mohamed F Bedair.Journal of pharmaceutical and biomedical analysis 21 (3), 535-548, 1999
39. Reversed-phase high-performance thin-layer chromatography of mebeverine hydrochlordie and related compounds.JA De Schuter, G Van der Weken, W Van den Bossche, P De Moerloose.Journal of Chromatography A 350, 135-144, 1985
40. Comparative study of the resolution efficiency of HPLC and HPTLC-densitometric methods for the analysis of mebeverine hydrochloride and chlordiazepoxide in their binary mixture.Adel Magdy Michael, Yasmin Mohamed Fayez, Christine Kamal Nessim, Hayam Mahmoud Lotfy.European Journal of Chemistry 7 (3), 315-321, 2016
41. Development and validation of spectrophotometric, HPTLC and HPLC methods for the determination of mebeverine hydrochloride and chlordiazepoxide in pharmaceutical dosage forms.Dhara Patel, JK Patel
42. Quantitative estimation of mebeverine hydrochloride in sustained-release dosage form using an analytical lifecycle management oriented stability-indicating LC method.Sagar Suman Panda,Venkata Varaha Ravi Kumar Bera,Padmalaya Sahoo &Biswajit Sahu.Pages 637-644 | Received 28 May 2018, Accepted 10 Jul 2018, Published online: 01 Oct 2018
43. Stress degradation studies on mebeverine hydrochloride and development of a validated stability indicating UPLC method.V Srinivasan, H Sivaramakrishnan, B Karthikeyan, TS Balaji, S Vijayabaskar.Journal of liquid chromatography & related technologies 34 (16), 1631-1644, 2011
44. The metabolism of mebeverine in man: Identification of urinary metabolites by gas chromatography/mass spectrometry.Jakob Kristinsson, Ingibjörg Snorradóttir, Magnüs Jóhannsson.Pharmacology & toxicology 74 (3), 174-180, 1994
45. Determination of two mebeverine metabolites, mebeverine alcohol and desmethylmebeverine alcohol, in human plasma by a dual stable isotope-based gas chromatographic-mass spectrometric method.Author links open overlay panelLinda J.TulichJared L.RandallGary R.KelmKenneth R.Wehmeyer.Procter & Gamble Pharmaceuticals, P.O. Box 538707, Cincinnati, OH 45253, USA
46. Simultaneous determination of 2-chloro methyl propionate, 1,4-di-bromo butane and para anisic aldehyde in mebeverine hydrochloride API by gas chromatography-mass spectrometric with selected-ion-monitoring mode.September 2016Asian Journal of Pharmaceutical and Clinical Research 9:168
47. The antispasmodic drug mebeverine leads to positive amphetamine results by fluorescence polarization immunoassay (FPIA)—studies on the toxicological analysis of urine by FPIA.Thomas Kraemer, Robert Wennig, Hans H Maurer.Journal of analytical toxicology 25 (5), 333-338, 2001
48. E.G.C. Clarke, Methods of Forensic Science, F. Lundquist, ed., Inter-Science Publishers, New York, 1962.

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