

**A REVIEW ON ANALYTICAL METHODS FOR ESTIMATION OF INDAPAMIDE
IN BULK AND PHARMACEUTICAL DOSAGE FORMS**

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Received 28th Sept. 2020; Revised 24th Oct. 2020; Accepted 15th Nov. 2020; Available online 1st Sept. 2021

<https://doi.org/10.31032/IJBPAS/2021/10.9.5617>

ABSTRACT

The main aim of this review is to estimate the Indapamide and its combination of drugs by various analytical techniques. Indapamide, belongs to a class of drugs known as diuretics or "water pills" is used to treat high blood pressure and also used to reduce extra fluid in the body (edema) caused by heart failure which helps in lowering high blood pressure, thus prevents strokes, heart attacks, and kidney problem. In this review article, different analytical techniques like UV Spectrophotometry, chromatographic techniques such as High performance liquid chromatography(HPLC), High performance thin layer chromatography(HPTLC) and hyphenated techniques like Liquid chromatography-Mass spectroscopy, Ultra Performance Liquid Chromatography-Mass Spectroscopy are discussed for the estimation of Indapamide and its combination of drugs by various researches. This review makes clear that the best suitable conditions favoring for the Indapamide estimation.

Keywords: Indapamide, UV- Spectroscopy, HPLC, HPTLC, LC-MS

INTRODUCTION:

Indapamide is a non-thiazide sulphonamide diuretic drug, and mostly utilized in the treatment of hypertension. Chemically Indapamide is 3-(amino sulfonyl)-2methyl-4-imdol-1-yl) benzamide [1]. Indapamide combined with beta blockers, methyldopa and other

antihypertensive reagents are being used commonly. Its molecular formula is reported as $\text{CH}_{16}\text{CN}_3\text{O}_3\text{S}$ and its molecular mass is 365.8 g/mol. It is white to yellow white crystalline powder with odorless property and it is stated to be soluble in ethanol, acetic acid, methanol, ethyl

acetate and very slightly soluble in chloroform [2]. Indapamide controls hypertension by inhibiting reabsorption of sodium (Na^+) and chloride (Cl^-) ions from distal convoluted tubule (DCT) in the kidneys by blocking the Na^+Cl^- symporter similar to other thiazides. Indapamide is available in tablet formulations. The Recommended Dose is Daily 1.25- 2.5mg [3]. This review is to assemble the analytical method published for analysis of Indapamide in Bulk and pharmaceutical formulation.

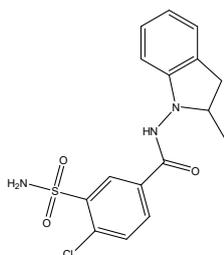


Figure 1: Chemical structure of Indapamide

METHODS FOR INDAPAMIDE

Spectroscopic methods:

Various methods for the estimation of Indapamide in single and in combination with other drugs by UV Spectroscopic methods are enlisted in the **Table 1**.

Chromatographic methods:

Chromatographic methods like HPLC, HPTLC, UPLC were developed for estimation of Indapamide in single and combination with other drugs. Methods for estimation of Indapamide by HPLC and HPTLC are listed in the **Table 2, 3**.

Hyphenation techniques:

Hyphenation technique was developed for estimation of Indapamide. Methods developed for the estimation of Indapamide are enlisted in **Table 4**.

Table 1: Methods for the estimation of Indapamide in single and in combination with other drugs by UV Spectroscopy

S. No.	DRUGS	APPLICATION	DESCRIPTION	REF NO
01	Indapamide	Bulk and pharmaceutical dosage form	Detection wave length: 223nm Solvent: Phosphate buffer 7.4 Linearity range: 5-40µg/ml Correlation coefficient: 0.998	[4]
02	Indapamide	Bulk and pharmaceutical formulation	Detection wave length: 238-248nm Solvent: Methanol Linearity range: 6-16 µg/ml	[5]
03	Indapamide and Telmisartan	Bulk and pharmaceutical dosage form	Detection wave length: Indapamide: 242nm Telmisartan: 230nm Solvent: Methanol Linearity range: Indapamide: 4-14 µg/ml Telmisartan: 4-14 µg/ml LOD&LOQ: Indapamide: 0.31µg/ml &0.93 µg/ml Telmisartan: 0.11µg/ml &0.34 µg/ml	[6]
04	Indapamide	Pharmaceutical dosage form	Detection wave length: First derivative: 252.8nm Second derivative: 264nm Solvent: Methanol Linearity range: First derivative: 1-30 µg/ml Second derivative: 1-35 µg/ml	[7]

05	Indapamide and Amlodipine Besylate	Tablet dosage form	Detection wave length: First derivative: Indapamide: 238nm Amlodipine Besylate: 242nm Solvent: Methanol Linearity range: Indapamide: 2-16 µg/ml Amlodipine Besylate: 10-70 µg/ml R ² : Indapamide: 0.998 Amlodipine Besylate: 0.997	[8]
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Table 2: Methods for the estimation of Indapamide in single and in combination with other drugs by HPLC method

S. No.	DRUGS	APPLICATION	DESCRIPTION	REF NO
06	Indapamide and Amlodipine	Combined tablet dosage form	Detection wavelength: 238nm Column: C-18, ODS bonded column Mobile phase: Methanol: water (90:5)v/v Flow rate : 1.0ml/min Linearity range: Indapamide: 1-7 µg/ml Amlodipine : 2-16µg/ml Retention time: Indapamide: 2.850min Amlodipine : 8.780min	[9]
07	Indapamide And Perindopril	Pharmaceutical formulations	Detection wavelength: 215nm Column: Reverse phase RP-YMC pack ODS A-132 C ₁₈ column Mobile phase: Phosphate buffer pH 2.4 : Acetonitrile (7:3)v/v Flow rate: 1ml/min Linearity range: Indapamide: 10-30µg/ml Perindopril: 10-50µg/ml Retention time: Indapamide: 5.80min Perindopril: 3.20min	[10]
08	Indapamide and Amlodipine	Bulk drug and Tablet dosage form	Detection wavelength: 238nm Column: C-18 Mobile phase: Acetonitrile: Water 70:30v/v Flow rate: 8ml/min Retention time: Indapamide :3.27mins Amlodipine:4.7min	[11]
09	Indapamide	pharmaceutical dosage form	Detection wavelength: 240nm Column: RP C-8 Mobile phase: 0.15% Triethylamine (pH3.5): Acetonitrile 63:37 v/v Linearity range: 10-100ng/ml LOQ:10	[12]
10	Indapamide	Bulk and tablet dosage form	Detection wavelength: 242nm Column: C-18 Mobile phase: Acetonitrile:Methanol:Water 40:50:10 v/v/v Flow rate: 1ml/min Linearity range: 10-60µg/ml Retention time: 3.233min	[13]
11	Indapamide and Atenolol	Pharmaceutical formulations	Detection wavelength: 230nm Column: Waters C-18 Mobile phase: Methanol:Water 80:20 v/v Flow rate: 1ml/min Linearity range: Indapamide: 0.625-7.5 µg/ml Atenolol: 12.5-150µg/ml Retention time: Indapamide: 3.405min Atenolol: 1.766 min	[14]

12	Indapamide, and Amlodipine Besylate	Pharmaceutical formulation	Detection wavelength: 242nm Column: Brownlee C-18 Mobile phase: 0.02M Potassium dihydrogen phosphate(pH 3):methanol 30:70 v/v Retention time: Indapamide: 3.6min Amlodipine Besylate: 5.9 min	[15]
13	Indapamide and Amlodipine Besylate	Tablet dosage form	Detection wavelength: 241 nm Column: Nucleosil C-18 Mobile phase: 0.01M Potassium dihydrogenphosphate(pH 3):Methanol 30:70 v/v Retention time: Indapamide: 3.84min Amlodipine Besylate: 5.96 min	[16]
14	Indapamide and Nebivolol hydrochloride	Tablet dosage form	Detection wavelength: 266nm Column: Kromosil C-18 Mobile phase: Ammonium acetate (pH 4.5):Methanol 45:65 v/v Flow rate: 1ml/min Linearity range: Indapamide: 9-21 µg/ml Nebivolol hydrochloride: 30-70µg/ml Retention time: Indapamide: 2.35min Nebivolol hydrochloride: 3.49min	[17]
15	Indapamide and Atenolol	Tablet dosage form	Detection wavelength: 240nm Column: L1 column Hypersil gold Column temperature: 30°C Mobile phase: 0.1% Triethylamine (pH 3):Methanol 30:770 v/v Flowrate:1ml/min Retention time: Indapamide: 3.93min Atenolol: 3.05 min	[18]
16	Indapamide and Atenolol	Marketed tablet formulation	Detection wavelength: 260nm Column: C-18 Mobile phase: Methanol:Water 60:40 v/v Flowrate:1ml/min Linearity range: Indapamide: 0.225-25 µg/ml Atenolol: 4.5-500µg/ml Retention time: Indapamide: 8.9min Atenolol: 7.5min	[19]

Table 3: Methods for the estimation of Indapamide in combination with other drugs by HPTLC method

S. No.	DRUGS	APPLICATION	DESCRIPTION	REF NO
17	Indapamide and Atenolol	Tablet formulation	Detection of spot: 229nm Column: Aluminium foil plates with silica gel 60F254 Mobile phase: Toulene:Ethyl acetate:Methanol:Ammonia 5:3:3:0.1 v/v/v/v Linearity range: Indapamide : 100-600ng/spot Atenolol: 200-1200ng/spot Retardation Factor: Indapamide : 0.71 Atenolol: 0.27	[20]

18	Indapamide and Olmesartan medosomil	Tablet formulation	Column: Aluminium plates with silica gel 60F254 Mobile phase: Toulene:Chloroform:Methanol 4:1:1 v/v/v Linearity range: Indapamide: 100-600 µg/ml Olmesartan medosomil: 100-700µg/ml Retardation Factor: Indapamide: 0.47 Olmesartan medosomil: 0.15	[21]
19	Indapamide and Amlodipine Besylate	Tablet formulation	Detection of spot: 241nm Column: 60F254 Silica gel on Aluminium sheet Mobile phase: Dichloromethane:Ethanol:Ammonia 8.5:1.5:0.1 v/v/v Correlation coefficient: Indapamide: 0.9977 Amlodipine Besylate: 0.9995 %Recovery: Indapamide : 99.2-102.09 Amlodipine Besylate: 98.49-102.05	[22]
20	Indapamide and Telmisartan	Pharmaceutical solid dosage form	Column: Precoated Silica gel GF 254 Mobile phase: Hexane: Ethyl acetate: Methanol: Glacial acetic acid 14:6:2:1 Linearity range: Telmisartan: 2000-7000ng/spot Indapamide: 75-262.5 ng/spot Retardation factor: Telmisartan: 0.21 Indapamide: 0.36	[23]

Table 4: Methods for the estimation of Indapamide in single and in combination with other drugs by LC-MS (Liquid Chromatography- Mass Spectroscopy) method and UPLC-MS

S. No.	DRUGS	APPLICATION	DESCRIPTION	REF NO
21	Indapamide	Bulk and pharmaceutical dosage form	Column: Stainless C-18 shim pack Ionizer: Electron spray ionizer Flow rate: 0.2ml/min Analyzer: Single quadrupole mass spectrophotometer Concentration Range: 0.5-100ng/ml Coefficient of determination:0.9998	[24]
22	Indapamide	pharmaceutical dosage form	Column: C-18 Ionizer: Electron spray ionizer Mobile phase: 10mM Ammonium acetate:Methanol 22:78 v/v Analyzer: Single quadrupole mass spectrophotometer Concentration Range: 0.1-100ng/ml	[25]
41	Indapamide and Perindopril Arginine	Combined dosage form	Detector: UHPLC-Quadrupole-TOF-MS Column: BEH C-18 Mobile phase: 0.01% Formic acid (pH 4):Acetonitrile 40:60 v/v %RSD: Indapamide:0.63% Perindopril Arginine:0.84%	[26]

CONCLUSION

The review discussed the reported spectroscopic technique like UV Spectroscopy and Chromatographic

techniques like HPLC, HPTLC and hyphenated techniques developed and validated for the estimation of Indapamide in single or in combination with other

pharmaceutical drugs. It was reviewed that out of all these techniques HPLC with UV detection was extensively used with mobile phase such as methanol, potassium dihydrogen phosphate buffer, acetonitrile, ammonium acetate buffer were used for better elution. It was observed that a flow rate of 1.0ml/min was used in all the techniques for better column separations. From spectroscopic technique methods discussed methanol is used as common solvent with correlation coefficient of 0.998. Hence all these methods were simple, precise, accurate, and offers reproducibility with reliability and low in cost even with advanced techniques.

ACKNOWLEDGEMENTS

I am very grateful to Chalapathi Institute of Pharmaceutical Sciences, Lam, Guntur, for providing support, guidance and necessities.

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