A REVIEW ON ANALYTICAL METHODS FOR ESTIMATION OF TELMISARTAN IN PHARMACEUTICALS

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ABSTRACT

The present review focuses on estimation of Telmisartan and its combination of drugs by different analytical techniques. Telmisartan is very effectively used in the treatment of hypertension. It is a potent inhibitor of binding of angiotensin-II to the angiotensin –II AT_1 receptor and blocks the secretory effects of angiotensin-II and thus reduces hypertension. This review discusses the analytical methods such as UV-spectroscopy, High performance liquid chromatography (HPLC), High performance thin layer chromatography (HPTLC) for the estimation of Telmisartan in bulk and pharmaceutical dosage forms in various research publications. This review enlightens the various solvents and conditions suitable for the estimation of Telmisartan and its combination of drugs. The techniques illustrated here may find application in the qualitative and quantitative estimation of Telmisartan and in analyzing other related properties.

Keywords: Telmisartan, Antihypertensive agent, UV- Spectroscopy, HPLC, HPTLC

INTRODUCTION

Hypertension is one of the most common chronic disorders characterized by elevated blood pressures [1]. Telmisartan is an Angiotensin-II receptor antagonist (ARB) used in the treatment of hypertension in single or in combination with other classes of antihypertensives, also used in treating patients with diabetic nephropathy and in cases of congestive heart failure. Telmisartan, an Angiotensin-II receptor blocker bind to the angiotensin-II type 1 receptors with high affinity, leading to the inhibition of the action of angiotensin II on vascular smooth muscle, eventually causing

a reduction in arterial blood pressure **[2]**. Chemically Telmisartan is '2-[4-[[4-methyl-6-(1-methylbenzimidazol-2-yl)-2-propylbenzimidazol-1-yl]methyl]phenyl]benzoic acid. It has a molecular formula of $C_{33}H_{30}N_4O_2$ with molecular weight 514.6g/mol. It has a melting point of 261^0-263^0C. It is insoluble in water and is sparingly soluble in strong acid and soluble in strong base **[3]**. Because of its therapeutical importance, the quantitative estimation of Telmisartan has considerable significance in pharmaceuticals. This article reviews analytical methods are developed for the estimation of Telmisartan in bulk and in combination with other drugs.
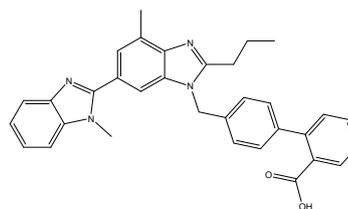

Figure 1: Structure of Telmisartan

METHODS FOR TELMISARTAN

UV Spectrophotometric methods:

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

Chromatographic methods:

Several chromatographic methods like HPLC, HPTLC and UPLC were developed for estimation of Telmisartan in single and combination with other drugs. Methods for estimation of Telmisartan by HPLC and HPTLC are enlisted in the **Table 2, 3**.

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

S. No.	DRUGS	APPLICATION	DESCRIPTION	REF NO
01	Telmisartan	Bulk and pharmaceutical dosage form	Detection wave length: 249nm Solvent: Methanol Linearity range: 5-100 µg/ml Correlation coefficient: 0.999	[4]
02	Telmisartan and Metoprolol succinate	Combined tablet dosage form	Detection wave length: Telmisartan: 296nm Metoprolol succinate: 223nm Solvent: Methanol Linearity range: Telmisartan: 2-16 µg/ml Metoprolol succinate: 3-24 µg/ml	[5]
03	Telmisartan	Bulk and tablet dosage Form	Detection wave length: Zero order : 235nm Solvent: 0.1N NaOH Linearity range: 4-25 µg/ml Correlation coefficient: 0.999	[6]
04	Telmisartan Hydrochlorthiazide and Amlodipine Besylate	Bulk and combined tablet dosage form	Detection wave length: Telmisartan: 296nm Hydrochlorthiazide: 272nm Amlodipine Besylate: 360nm Solvent: Methanol Linearity range: Telmisartan: 2-20mcg/ml Hydrochlorthiazide: 2-12mcg/ml Amlodipine Besylate:	[7]

S. No.	DRUGS	APPLICATION	DESCRIPTION	REF NO
			10-70mcg/ml %RSD: <2	
05	Telmisartan and Amlodipine Besylate	Bulk drugs and formulations	Detection wave length: Telmisartan: 240nm Amlodipine Besylate: 230nm Linearity range: Telmisartan: 0-60 μg/ml Amlodipine Besylate: 0-25 μg/ml Range: Telmisartan: 100.57% Amlodipine Besylate: 100.35%	[8]
06	Telmisartan Hydrochlorthiazide and Amlodipine Besylate	Combined tablet dosage form	Detection wave length: First order derivative: Telmisartan: 252nm Hydrochlorthiazide: 271nm Amlodipine Besylate: 239nm Solvent: Methanol Linearity range: 5-30 μg/ml %RSD: Telmisartan: 0.01292 Hydrochlorthiazide: 0.03163 Amlodipine Besylate: 0.02863	[9]
07	Telmisartan and Metformin hydrochloride	Combined pharmaceutical dosage form	Detection wave length: Telmisartan: 217nm Metformin hydrochloride: 251nm Solvent: Methanol Linearity range: 6-16 μg/ml %RSD: <2	[10]

Table 2: Methods for the estimation of Telmisartan in single and combination with other drugs by HPLC method

S. No.	DRUGS	APPLICATION	DESCRIPTION	REF NO
08	Telmisartan	Bulk and pharmaceutical dosage form	Detection wavelength: 232nm Column: Welchrom C_{18} Mobile phase: Phosphate buffer pH 3.3 : Acetonitrile (50:50)v/v Flow rate: 1.0ml/min	[11]
09	Telmisartan and Metoprolol succinate	Bulk and pharmaceutical dosage form	Detection wavelength: 230nm Column: Reverse phase C_{18} (Phenomenex-RP Aqueous) Mobile phase: 15mM Ammonium acetate pH 6.5: Acetonitrile(58:24)v/v Flow rate: Telmisartan: 5.3 ml/min Metoprolol succinate: 3.9 ml/min Linearity range: Telmisartan: 2-10 μg/ml Metoprolol succinate: 5-25 μg/ml Regression coefficient: 0.9999	[12]
10	Telmisartan Hydrochlorthiazide and Amlodipine Besylate	Bulk and pharmaceutical dosage form	Detection wavelength: 333nm Column: RP-C_{18} Mobile phase: Acetonitrile: Acetate buffer pH 5 (60:40v/v) Flow rate: 1.0ml/min Linearity range: 20-100 μg/ml Retention time: Telmisartan: 7.10min Hydrochlorthiazide: 2.56min Amlodipine Besylate: 3.80 min	[13]
11	Telmisartan and Indapamide	Bulk drug and finished product	Detection wavelength:240 nm Column: Hi Qsil C_{18} Mobile phase: Acetonitrile: 20mM Ammonium acetate buffer(pH 4.5) 60:40v/v Flow rate:1.0ml/min Linearity range: Telmisartan: 0.5-60 μg/ml	[14]

			Indapamide: 0.05-2.2 µg/ml **Retention time:** **Telmisartan: 8min** **Indapamide : 5min**	
12	**Telmisartan and Ramipril**	**Pharmaceutical formulations**	**Detection wavelength: 210nm** **Column: Inertsil ODS C$_{18}$** **Mobile phase: Potassiun dihydrogen phosphate buffer(pH 2.8):Acetonitrile 60:40v/v** **Flow rate: 1.5ml/min** **Linearity range:** **Telmisartan: 2.5-25.5ppm** **Ramipril: 3-7.25ppm** **Retention time:** **Telmisartan: 5.7min** **Ramipril: 10.8mins**	[15]
13	**Telmisartan and Hydrochlorothaizide**	**Pharmaceutical dosage form**	**Detection wavelength: 230nm** **Column: Hypersil BDS C-18** **Mobile phase: Tetrabutyl ammonium hydroxide phosphate buffer(pH 2.26):Acetonitrile 78:22v/v** **Column temperature: 30^{0}C** **Linearity range:** **Telmisartan: 5-200 µg/ml** **Hydrochlorothaizide:1.6-64µg/ml**	[16]
14	**Telmisartan and Pioglitazone**	**Bulk and pharmaceutical dosage form**	**Detection wavelength: 210nm** **Column: Phenomenex C$_8$** **Mobile phase: Acetonitrile: Ammonium dihydrogen phosphate(pH 4.8) 65:35v/v** **Flow rate: 1.0ml/min** **Linearity range:** **Telmisartan: 10-50 µg/ml** **Pioglitazone: 7.5-37.5 µg/ml** **Retention time:** **Telmisartan: 2.38min** **Pioglitazone: 3.16 min**	[17]
15	**Telmisartan and Ramipril**	**Tablet formulation**	**Detection wavelength: 210nm** **Column: Genesis C$_{18}$** **Mobile phase: 0.01M potassium dihydrogen phosphate buffer (pH 3.4) : Methanol: Acetonitrile 15:15:75 v/v** **Flow rate: 1.0ml/min** **Linearity range:** **Telmisartan: 28-52µg/ml** **Ramipril: 3.5-6.5µg/ml** **Retention time:** **Telmisartan: 4.98min** **Ramipril: 3.68min**	[18]
16	**Telmisartan**	**Tablet formulation**	**Detection wavelength: 256nm** **Column: Chromosil C$_{18}$** **Mobile phase: Methanol:0.1% O-phoshoric acid : Acetonitrile 80:0.5:13v/v/v** **Flow rate : 1.5ml/min** **Retention time: 2.7min**	[19]
17	**Telmisartan and Amlodipine Besylate**	**Combined dosage form**	**Detection wavelength: 250nm** **Column: Prontosil-C$_{18}$** **Mobile phase: Methanol: potassium dihydrogen phosphate buffer (pH 4) 75: 25v/v** **Flow rate: 0.7ml/min** **Linearity range:** **Telmisartan: 1-35 µg/ml** **Amlodipine Besylate: 2-16 µg/ml** **Retention time:** **Telmisartan: 8.2min**	[20]

18	Telmisartan	Bulk drug and tablet formulation	**Amlodipine Besylate: 3.5 min**	
18	Telmisartan	Bulk drug and tablet formulation	Detection wavelength: 220nm Column: Symetry C-18 Mobile phase: 10mM Ammonium acetate buffer(pH 4) : Acetonitrile 40:60v/v Flow rate: 1.0ml/min Linearity range: 1-16 µg/ml	[21]
19	Telmisartan and Metoprolol succinate	Bulk drug and formulation	Detection wavelength: 223nm Column: Hi Q Sil C$_{18}$ Mobile phase: Methanol: 10mM potassium dihydrogen phosphate buffer: 10mM Hexane sulphonic acid: 18:10:10v/v/v Flow rate: 1.0ml/min Linearity range: Telmisartan: 5-60 µg/ml Metoprolol succinate: 5-80 µg/ml Retention time: Telmisartan: 5.653min Metoprolol succinate: 3.067 min	[22]
20	Telmisartan and Chlorthalidone	Bulk and tablet formulation	Detection wavelength: 242nm Column: C$_{18}$ Mobile phase: Acetonitrile: Methanol 85:15v/v Flow rate: 1.0ml/min Linearity range: Telmisartan:15-56 µg/ml Chlorthalidone: 5-17.5 µg/ml Retention time: Telmisartan: 3.96min Chlorthalidone: 2.63min	[23]
21	Telmisartan and Atorvastatin calcium	API and tablet dosage form	Detection wavelength: 235 nm Column: Boston ODS C$_{18}$ Mobile phase: Methanol: Acetonitrile: Buffer 35:25:40 Flow rate: 1.0ml/min Retention time: Telmisartan: 3.490min Atorvastatin calcium : 2.350min	[24]
22	Telmisartan and Amlodipine Besylate	Pharmaceutical dosage form	Detection wavelength: 201nm Column: Luna C$_{18}$ Mobile phase: Phosphate buffer(pH 3) : Acetonitrile: 60:40v/v Flow rate: 1.0ml/min Linearity range: Telmisartan: 160-240 µg/ml Amlodipine Besylate: 25-45 µg/ml Retention time: Telmisartan: 4.427min Amlodipine Besylate: 2.643 min	[25]

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

S. No.	DRUGS	APPLICATION	DESCRIPTION	REF NO
23	Telmisartan and Amlodipine Besylate	Tablet dosage form	Column: Aluminium packed silica gel 60F 254 Mobile phase: Ethyl acetate: Methanol: Ammonia: Glacial acetic acid 7.5:1.5:1:0.2v/v/v/v Detection of spot: 226nm Retardation Factor: Telmisartan: 0.60 Amlodipine Besylate : 0.34	[26]
24	Telmisartan and Indapamide	Pharmaceutical dosage form	Column: Precoated Silica gel GF 254 Mobile phase: Hexane: Ethyl acetate: Methanol: Glacial acetic	[27]

			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	

CONCLUSION

This review discussed the reported spectroscopic techniques like UV Spectroscopy and Chromatographic techniques like HPLC, HPTLC methods developed and validated for the estimation of Telmisartan in single and in combination with other pharmaceutical drugs. It can be reviewed that out of all these techniques HPLC with UV detection was extensively with best suitable solvents like acetonitrile, potassium dihydrogen phosphate buffer, methanol, ammonium acetate buffer for better resolution. It was also observed that a flow rate of 1.0ml/min gives best compounds detection. Hence all these methods were simple, precise, accurate, and offers reproducibility with reliability with low in cost in compared with advanced technology.

ACKNOWLEDGEMENTS

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