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ANALYTICAL METHOD DEVELOPMENT AND FORCE DEGRADATION STUDY TO DETERMINE INHERENT STABILITY BY RP-HPLC METHOD FOR THE RELATED SUBSTANCES OF LERCANIDIPINE HYDROCHLORIDE IN LERCANIDIPINE HYDROCHLORIDE TABLETS 10MG

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ABSTRACT

A simple, accurate, selective, specific and stability indicating method was developed by RP-HPLC method for estimation of related substance Lercanidipine Hydrochloride in Lercanidipine Hydrochloride Tablet. A gradient RP-HPLC method was developed and force degradation study performed on C-8 Column, Water symmetry C8, 250 X 4.6mm, 5 µ or equivalent, using Sodium Perchlorate Monohydrate with pH 4.0 with Acetonitrile in the ration of 50:50 v/v as mobile phase. The flow rate was adjusted to 1.5 ml/min, column oven temperature 30°C and the detection wavelength was 220 nm with 70 minutes run time (for sample solution, system suitability solution, diluent, placebo Solution), 30 minutes (For diluted standard). The retention time for Lercanidipine Hydrochloride was found to be 20 minutes. Proposed method was validated for specificity and force degradation study. This validation study is intended to show that the method is stability indicating and is suitable to determine inherent stability of drug for Lercanidipine Hydrochloride in Lercanidipine Hydrochloride Tablets of 10 mg and 20mg dosage strengths.

KEYWORDS: Lercanidipine Hydrochloride, Impurities, RP- HPLC, Stability indicating, Force Degradation.

INTRODUCTION

Lercanidipine hydrochloride is yellow powder and soluble in methanol, practically insoluble in water. Lercanidipine hydrochloride Melting range is Between 165.0°C and 180.0°C. Lercanidipine Hydrochloride has the structural formula shown below.

Structure Formula

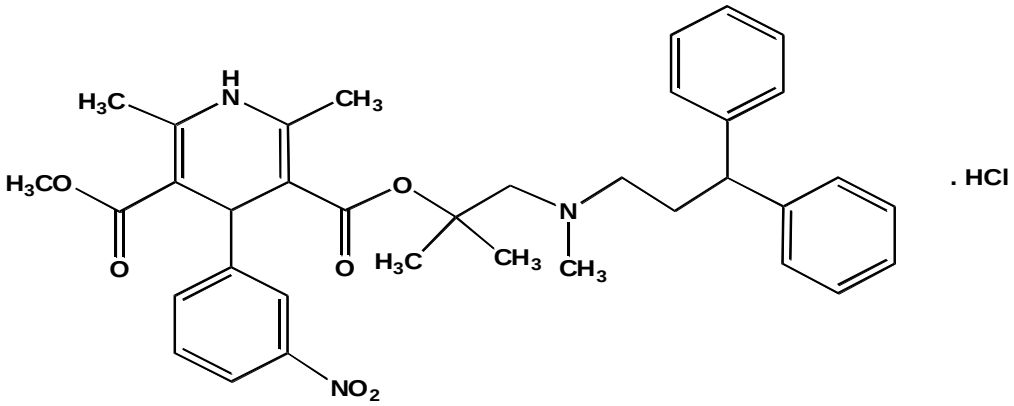


Figure. 1.

Chemical Name: 1,4-Dihydro-2,6-dimethyl-4-(3-nitrophenyl)-3,5-pyridinedicarboxylic acid-2-[(3,3- diphenylpropyl)-methylamino]-1,1-dimethylethyl methyl ester hydrochloride; (±)-1,4- Dihydro- 2,6-dimethyl-4-(3-nitropheny l)pyridine- 3,5 -dicarboxylic acid- 2 - [N (3,3-diphenylpropyl)-N–ethylamino]-1, 1-dimethylethyl methyl diester hydrochloride

Molecular Formula: $C_{36}H_{41}N_3O_6$. HCl

CAS No. : [132866-11-6]

Molecular Weight : 648.19

Lercanidipine Hydrochloride is an active ingredient of Lercanidipine Hydrochloride Tablets for oral administration. Each Tablets contains 10mg or 20mg of Lercanidipine Hydrochloride. An HPLC method for determination of related substance for Lercanidipine Hydrochloride in Lercanidipine Hydrochloride Tablets has been developed and being force degradation study for routine use and testing the stability samples. Since the excipients used are proportionally same in all strengths and chromatographic conditions are same for all strengths of Tablets, the complete force degradation was carried out for Lercanidipine Hydrochloride Tablets 10mg. This paper describes the experiments performed for force degradation study on the related substance method for Lercanidipine Hydrochloride in Lercanidipine Hydrochloride Tablets.

Chemical Name of Impurities

Impurity A: Methyl propyl-2, 6-dimethyl-4-(3-nitro phenyl)-1,4-dihydropyridine 3,5-dicarboxylate.

Impurity B: Dipropyl 1, 4-dihydro-2,6-dimethyl-4-(3-nitrophenyl)-3,5-pyridine dicarboxylate.

Impurity C: 1, 4-Dihydro-2,6-dimethyl-4-(3-nitrophenyl)pyridine-3, 5-dicarboxylic acid 2-[N-3, 3- Diphenyl propyl)-N-methylamino]-1, 1-dimethyl ethyl propyl diester.

Impurity D: 2, 6-Dimethyl-4-{3-nitrophenyl}-pyridine-3, 5-dicarboylic acid 3-{2-[([3,3-dipheyl Propyl) methyl amino}-1, 1-dimethyl ethyl} ester 5-methyl ester.

MATERIALS AND METHODS

A-1 Reagents and Chemicals

Sodium perchlorate monohydrate (Merck Grade)

Perchloric acid (70%) (Merck Grade)

Acetonitrile (HPLC grade)

Hydrogen Peroxide (AR grade)

Sodium Hydroxide (GR grade)

Concentrated Hydrochloric Acid (AR grade)

Water (Milli Q grade)

A-2 Standards: Lercanidipine Hydrochloride working standard, Impurity A, B, C, D working standard.

A-3 Preparation of dilute Perchloric acid: Dilute 3 ml of Perchloric acid to 100 ml with purified water.

A-4 Preparation of Buffers: Weigh and transfer accurately about 21.07 g. of Sodium Perchlorate Monohydrate in 1000ml of water and mix. Adjust the pH to 4.0±0.05 with dilute per chloric acid.

A-5 Preparation of Mobile Phase: Prepare a mixture of Buffer and Acetonitrile in the ratio 50:50 v/v.

A-6 Diluent: Use mobile phase as the diluent.

A-7 Preparation of System suitability solution

Impurity D stock solution-100ppm: Weigh accurately about 2.0mg of impurity D into a 20 ml volumetric flask add 10 ml of acetonitrile sonicate to dissolve and make up to volume with acetonitrile.

Weigh accurately about 100.0 mg of Lercanidipine HCl working standard into a 100ml volumetric flask add 50.0ml mobile phase sonicate to dissolve add 5ml of impurity D stock solution and make It up to the mark with diluent.

A-8 Chromatographic Conditions

Column	: Water symmetry C8, 250 X 4.6mm, 5 µ or equivalent.
Flow Rate	: 1.5 ml/minute.
Detection	: uv220nm.
Injection volume	: 20 µl.
Column oven	: Ambient.
Run Time	: 70 minutes (For sample solution, system suitability solution, diluent, placebo Solution) 30 minutes (For diluted standard).
Retention Time	: About 20 minutes for main peak.

A-9 Preparation of Standard Stock Solutions

Weigh accurately 50 mg of Lercanidipine Hydrochloride working standard into 50 ml volumetric flask. Add 25ml of diluent, sonicate to dissolve and makeup to the mark with diluent Pipette 1 ml of this solution to 100 ml volumetric flask and make up to the mark with diluent. Further dilute 5 ml of this solution to 50 ml with diluent.

A-10 Preparation of Sample Solution (for 10mg Tablets)

Accurately Weigh and transfer tablet powder equivalent to 100 mg of Lercanidipine HCL (Tablet powder approximately 1020 mg) into 100 ml volumetric flask. Add about 50 ml of diluent and sonicate for about 20 min with intermediate shaking at room temperature. Dilute up to the mark with diluent. Filter through 0.45µ Nylon filter.

A-11 Procedure

Separately inject equal volumes of Blank, system suitability solution, placebo and six replicates of diluted standard and single injection of sample preparation. Disregard peaks due to blank, placebo and below % LOQ**.**

Table-1: Table for Relative Retention Time (RRT), Response Factor (RF) and Limit of Quantification (LOQ).

Name	RRT	%LOQ	RF
Impurity A	0.80	0.01	0.94
Impurity D	0.90	0.01	0.92
Lercanidipine Hydrochloride	1.00	0.01	1.00
Impurity B	1.58	0.01	0.99
Impurity C	1.82	0.01	1.01

A-13 Evaluation of System Suitability

The resolution between impurity D and Lercanidipine peak should not be less than 1.5 in the chromatogram obtained with system suitability solution. The Tailing factor for Lercanidipine peak obtained in the diluted standard solution should not be more than 2.0. The relative standard deviation determined from the diluted standard for six replicates should not be more than 5.0%.

Stability indicating data

1. Specificity

1.1 Selectivity

Experiment: A representative of Lercanidipine Hydrochloride standard solution, known impurities (Impurity A, Impurity B, Impurity C and Impurity D), and sample solution of Lercanidipine Hydrochloride Tablets were prepared as per the methodology and chromatographed the solutions along with blank/diluent and placebo using the chromatographic system described in the methodology and a photodiode array detector.

Table. 2: Selectivity Data for Lercanidipine Hydrochloride.

Sr. No.	Name	Retention Time	Purity Angle	Purity Threshold	Purity Criteria
1.	Lercanidipine Hydrochloride in standard solution	20.354	7.713	10.462	Pass
2.	Impurity-A in Identification solution	15.834	0.234	1.261	Pass
3.	Impurity-B in Identification solution	31.912	0.269	1.323	Pass
4.	Impurity-C in Identification solution	40.344	0.668	1.829	Pass
5.	Impurity-D in Identification solution	18.661	4.459	14.040	Pass
6.	Lercanidipine Hydrochloride in Spike sample	19.980	0.033	1.161	Pass
7.	Impurity-A in Spiked sample	15.236	1.363	10.364	Pass
8.	Impurity-B in Spiked sample	30.528	2.978	19.104	Pass
9.	Impurity-C in Spiked sample	37.672	2.851	22.233	Pass
10.	Impurity-D in Spiked solution	17.958	5.153	39.453	Pass

Lercanidipine Hydrochloride.

1.2 Placebo Interference

Experiment: Diluent (Blank), placebo, standard and sample solutions were chromatographed as per methodology and evaluated for any placebo interference.

1.3 Forced Degradation Studies

1.3.1 Acid Degradation (2 M HCl)

Procedure: Accurately Weighed and transferred tablet powder equivalent to 100 mg of Lercanidipine HCl into 100ml volumetric flask. Added about 25ml of diluent and sonicated for about 20 min with intermediate shaking at room temperature. Added 5mL of 2M HCl solution, heated the content to 70°C for 60 minutes and then cooled the content. Neutralized the content by adding 5 mL of 2M NaOH solution. Diluted up to the mark with diluent. Filtered through 0.45 µ Nylon filter.

1.3.2 Base Degradation (2 M NaOH)

Procedure: Accurately Weighed and transferred tablet powder equivalent to 100 mg of Lercanidipine HCl into 100ml volumetric flask. Added about 25ml of diluent and sonicated for about 20 min with intermediate shaking at room temperature. Added 3mL of 2M NaOH solution, heated the content to 70°C for 20 minutes and then cooled the content. Neutralized the content by adding 3mL of 2M HCl solution. Diluted up to the mark with diluent. Filtered through 0.45µ Nylon filter.

1.3.3 Peroxide Degradation (50 %v/v H_2O_2)

Procedure: Accurately Weighed and transferred tablet powder equivalent to 100 mg of Lercanidipine HCl into 100ml volumetric flask. Added about 25ml of diluent and sonicate for about 20 min with intermediate shaking at room temperature. Added 2mL of 50 %v/v H_2O_2 solution heated the content to 70°C for 20 minutes and then cooled the content. Diluted up to the mark with diluent. Filtered through 0.45µ Nylon filter.

1.3.4 Thermal Degradation (60°C/12 hrs.)

Procedure: Sample exposed at 60°C for 12 hours were analyzed as per Methodology.

1.3.5 Photolytic Degradation (1.2 million Lux hours)

Procedure: Sample exposed at 1.2 million Lux hours were analyzed as per methodology.

1.3.6 Humidity Degradation (25°C/92% for 12 hrs.)

Procedure: Sample exposed at 25°C/92%RH humidity condition for at least 12 hours were analyze as per methodology.

Note: Simultaneously placebo were subjected to above stress conditions and chromatographed along with samples.

RESULT AND DISCUSSION

Table. 2: Forced Degradation Studies for Lercanidipine Hydrochloride.

Sr. No.	Name	Condition	RT	Purity Angle	Purity Threshold	Purity Criteria	% Degradation
1	Acid degradation	2.0 M HCl- 70°C/60 min.	21.838	0.035	1.210	Pass	No degradation
2	Base degradation	2.0 M NaOH- 70°C/20 min.	21.873	0.052	8.416	Pass	5.648
3	Peroxide degradation	50 % H_2O_2- 70°C /20 min.	22.014	0.028	1.972	Pass	11.187
4	Thermal degradation	60°C for 12hours	21.976	0.034	1.174	Pass	No degradation
5	Photolytic degradation	1.2 million Lux hours	20.048	0.746	1.359	Pass	4.896
6	Humidity degradation	25°C / 92% RH for 12 hours	21.929	0.040	1.201	Pass	No degradation

Retention time of Lercanidipine Hydrochloride peak and Known impurities in sample preparation is comparable with respect to retention time of standard preparation. Peak purity passes for Lercanidipine Hydrochloride peak in both standard and sample preparation. Therefore, the HPLC method for the determination of related substances for Lercanidipine Hydrochloride in Lercanidipine Hydrochloride Tablets is selective. No interference was observed at the retention time of Lercanidipine Hydrochloride peak and Known impurities. Therefore, the HPLC method for the determination of related substances for Lercanidipine Hydrochloride in Lercanidipine Hydrochloride Tablets is selective and specific. The peak purity data of Lercanidipine Hydrochloride peak at every degradation sample shows that the Lercanidipine Hydrochloride peak is homogeneous and there were no co-elution peaks indicating that the method is stability indicating showing inherent stability of drug and specific.

Chromatograms

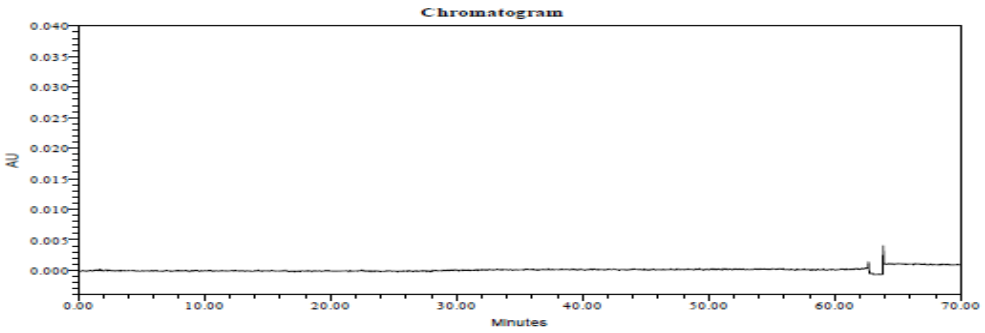


Figure. 2: (Diluent).

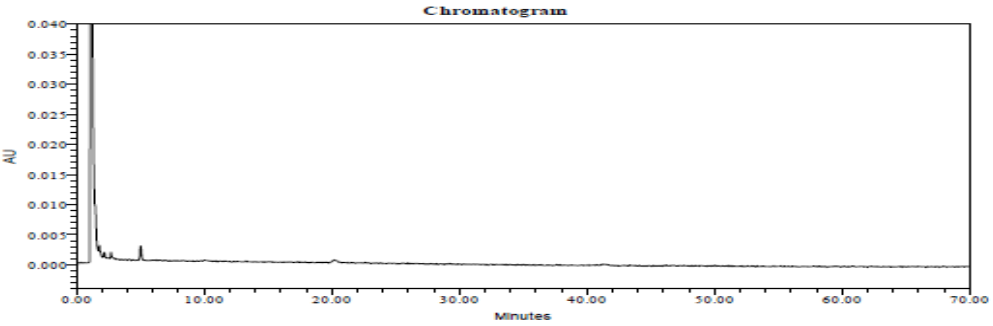


Figure. 3: (Control Placebo).

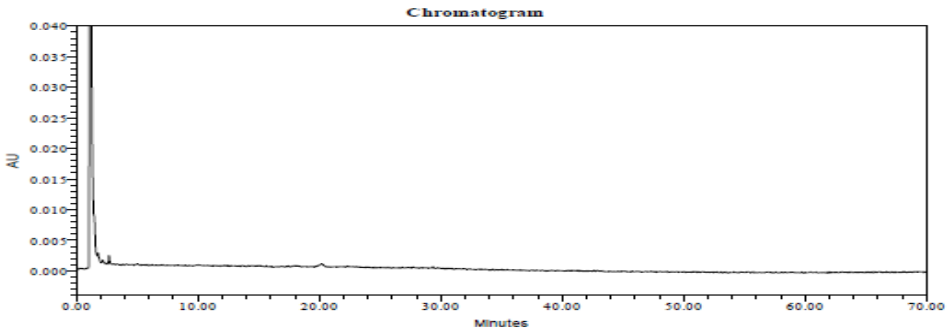


Figure. 4: (Photo Degradation Placebo).

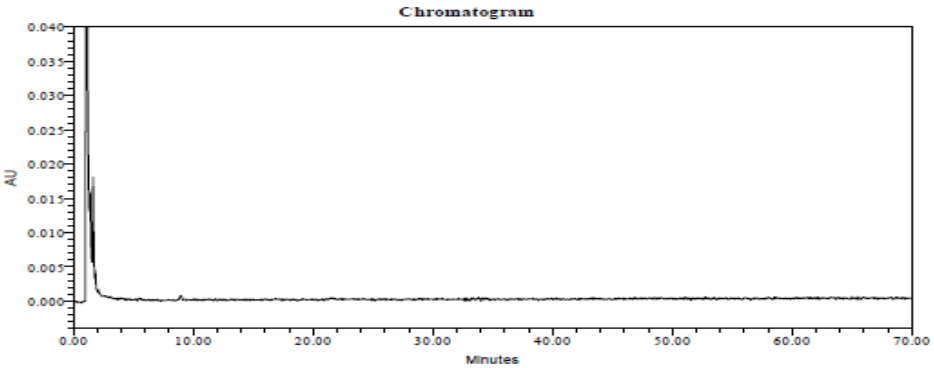


Figure. 5: (Acid Degradation Placebo).

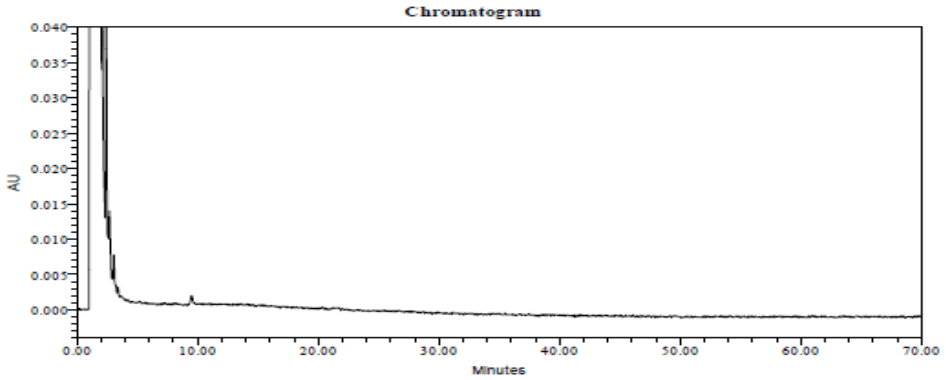


Figure. 5: (Base Degradation Placebo).

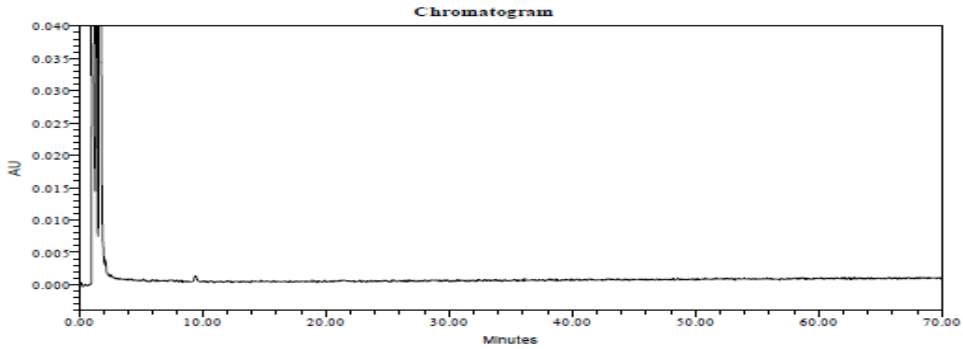


Figure. 6: (Peroxide Degradation Placebo).

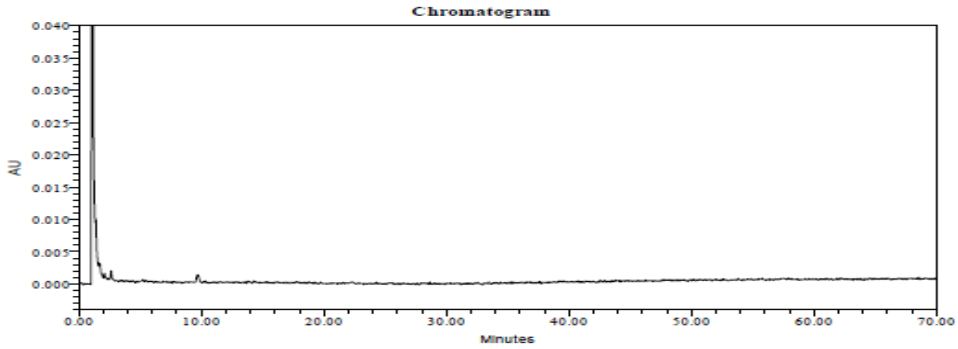


Figure. 7: (Thermal Degradation Placebo).

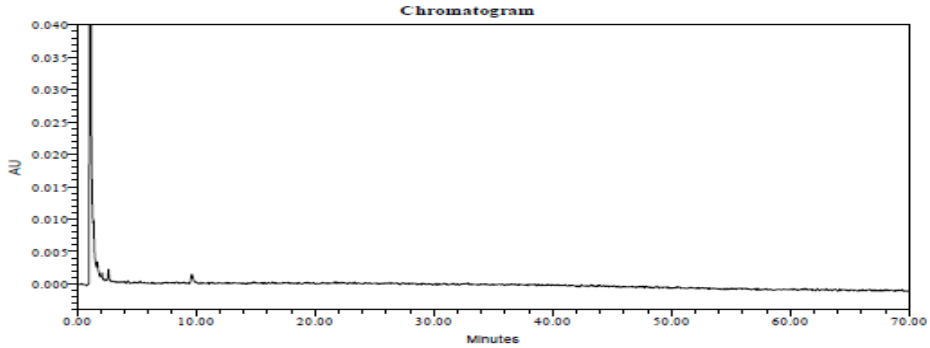
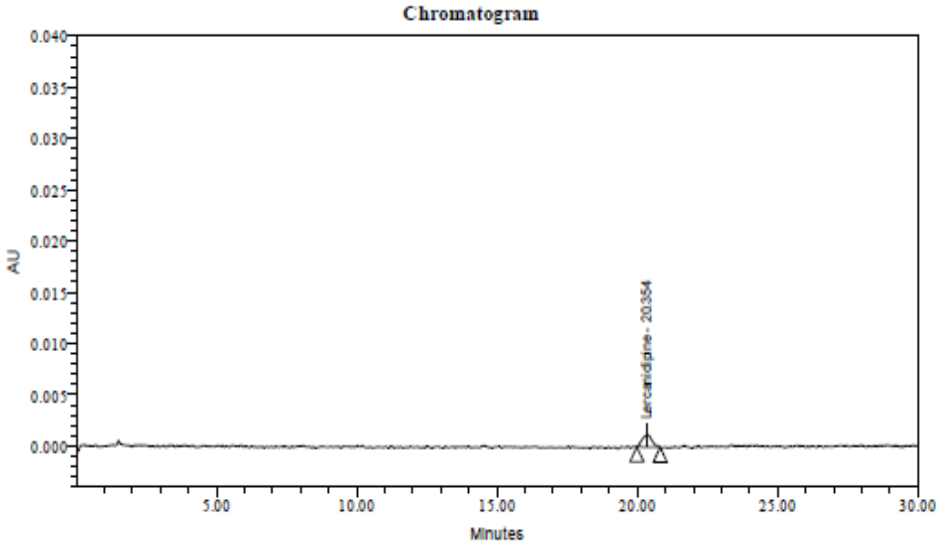


Figure. 8: (Humidity Degradation Placebo).



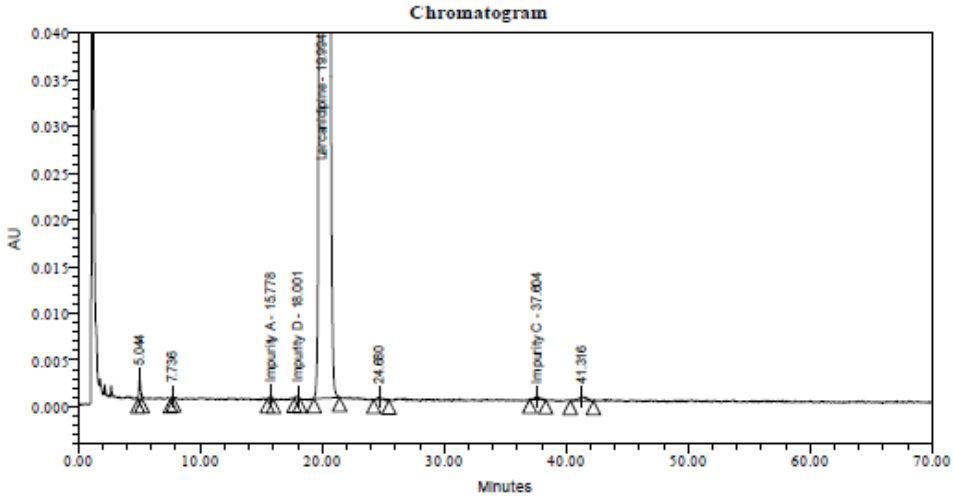
Peak Results

	Name	RT	Area	USP Plate Count	USP Tailing
1	Lercanidipine	20.354	29129	16627	1.10

Peak Purity Table

	Name	RT	Purity1 Angle	Purity1 Threshold	Purity_Criteria
1	Lercanidipine	20.354	7.713	10.462	Pass

Figure. 9: (Standard solution).



Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
1		5.044		19943		7188	1.20
2		7.736		1832	11.61	23522	0.73
3	Impurity A	15.778	0.789	6030	25.54	21677	0.92
4	Impurity D	18.001	0.900	4269	5.28	29088	0.71
5	Lercanidipine	19.994		30149034	3.23	10057	1.69
6		24.680		9097	4.14	11307	1.40
7	Impurity C	37.604	1.881	10007	13.13	33402	1.02

Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
8		41.316		18735	5.38	22950	0.90

Peak Purity Table

	Name	RT	Purity1 Angle	Purity1 Threshold	Purity_Criteria
1		5.044	16.076	90.000	Pass
2		7.736	46.281	90.000	Pass
3	Impurity A	15.778	69.833	90.000	Pass
4	Impurity D	18.001	62.992	90.000	Pass
5	Lercanidipine	19.994	0.037	1.179	Pass
6		24.680	46.800	90.000	Pass
7	Impurity C	37.604	37.519	90.000	Pass
8		41.316	52.268	90.000	Pass

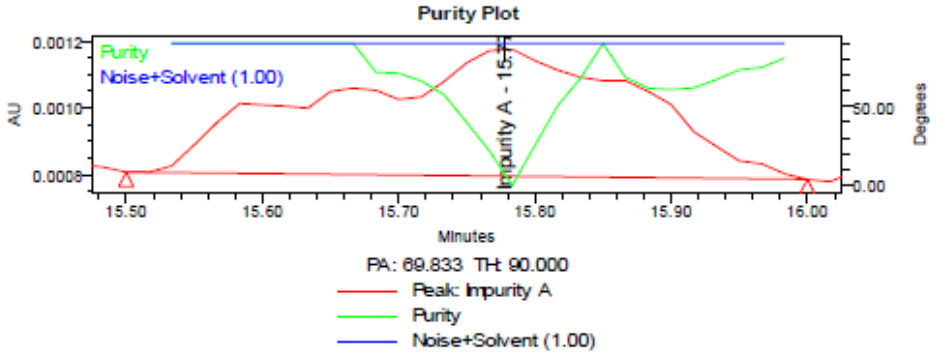
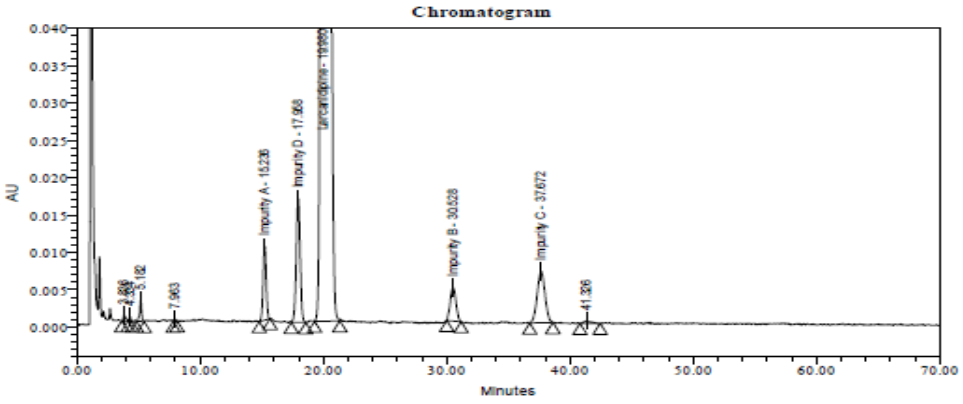


Figure. 10: (Control Sample).



Peak Results

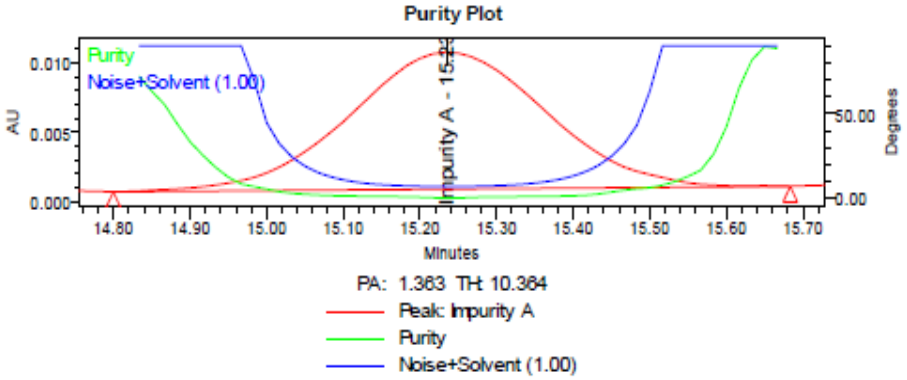
	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
1		3.836		11130		1590	1.42
2		4.334		4323	1.59	8426	0.96
3		5.182		30688	3.46	7025	0.96
4		7.963		2435	10.41	9834	1.08
5	Impurity A	15.236	0.763	175459	19.51	16865	0.98
6	Impurity D	17.958	0.899	369792	5.04	14626	1.01
7	Lercanidipine	19.960		32531021	2.82	9586	1.75

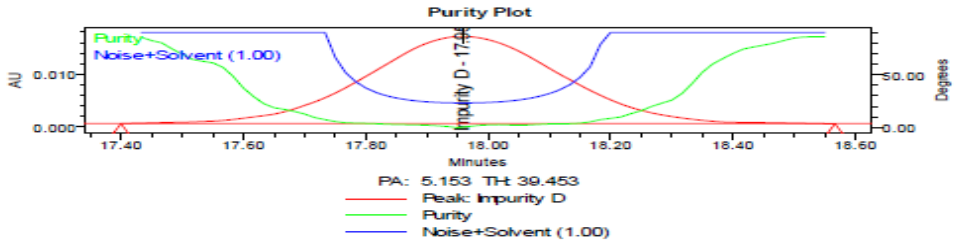
Peak Results

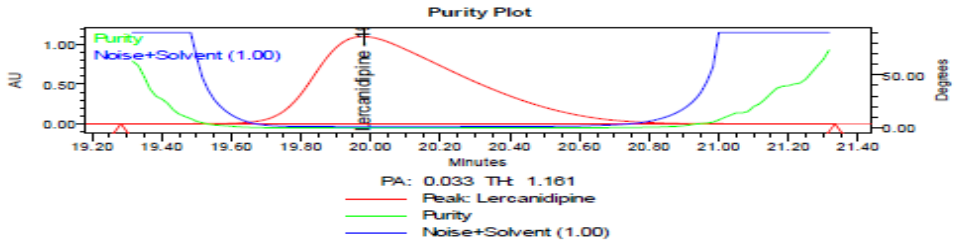
	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
8	Impurity B	30.528	1.528	144602	12.51	18635	1.06
9	Impurity C	37.672	1.885	301605	6.97	15553	1.00
10		41.326		12747	3.49	23263	1.55

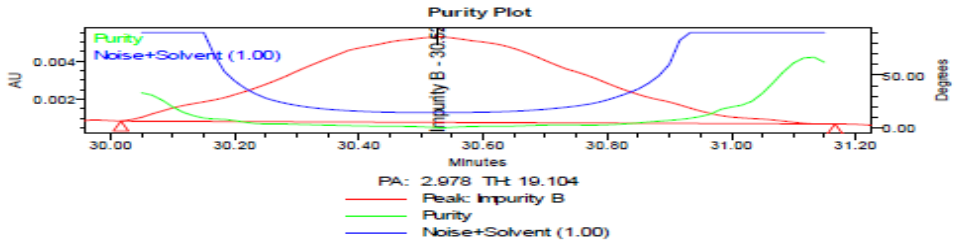
Peak Purity Table

	Name	RT	Purity1 Angle	Purity1 Threshold	Purity_Criteria
1		3.836	42.384	90.000	Pass
2		4.334	44.731	90.000	Pass
3		5.182	64.726	90.000	Pass
4		7.963	37.130	90.000	Pass
5	Impurity A	15.236	1.363	10.364	Pass
6	Impurity D	17.958	5.153	39.453	Pass
7	Lercanidipine	19.980	0.033	1.161	Pass
8	Impurity B	30.528	2.978	19.104	Pass
9	Impurity C	37.672	2.851	22.233	Pass
10		41.326	53.248	90.000	Pass









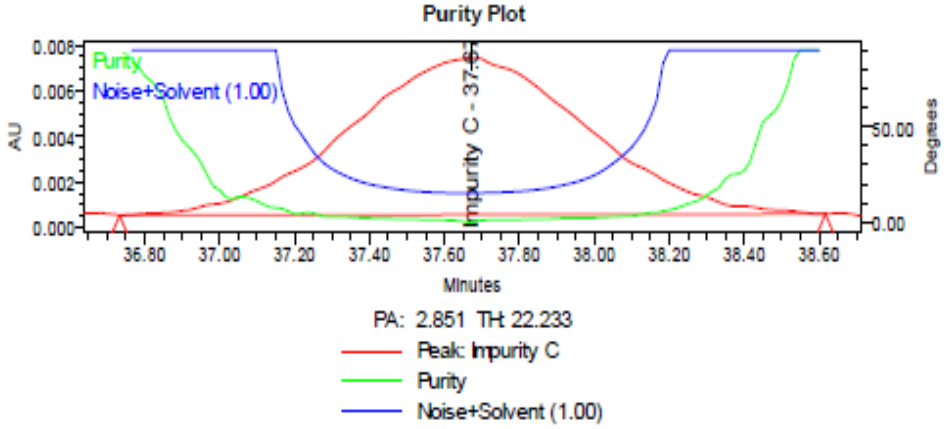
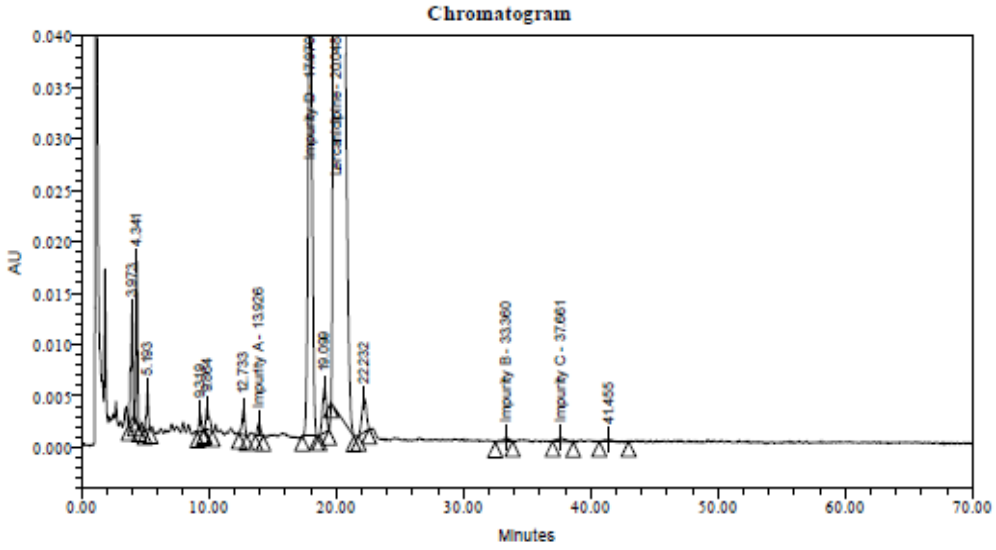


Figure. 11: (Spike Sample).



Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
1		3.973		115352		3765	0.77
2		4.341		136811	0.73	5491	1.10
3		5.193		37327	3.56	8025	0.85
4		9.319		21715	14.34	13146	1.15
5		9.864		37361	1.05	3795	1.53
6		12.733		36776	5.23	18146	0.81
7	Impurity A	13.926	0.695	20545	2.83	13939	1.15

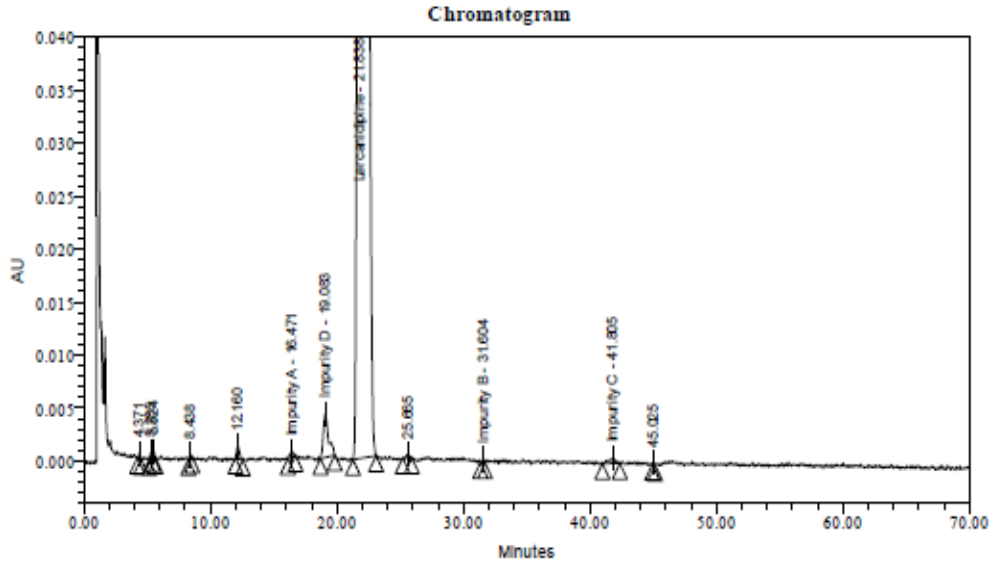
Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
8	Impurity D	17.970	0.896	991358	7.72	15234	1.01
9		19.099		88790	1.97	18434	0.91
10	Lercanidipine	20.048		25608040	1.42	10914	1.68
11		22.232		79045	3.04	18473	0.90
12	Impurity B	33.360	1.664	13150	8.64	118596	0.80
13	Impurity C	37.661	1.879	16547	3.28	6266	1.27
14		41.455		10498	5.10	7614	0.66

Peak Purity Table

	Name	RT	Purity1 Angle	Purity1 Threshold	Purity_Criteria
1		3.973	9.120	22.599	Pass
2		4.341	1.610	20.143	Pass
3		5.193	52.167	90.000	Pass
4		9.319	8.330	90.000	Pass
5		9.864	16.644	90.000	Pass
6		12.733	48.282	90.000	Pass
7	Impurity A	13.926	6.039	90.000	Pass
8	Impurity D	17.970	2.659	27.272	Pass
9		19.099	8.608	90.000	Pass
10	Lercanidipine	20.048	0.746	1.359	Pass
11		22.232	5.499	90.000	Pass
12	Impurity B	33.360	54.735	90.000	Pass
13	Impurity C	37.661	49.961	90.000	Pass
14		41.455	75.397	90.000	Pass

Figure. 12: (Photo Degradation sample).



Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
1		4.371		3563		10748	0.97
2		5.285		3937	4.06	4454	1.00
3		5.524		2855	1.03	21090	1.47
4		8.438		2745	14.44	26930	0.79
5		12.160		18428	11.91	16429	1.59
6	Impurity A	16.471	0.754	9715	11.35	24834	0.81
7	Impurity D	19.083	0.874	117591	5.18	14200	1.49

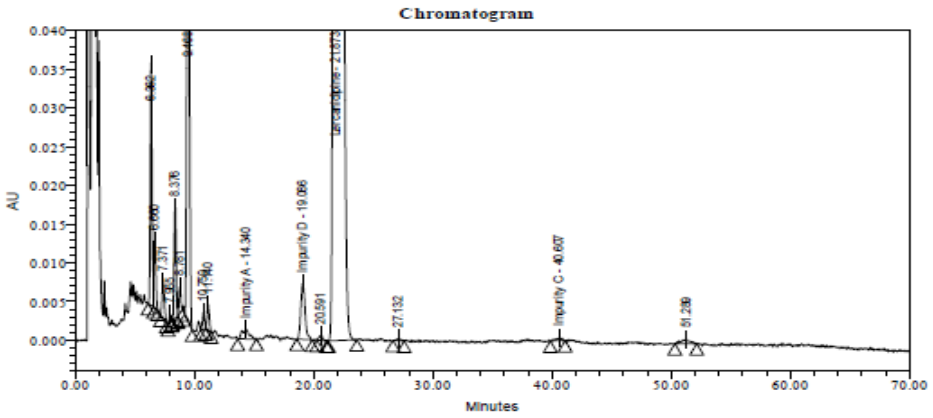
Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
8	Lercanidipine	21.838		30960344	3.51	9421	1.76
9		25.665		5853	6.31	121065	0.71
10	Impurity B	31.604	1.447	3409	20.42	273242	0.66
11	Impurity C	41.805	1.914	17810	8.01	7538	0.81
12		45.025		1510	2.63	962481	1.19

Peak Purity Table

	Name	RT	Purity1 Angle	Purity1 Threshold	Purity_Criteria
1		4.371	41.891	90.000	Pass
2		5.285	54.159	90.000	Pass
3		5.524	33.461	90.000	Pass
4		8.438	38.481	90.000	Pass
5		12.160	9.226	90.000	Pass
6	Impurity A	16.471	14.627	90.000	Pass
7	Impurity D	19.083	14.686	90.000	Pass
8	Lercanidipine	21.838	0.035	1.210	Pass
9		25.665	16.255	90.000	Pass
10	Impurity B	31.604	60.906	90.000	Pass
11	Impurity C	41.805	41.197	90.000	Pass
12		45.025	59.808	90.000	Pass

Figure. 13: (Acid Degradation sample).



Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
1		6.362		323299		9088	
2		6.660		95960			
3		7.371		62520		6203	1.16
4		7.965		9956	1.89	17133	0.83
5		8.376		165382	1.45	11440	1.01
6		8.781		36915	1.32	13927	1.02
7		9.468		1032348	2.04	10297	1.06

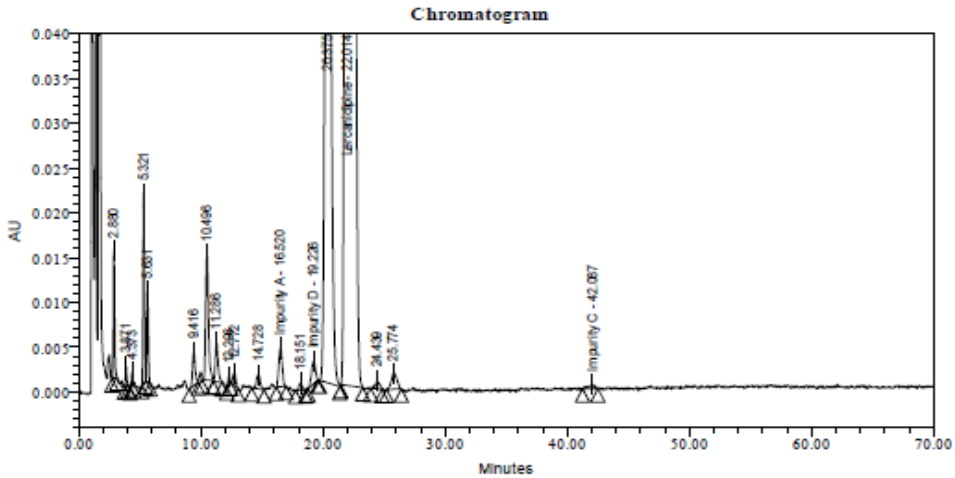
Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
8		10.759		25270	3.75	20743	0.94
9		11.140		40988	1.19	16677	1.21
10	Impurity A	14.340	0.656	52173	5.07	4302	1.09
11	Impurity D	19.086	0.873	179023	6.02	13129	1.32
12		20.591		13572	2.37	26401	1.05
13	Lercanidipine	21.873		27236379	1.69	10021	1.67
14		27.132		5394	7.83	228222	0.81
15	Impurity C	40.607	1.857	12630	8.90	21838	0.77
16		51.289		27113	5.17	3677	0.83

Peak Purity Table

	Name	RT	Purity1 Angle	Purity1 Threshold	Purity_Criteria
1		6.362	1.767	90.000	Pass
2		6.660	1.682	90.000	Pass
3		7.371	0.696	90.000	Pass
4		7.965	2.298	90.000	Pass
5		8.376	1.184	90.000	Pass
6		8.781	3.190	90.000	Pass
7		9.468	0.241	90.000	Pass
8		10.759	5.277	90.000	Pass
9		11.140	4.627	90.000	Pass
10	Impurity A	14.340	12.835	90.000	Pass
11	Impurity D	19.086	12.541	90.000	Pass
12		20.591	71.740	90.000	Pass
13	Lercanidipine	21.873	0.052	8.416	Pass
14		27.132	48.705	90.000	Pass
15	Impurity C	40.607	37.385	90.000	Pass
16		51.289	13.022	90.000	Pass

Figure. 14: (Base Degradation sample).



Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
1		2.880		94946		4570	1.33
2		3.871		15400	5.37	6677	1.22
3		4.373		10026	2.63	8407	0.96
4		5.321		164949	4.70	10220	1.07
5		5.631		82300	1.42	10370	1.20
6		9.416		55966	12.37	9819	1.08
7		10.496		227126	2.64	10069	1.39

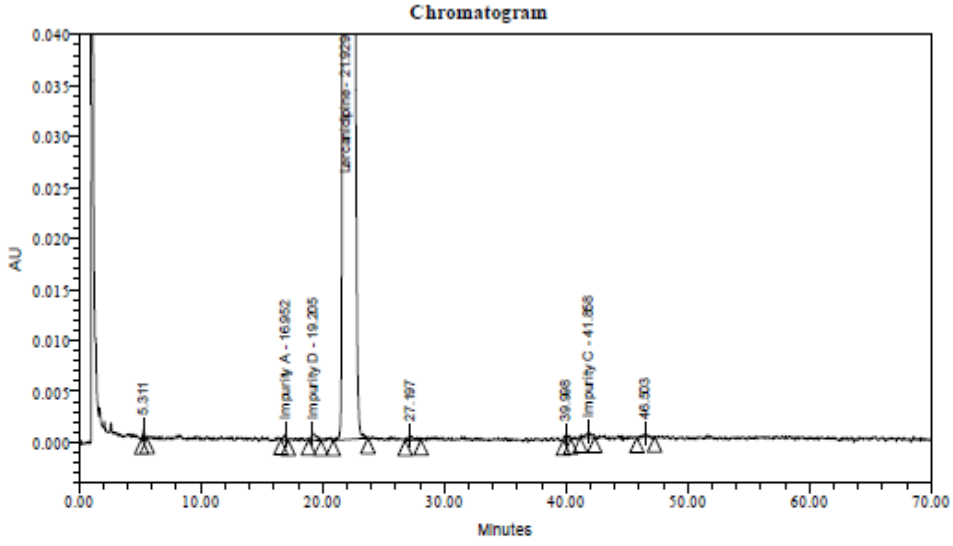
Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
8		11.286		67471	1.92	13689	1.40
9		12.296		8494	3.11	36212	0.94
10		12.772		22113	1.33	13219	0.97
11		14.728		35203	4.07	14726	1.04
12	Impurity A	16.520	0.750	84589	3.23	16045	1.03
13		18.151		14564	3.11	17748	1.03
14	Impurity D	19.226	0.873	55766	2.07	17104	0.89
15		20.375		3020234	1.64	10161	1.21
16	Lercanidipine	22.014		25547609	1.93	10284	1.63
17		24.439		21425	2.62	17157	0.85
18		25.774		56559	1.35	16742	1.10
19	Impurity C	42.087	1.912	16847	14.73	4457	0.68

Peak Purity Table

	Name	RT	Purity1 Angle	Purity1 Threshold	Purity_Criteria
1		2.880	8.401	90.000	Pass
2		3.871	24.788	90.000	Pass
3		4.373	5.015	90.000	Pass
4		5.321	62.465	90.000	Pass
5		5.631	54.808	90.000	Pass
6		9.416	21.537	90.000	Pass
7		10.496	9.586	90.000	Pass
8		11.286	25.744	90.000	Pass
9		12.296	46.095	90.000	Pass
10		12.772	39.813	90.000	Pass
11		14.728	34.578	90.000	Pass
12	Impurity A	16.520	15.117	90.000	Pass
13		18.151	67.799	90.000	Pass
14	Impurity D	19.226	42.640	90.000	Pass
15		20.375	0.246	8.872	Pass
16	Lercanidipine	22.014	0.028	1.972	Pass
17		24.439	16.909	90.000	Pass
18		25.774	14.125	90.000	Pass

Figure. 15: (H_2O_2 Degradation sample).



Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
1		5.311		8852		4610	1.38
2	Impurity A	16.952	0.773	8673	35.31	26788	0.83
3	Impurity D	19.205	0.876	19138	4.25	4929	1.70
4	Lercanidipine	21.929		31016034	3.36	9527	1.75
5		27.197		14925	4.29	44861	1.09
6		39.998		10302	12.04	22503	1.45
7	Impurity C	41.858	1.909	17575	0.75	211298	0.88

Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
8		46.503		10561	1.42	331769	0.76

Peak Purity Table

	Name	RT	Purity1 Angle	Purity1 Threshold	Purity_Criteria
1		5.311	44.188	90.000	Pass
2	Impurity A	16.952	55.699	90.000	Pass
3	Impurity D	19.205	47.524	90.000	Pass
4	Lercanidipine	21.929	0.040	1.201	Pass
5		27.197	59.343	90.000	Pass
6		39.998	35.995	90.000	Pass
7	Impurity C	41.858	38.569	90.000	Pass
8		46.503	43.141	90.000	Pass

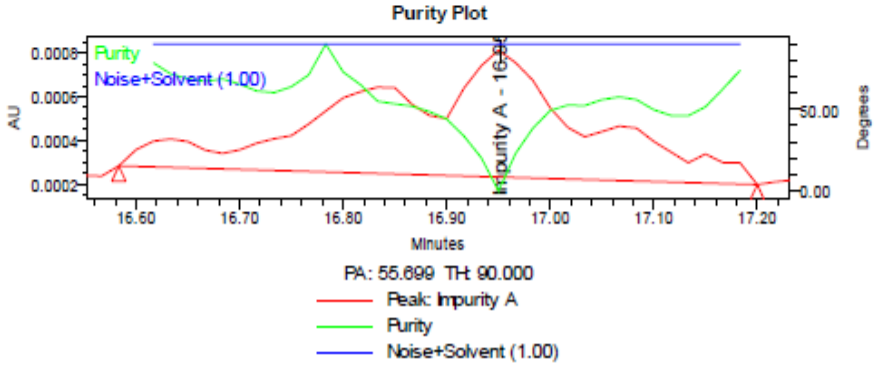
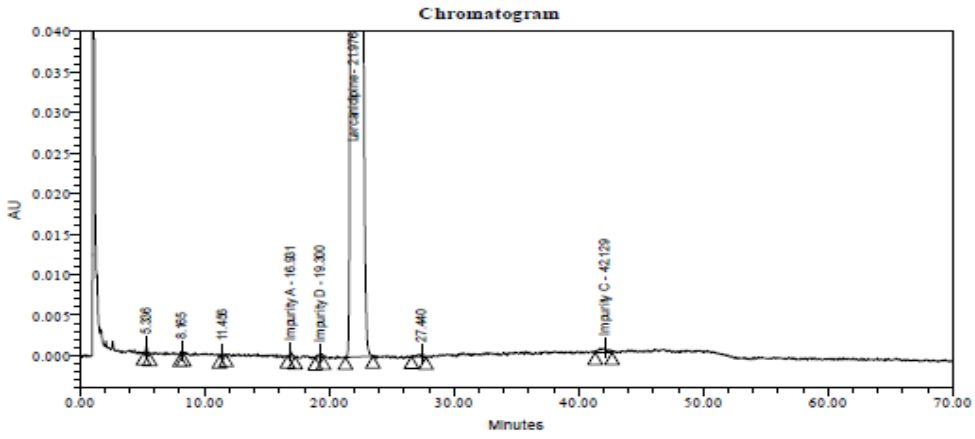


Figure. 16: (Thermal Degradation sample).



Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
1		5.336		7712		10789	1.03
2		8.165		3648	12.38	12285	1.01
3		11.456		3624	11.78	1542	0.62
4	Impurity A	16.931	0.770	7096	18.51	32119	1.53
5	Impurity D	19.300	0.878	10870	5.37	1212	0.78
6	Lercanidipine	21.976		31376786	3.52	9476	1.77
7		27.440		13407	5.08	7755	0.70

Peak Results

	Name	RT	RT Ratio	Area	USP Resolution	USP Plate Count	USP Tailing
8	Impurity C	42.129	1.917	26444	11.02	23915	0.85

Peak Purity Table

	Name	RT	Purity1 Angle	Purity1 Threshold	Purity_Criteria
1		5.336	47.411	90.000	Pass
2		8.165	62.084	90.000	Pass
3		11.456	74.011	90.000	Pass
4	Impurity A	16.931	77.307	90.000	Pass
5	Impurity D	19.300	54.897	90.000	Pass
6	Lercanidipine	21.976	0.034	1.174	Pass
7		27.440	55.737	90.000	Pass
8	Impurity C	42.129	38.204	90.000	Pass

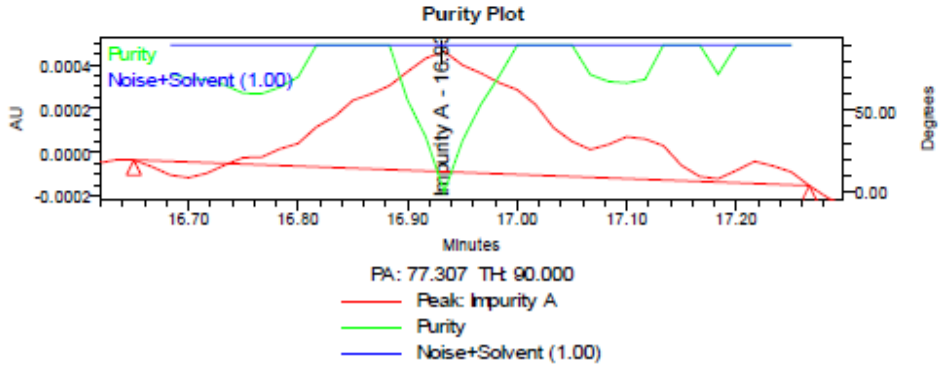


Figure. 17: (Humidity Degradation sample).

CONCLUSION

The test method was validated for specificity, selectivity and stability indicating was found to meeting the predetermined acceptance criteria as per Inernational Conference on Harmonization guideline entitled 'Stability testing of new drug substances and new drug products' (ICH) Q1A and 'Analytical method validation of new drug substances and new drug product' ICH Q2 R1 guideline. This force degradation study is intended to show that the method is stability indicating and is suitable to determine inherent stability of drug for Lercanidipine Hydrochloride in Lercanidipine Hydrochloride Tablets of 10 mg and 20mg dosage strengths. Hence this method can be introduced into routine use and testing of stability samples for the related substances of Lercanidipine Hydrochloride in Lercanidipine Hydrochloride Tablets, 10mg and 20mg.

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