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STABILITY INDICATING HPLC METHOD FOR THE QUANTIFICATION OF CEFIXIME, ORNIDAZOLE AND MOXIFLOXACIN IN SOLID DOSAGE FORMS

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ABSTRACT

Cefixime is used for bacterial infections recovery, Ornidazole is used as antibiotic for protozoan infections and Moxifloxacin is also an antibiotic for multiple bacterial infections. Accurate, simple and precise HPLC method was developed for the determination of Cefixime, Ornidazole and Moxifloxacin in the tablet pharmaceutical dosage form. The RP-HPLC method was developed and validated with precision, specificity, accuracy, ruggedness, robustness and linearity. Chromatographic conditions are mobile phase A: 6.8g KH_2PO_4 in 1000 ml water and mobile phase B: Acetonitrile, Agilent Zorbax SB- C18, 100 x 4.6mm, 5µm, 280 nm, 1.0ml/min, 25 min (gradient program: mobile phase B at 0min 5%, 5min 5%, 10 min 15%, 14 min 15%, 17 min 35%, 20 min 5% and 25 min 5%. All validation results showed the accuracy results and % RSD for test area, %assay values were also within the limits. This HPLC method can be used to analyze the regular product quality control purpose.

Keywords: Cefixime, Ornidazole, Moxifloxacin, Method development and validation

INTRODUCTION

Cefixime is used to treat bacterial infections includes otitis media, pneumonia, strep throat, urinary tract infections, gonorrhoea and lyme disease.[1-2] Cefixime was approved in USA IN 1989. It is marketed under many trade names such as texit (Apex, Cef-3 and Denvar.[3-5] Cefixime chemical formula is C16H15N5O7S2 and molecular mass is 453.452 g/mol. Ornidazole is used as antibiotic for some protozoan infections.[6-7] This drug can be used for crohn's disease after bowel resection.[8-10] Moxifloxacin is an antibiotic used to treat the number of bacterial infections.[11] These infections include pneumonia[12], conjunctivitis[13], endocarditis[14], tuberculosis and sinusitis.[15] Moxifloxacin was approved in the USA in 1999 and it is on the WHOs list of essential medicines.

Cefixime and Ornidazole were available in combined tablet dosage form with Cefixime 200 mg and Ornidazole 500 mg or Cefixime 50 mg and Ornidazole 125 mg. Cefixime and Moxifloxacin were available in combined tablet dosage form with Cefixime 400 mg and Moxifloxacin 400 mg. Cefixime, Ornidazole and Moxifloxacin chemical structures were represented in Fig.-1.

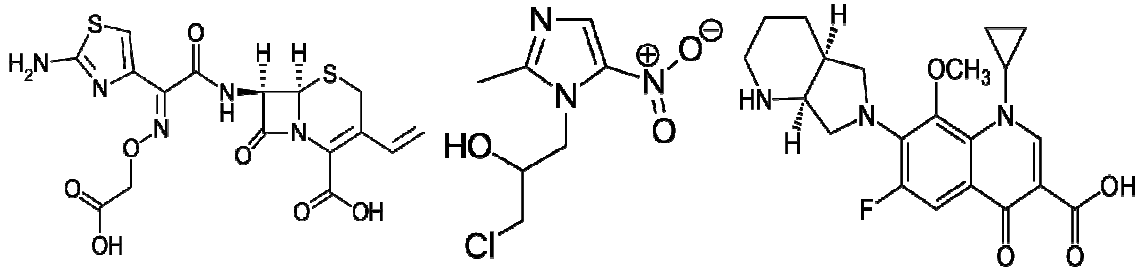

Fig.-1: Chemical Structures of Cefixime, Ornidazole and Moxifloxacin

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Literature survey reveals the few reported methods on Cefixime and Ornidazole on UV spectroscopy methods[16-17] and some methods were published on HPLC.[18] Cefixime and Moxifloxacin were determined by UV spectrophotometric method[19-22] and some of the authors were published on HPLC instrument.[23-28]

EXPERIMENTAL

Materials

Agilent makes alliance HPLC instrument equipped with a pump, detector, auto sampler, column oven and Empower software. Agilent makes Zorbax Eclipse SB C18 100mm column was purchased from a local distributor in Hyderabad. Analytical grade K_2HPO_4 buffer salt and ortho-phosphoric acid were used purchased from Merck India Pvt. Limited. Gradient grade acetonitrile and methanol were purchased from Qualigens chemical supplier from Hyderabad.

Methods

Reverse phase HPLC method was optimized to determine the Cefixime, Ornidazole and Moxifloxacin in solid dosage formulations. Optimized method was validated with precision, linearity, accuracy, limit of detection, limit of quantification, ruggedness and robustness. Chromatographic conditions were discussed below,

HPLC conditions

Column : Agilent Zorbax SB- C18, 100 x 4.6mm, 5µm
Flow rate : 1.0 mL/minute
Detection : 280 nm
Injection Volume : 20 µL
Column temperature : 30°C
Analysis time : 25 minutes

Mobile Phase-A

6.8 g of di-potassium hydrogen phosphate (KH_2PO_4) weighed and transferred into 1000 mL of water and sonicated to dissolve. The resulting solution was degassed through a 0.45µm membrane filter using a vacuum pump.

Mobile Phase-B

Gradient grade acetonitrile was used as mobile phase B and degassed through the 0.45µ filter.

Diluent

Mobile phase A and B were mixed in the ratio of 50:50 % v/v and mixed well.

Mobile Phase Elution Gradient Program

Table-1: Gradient Program

Time (Minutes)	Mobile Phase-A (%v/v)	Mobile Phase-B (%v/v)
0.00	95	5
5.00	95	5
10.00	85	15
14.00	85	15
17.00	68	32
20.00	95	5
25.00	95	5

Standard Stock Solution
50 mg of Cefixime standard, 50 mg Ornidazole standard and 50 mg of Moxifloxacin were weighed accurately and transferred into a 100 mL volumetric flask. 50 mL of diluent was added to dissolve the contents and mixed well. Remaining volume was filled and mixed.

Standard Solution Preparation
1.0ml of the standard stock solution was pipetted and transferred into 50 ml class A volumetric flask and diluted with a diluent.

Preparation of Cefixime and Ornidazole Sample Solution
Randomly selected 20 tablets and weighed individually and calculated the average weight of one tablet and prepared the fine powder. Equivalent to 50 mg of Cefixime and Ornidazole tablets powder was weighed and transferred into 100 mL volumetric flask. 50 ml of diluent was added and dissolve the content by using handshake and sonication for 10 minutes. Further volume was diluted with a diluent. The stock solution was filtered with Whatman filter. 1 mL of the above solution was transferred into a 50 mL volumetric flask and diluted.

Preparation of Cefixime and Moxifloxacin Sample Solution
Randomly selected 20 tablets and weighed individually and calculated the average weight of one tablet and prepared the fine powder. Equivalent to 50 mg of Cefixime and 50 mg Moxifloxacin tablets powder was weighed and transferred into 100 mL volumetric flask. 50 ml of diluent was added and dissolve the content by using handshake and sonication for 10 minutes. Further volume was diluted with a diluent. The stock solution was filtered with Whatman filter. 1 mL of the above solution was transferred into a 50 mL volumetric flask and diluted.

System Suitability Limits
All three peaks (Cefixime, Ornidazole and Moxifloxacin) in standard solution tailing factor should be not more than 2.0 and theoretical plates value should be more than 2000. %RSD for five replicate standard solutions area should be less than 2.0%.

Percentage Assay Value Calculation =

$$\frac{\text{Tarea X Tweight X 1 X 100 X 50 X Label claim X Potency}}{\text{Sarea X 100 X 50 X Sweight X 1X Tablet weight X 100 X 100}}$$

In the above calculation formula, Tarea is Peak area from sample preparation; Sarea is Average peak area from standard solution; Tweight is the weight of standard taken in mg; Sweight is the weight of the standard solution.

RESULTS AND DISCUSSION

HPLC Method Optimization
Method optimization was initiated based on the understanding of the molecules polarity, functional groups activity and reported literature. Solubility was checked in water with different pH levels, acetonitrile, methanol and mixed ratio solutions. UV spectroscopic nm was evaluated by scanning of the standard materials from 200 nm to 400 nm. Based on the evaluation of UV spectroscopic results 280 nm has a maximum absorbance at all compounds. Further, HPLC method optimization was performed. Figure-2 represented the UV spectrum of Cefixime, Ornidazole and Moxifloxacin.

HPLC Method Optimization Trial-1
Conditions

1. 1.0g of ammonium acetate in 1000 ml of water used as a buffer
2. 2. Buffer as mobile phase A and acetonitrile as mobile phase B was eluted with a gradient program

3. 3. Acetonitrile and acetonitrile 80:20 v/v used as mobile phase B
4. 4. Zorbax ODS 150x4.6mm,5µ column
5. 5. Flow rate 1.0ml/min, 30°C column temperature, 280 nm
6. 6. Gradient program at 0 min 15% mobile phase B, at 10 min 25%, at 18 min 40%, at 22 min 40%, at 23 min 15% and at 27 min 15%
7. 7. Diluent: buffer and acetonitrile 50:50 v/v.

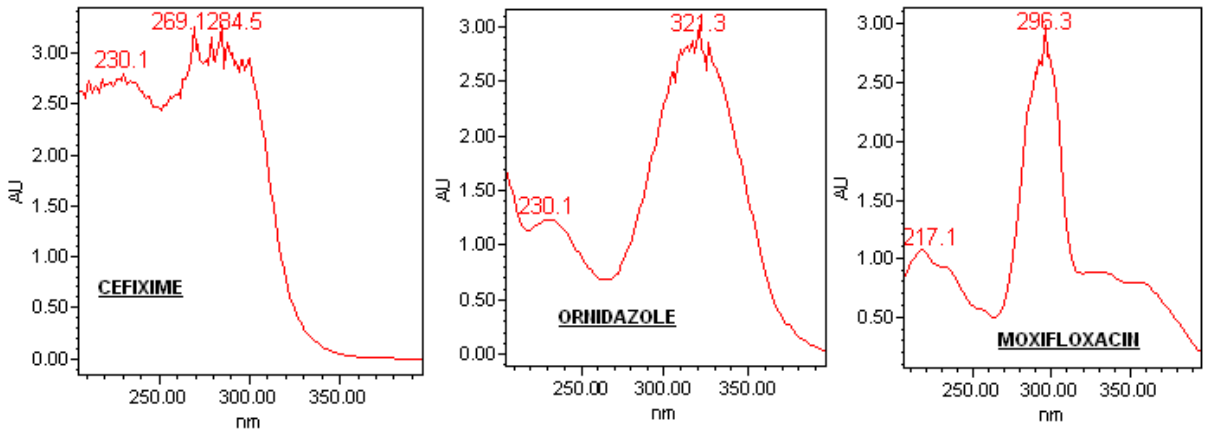

Fig.-2: UV Spectrum of Cefixime, Ornidazole and Moxifloxacin

Observation

All three peaks were eluted but Cefixime was eluted at 2.3 min and other components were eluted separately. Further optimization carried out by changing the mobile phase ratio. Cefixime, Ornidazole and Moxifloxacin individual samples were analyzed with the isocratic program with different mobile phase A and B ratios for elution confirmation and chromatograms were shown in Fig.-3 to 5 and development trial mixed sample chromatogram was represented in Fig.-6.

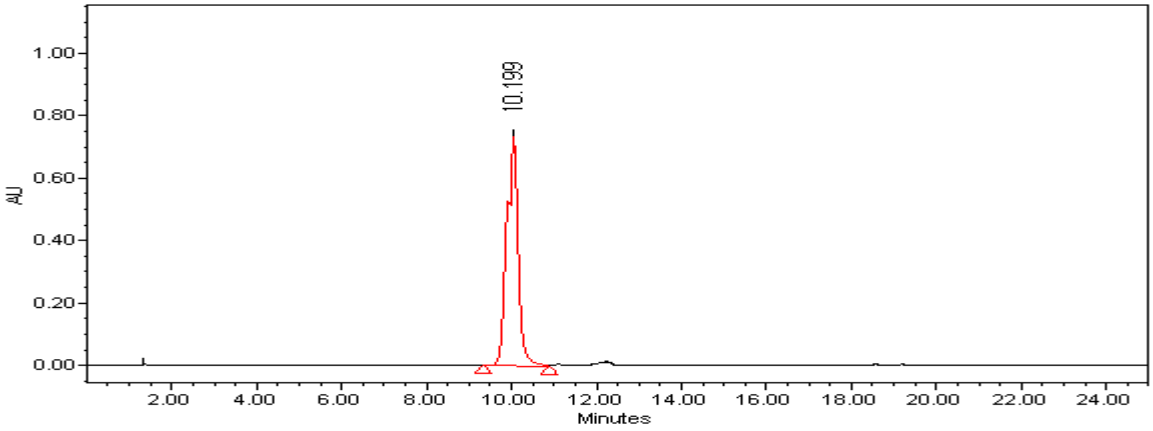

Fig.-3: Cefixime Chromatogram

HPLC Method Optimization Trial-2

Conditions

1. 6.8g of KH_2PO_4 in 1000 ml of water used as a buffer
2. Buffer as mobile phase A and acetonitrile as mobile phase B was eluted with a gradient program
3. Acetonitrile and acetonitrile 80:20 v/v used as mobile phase B
4. Intertsil ODS-3 250x4.6mm,5µ column
5. Flow rate 1.0ml/min, 40°C column temperature, 280 nm
6. Gradient program at 0 min 25% mobile phase B, at 8 min 25%, at 15 min 40%, at 22 min 40%, at 23 min 25% and at 27 min 55%
7. Diluent: buffer and acetonitrile 50:50 v/v.

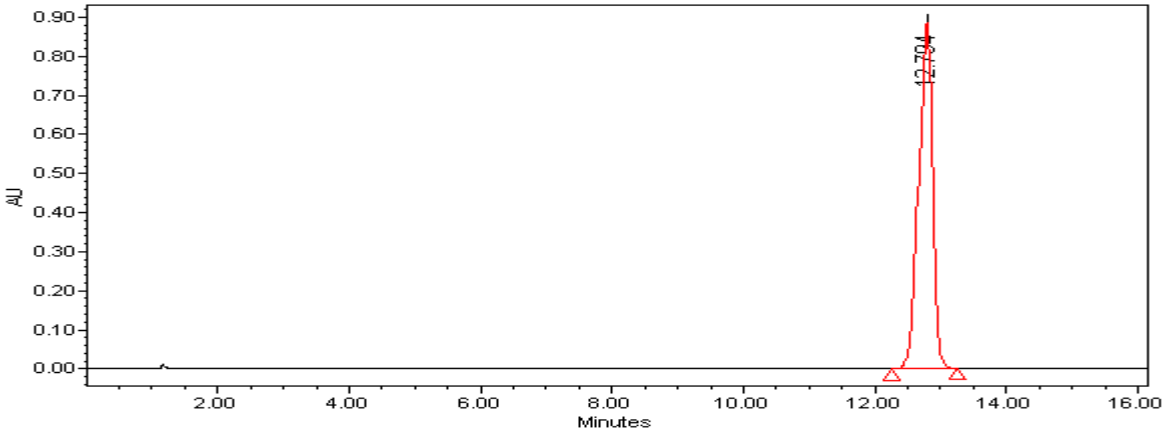

Fig.-4: Ornidazole Chromatogram

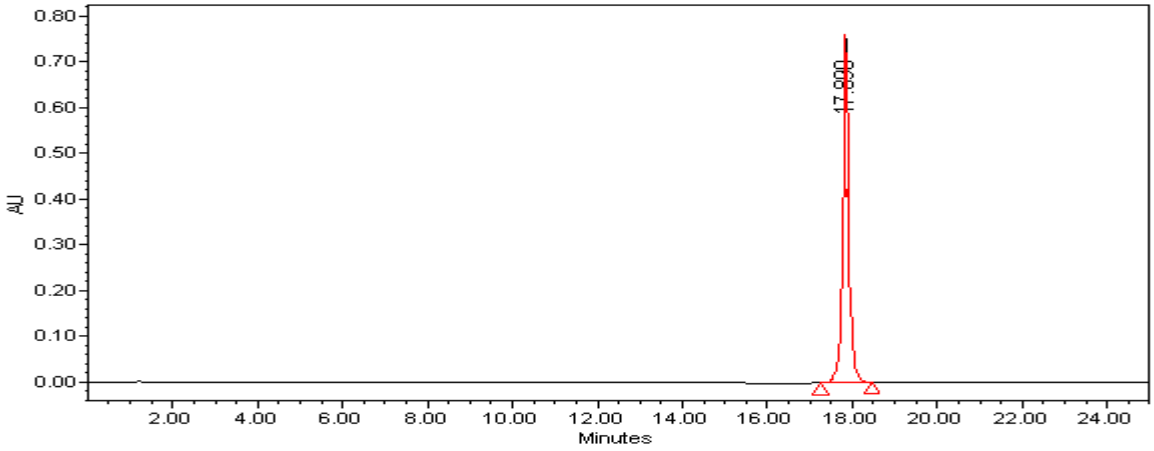

Fig.-5: Moxifloxacin Chromatogram

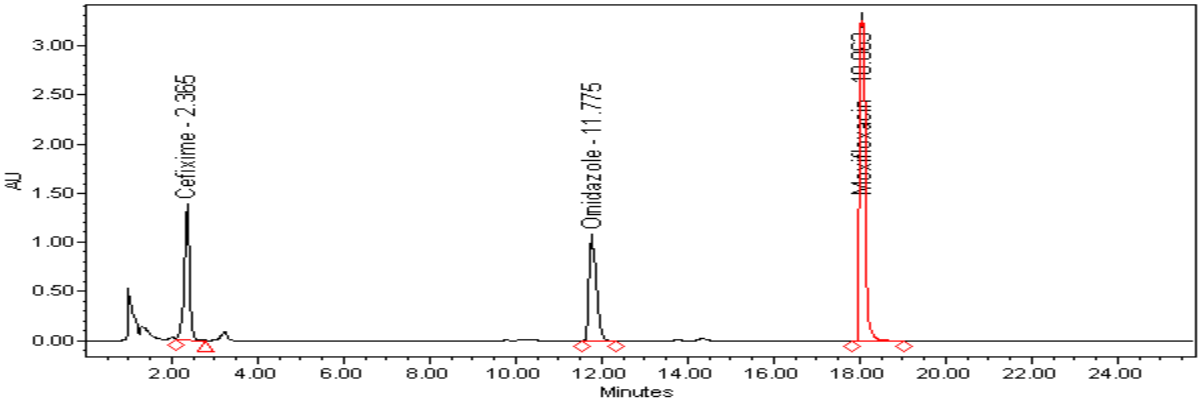

Fig.-6: Development Trial-1 Chromatogram

Observation

All three peaks were eluted but Cefixime peak shape was poor. Further optimization carried out by changing the HPLC column and gradient program. Development trial mixed sample chromatogram was represented in Fig.-7.

HPLC Method Optimization Trial-3

Conditions

1. 6.8g of KH_2PO_4 in 1000 ml of water used as a buffer

2. Buffer as mobile phase A and acetonitrile as mobile phase B was eluted with a gradient program
3. Acetonitrile and acetonitrile 80:20 v/v used as mobile phase B
4. Zorbax SB C18 100x4.6mm, 5µ column
5. Flow rate 1.0ml/min, 40°C column temperature, 280 nm
6. Gradient program at 0 min 10% mobile phase B, at 5 min 10%, at 10 min 20%, at 14 min 20%, at 17 min 40%, at 20 min at 10% and at 25 min 10%
7. Diluent: buffer and acetonitrile 50:50 v/v.

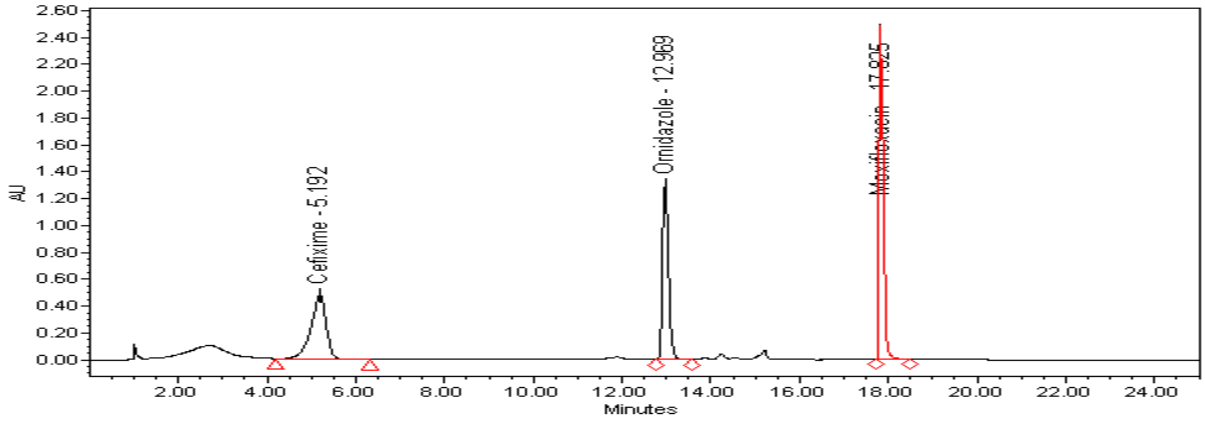

Fig.-7: Development Trial-2 Chromatogram

Observation

All three peaks were eluted and Cefixime and Ornidazole were eluted at 11.5 min and 12.4 min Moxifloxacin was eluted at 17.5 min. Slight gradient program needs to modify to get more separation between Cefixime and Ornidazole. Development trial mixed sample chromatogram was represented in Fig.-8.

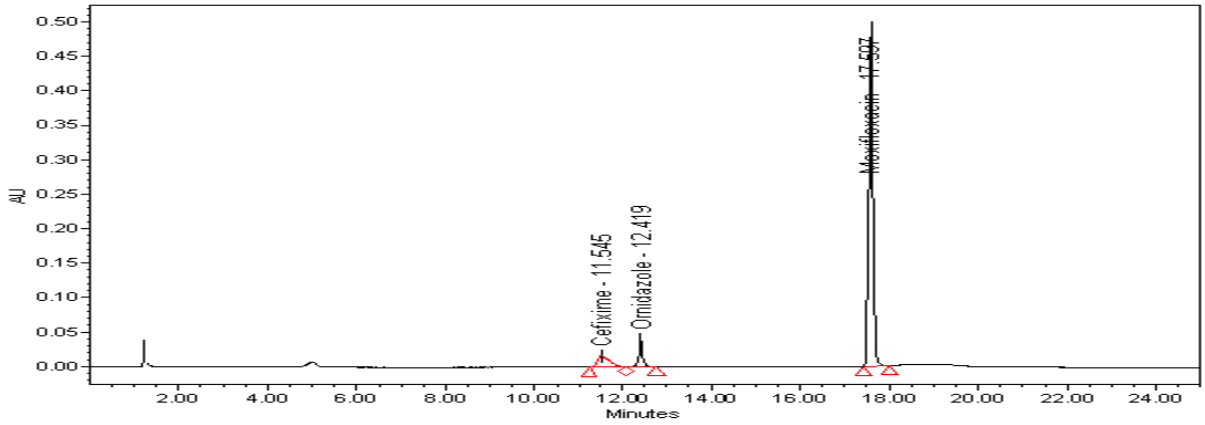

Fig.-8: Development Trial-3 Chromatogram

Method Validation

Optimized method was progressed for method validation as per the ICH Q2 guidance document. Precision, specificity, linearity, ruggedness, robustness and recovery studies were carried out.

System Suitability

Method system suitability was evaluated by preparing a fresh standard solution as per the finalized method mentioned in materials and method. Blank, placebo and five replicate standard solutions were injected in the HPLC system and system suitability parameters were evaluated. All system suitability results were satisfactory and all results were within the acceptable limits. Figure-9 and 10 were

represented the blank and placebo. Blank and standard overlay chromatogram were represented in Fig.-11. Figure-12 represented the placebo and standard chromatogram. Figure-13 represented the standard solution chromatogram. All five replicate standard solution chromatogram was represented in Fig.-14. Figure-15 to 17 were represented the peak purity plot for Cefixime, Ornidazole and Moxifloxacin. Table-2 represented the system suitability results.

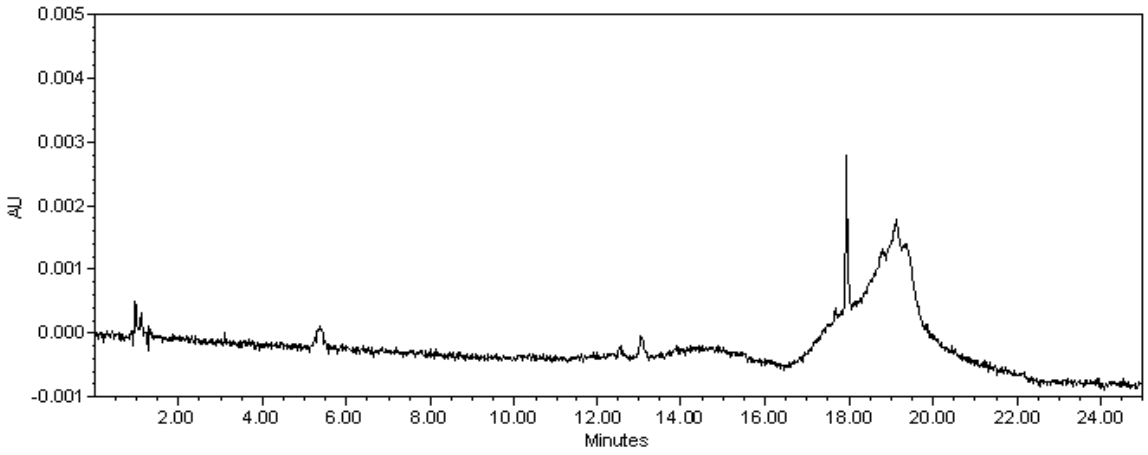

Fig.-9: Blank Chromatogram

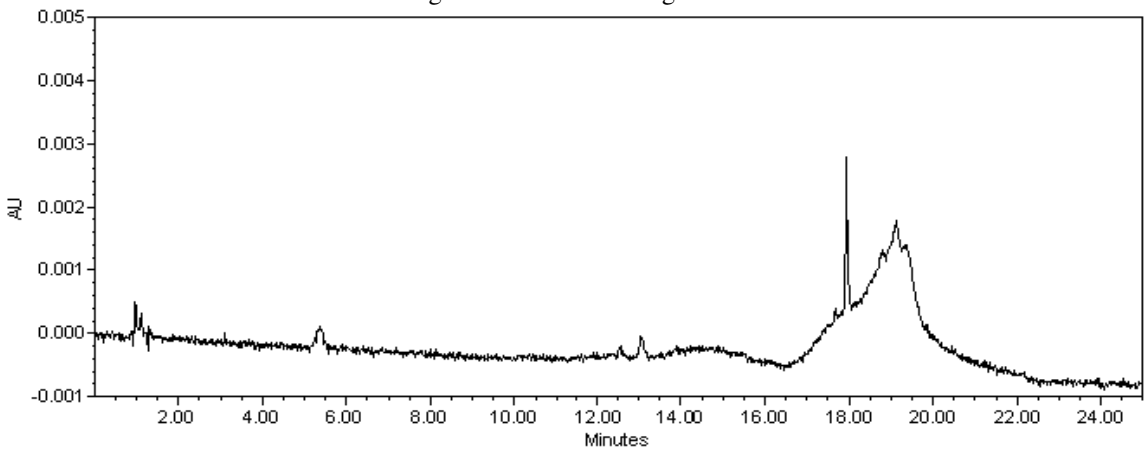

Fig.-10: Placebo Chromatogram

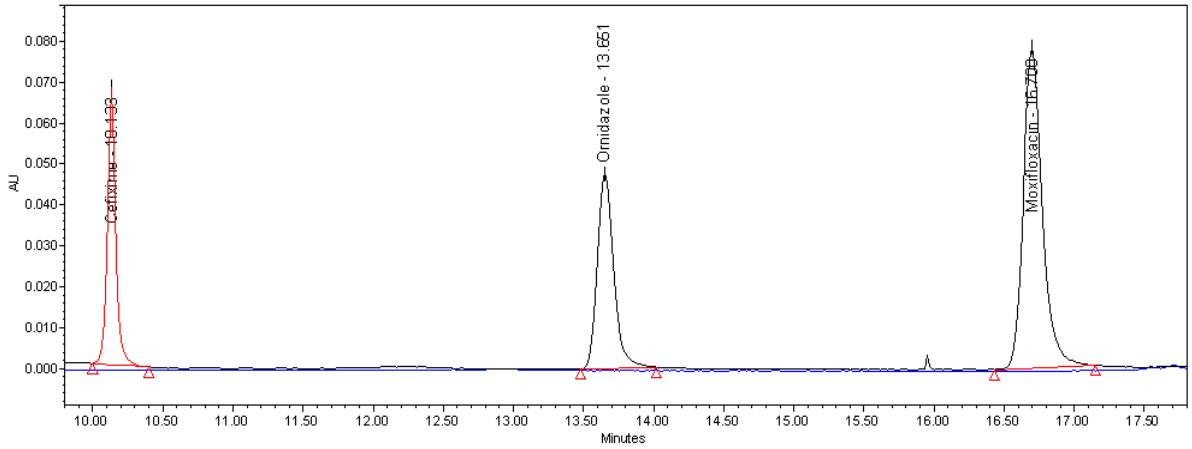

Fig.-11: Blank and Standard Overlay Chromatogram

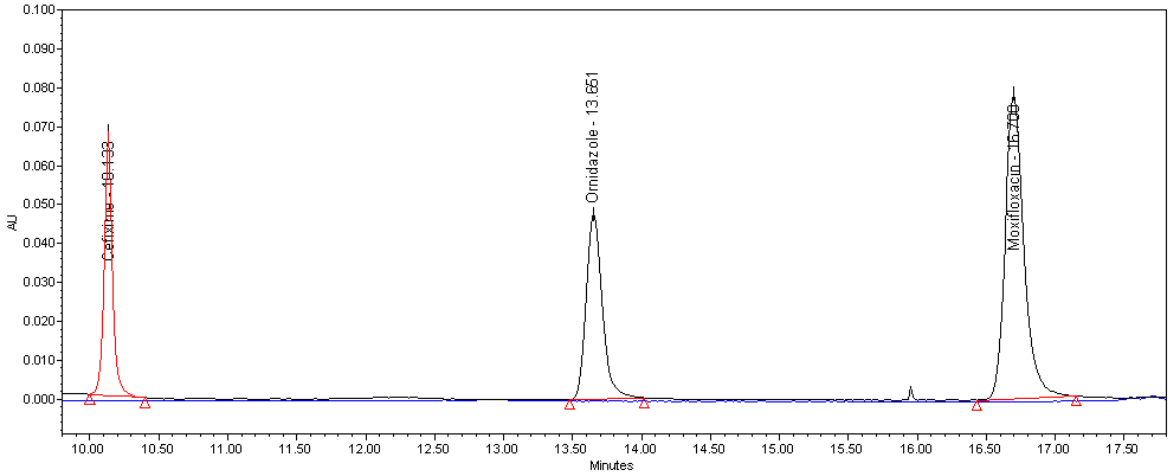

Fig.-12: Placebo and Standard Overlay Chromatogram

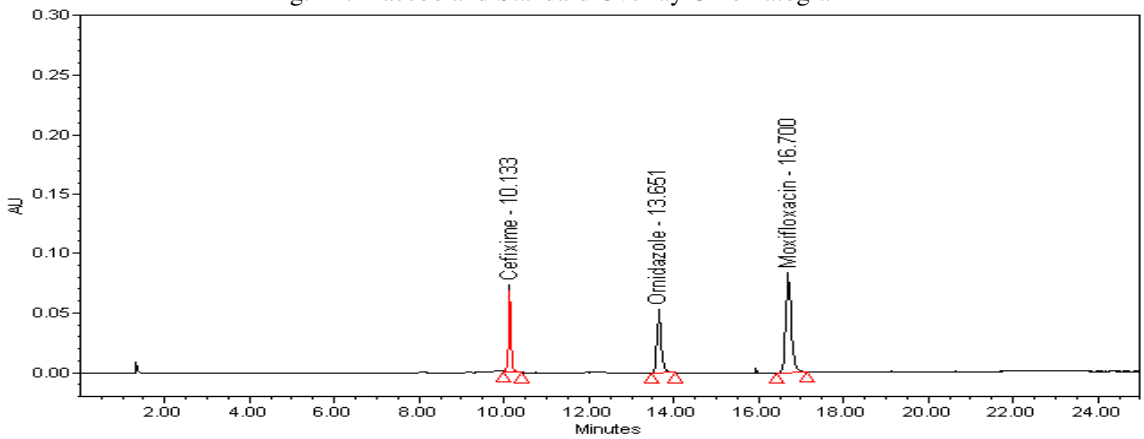

Fig.-13: Standard Solution Injection-1 Chromatogram

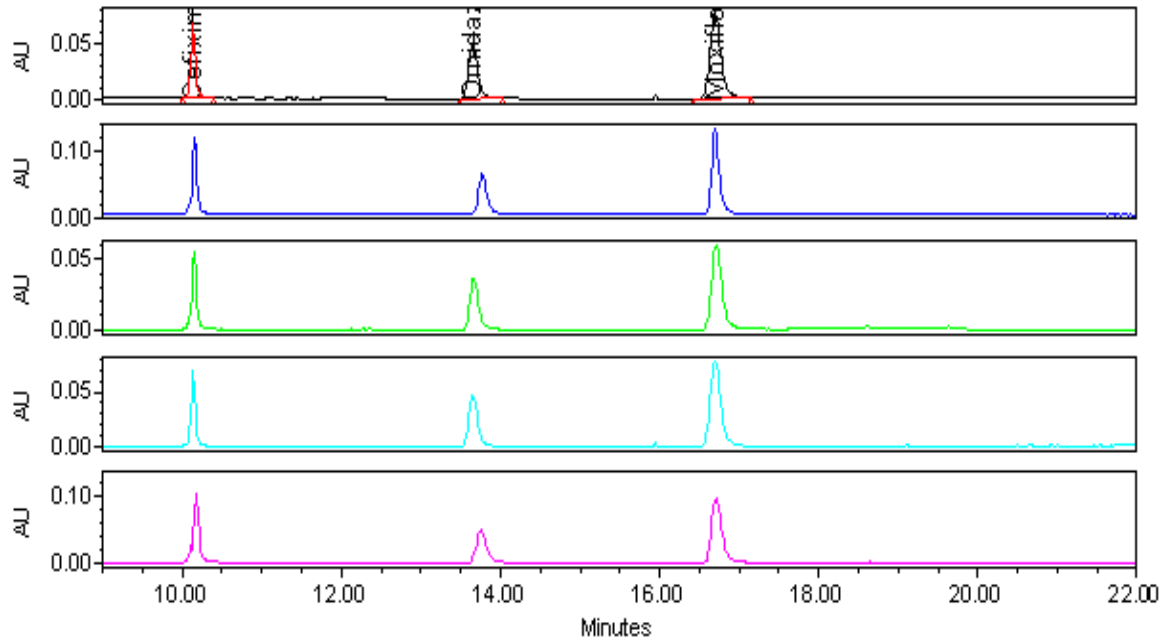

Fig.-14: Five Replicate Standard Solution Chromatogram

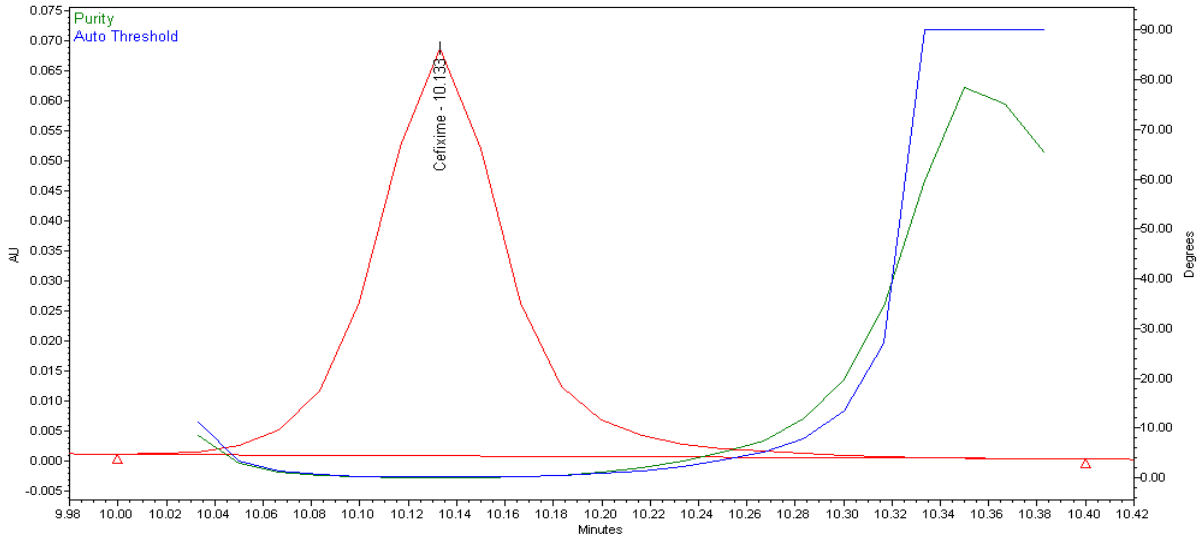

Fig.-15: Cefixime Peak Purity Plot

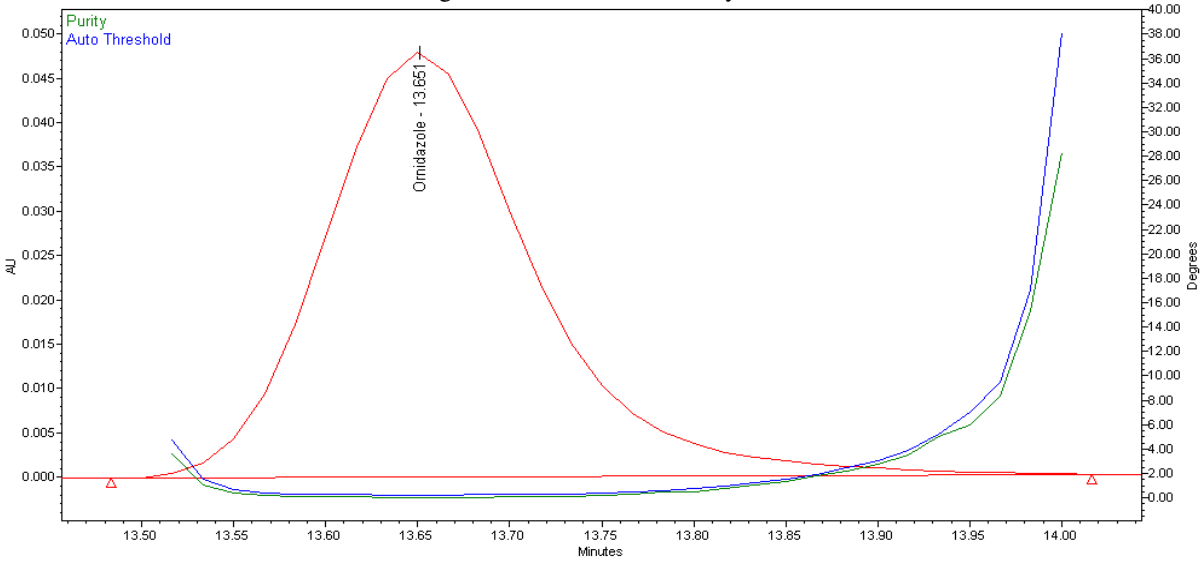

Fig.-16: Ornidazole Peak Purity Plot

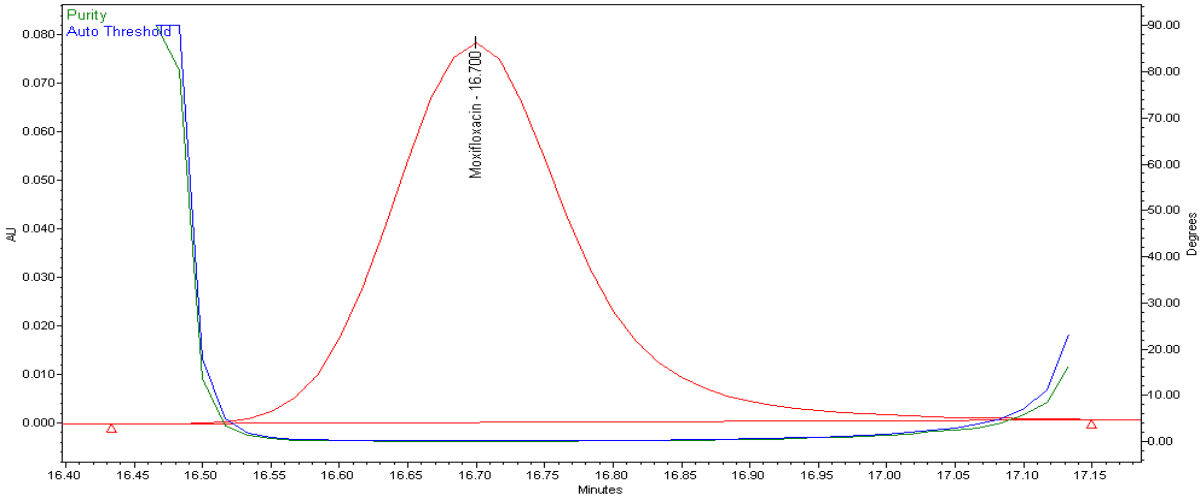

Fig.-17: Moxifloxacin Peak Purity Plot Chromatogram

Table-2: System Suitability Results

Injection	Retention time (min)			Area		
	Cefixime	Ornidazole	Moxifloxacin	Cefixime	Ornidazole	Moxifloxacin
1.	10.133	13.651	16.700	266504	256345	371025
2.	10.154	13.770	16.700	266125	256314	370152
3.	10.155	13.710	16.704	266314	256781	370145
4.	10.157	13.716	16.987	259987	254987	371025
5.	10.148	13.663	16.715	261046	255164	370146
%RSD	0.10	0.35	0.75	1.21	0.31	0.13
	Theoretical plates			Tailing factor		
1.	5342	5468	5497	1.2	1.1	1.2
2.	5216	5900	5682	1.1	1.3	1.2
3.	5415	6102	5637	1.3	1.2	1.3
4.	5701	5803	5429	1.2	1.4	1.1
5.	5634	5269	5498	1.4	1.2	1.2
Average	5461	5708	5548	1.24	1.24	1.20

Peak purity Results

Active component	Purity angle	Purity threshold	Peak purity Results
Cefixime	0.310	0.413	Pass
Ornidazole	0.131	0.289	Pass
Moxifloxacin	0.109	0.256	Pass

Precision

Method precision and system precision was evaluated with freshly prepared six test solutions. Intermediate precision was performed on a different instrument and different HPLC column. %RSD of assay values was calculated and results were within the 2.0% RSD. Figure-18 and 19 were represented the Cefixime, Ornidazole test sample and Cefixime, Moxifloxacin test sample chromatograms. Table-3 represented the precision and intermediate precision results.

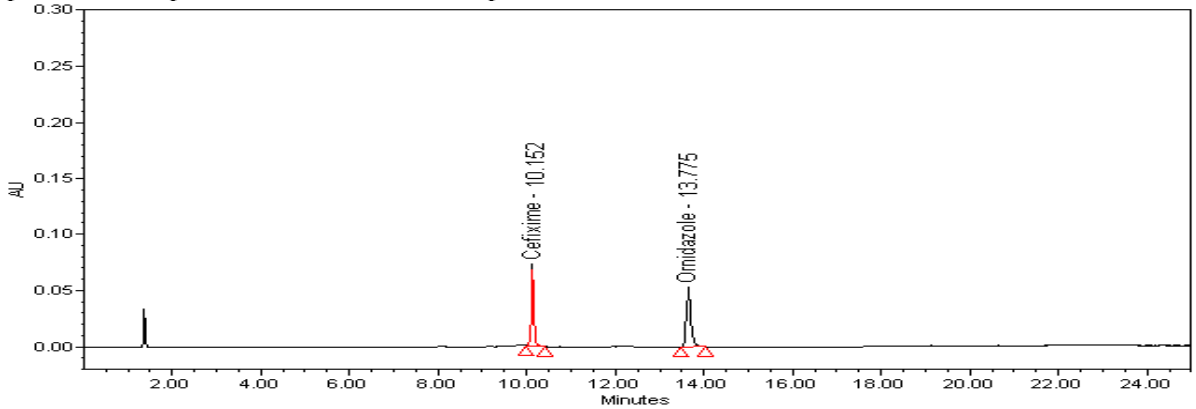

Fig.-18: Cefixime and Ornidazole Test Sample Chromatogram

Table-3: Precision and Intermediate Results

S. No.	Precision % Assay				Intermediate Precision % Assay			
	Cefi.	Orni.	Cefi.	Moxi.	Cefi.	Orni.	Cefi.	Moxi.
1	99.8	101.2	100.6	101.3	101.3	101.2	101.0	100.6
2	101.2	100.4	101.3	100.8	100.5	100.7	100.6	101.0
3	100.6	101.2	100.4	100.4	100.6	100.2	100.4	101.3
4	100.1	99.9	99.9	100.8	99.6	101.0	100.8	100.8
5	99.9	100.1	100.3	101.4	100.6	100.7	99.9	100.4
6	100.8	101.6	100.8	101.3	100.3	100.1	100.5	100.1
Average	100.4	100.73	100.5	101	100.48	100.65	100.5	100.7
% RSD	0.55	0.69	0.47	0.39	0.55	0.43	0.37	0.43

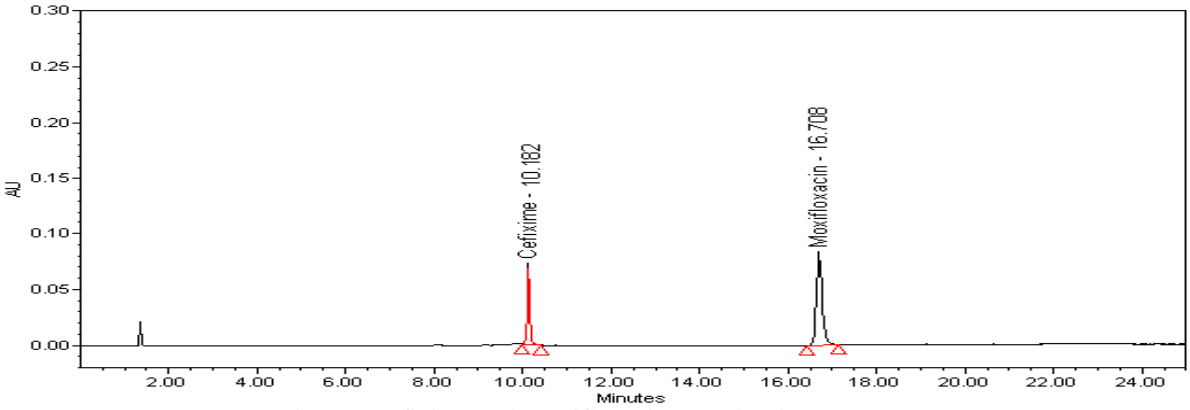

Fig.-19: Cefixime and Moxifloxacin Sample Chromatogram

Specificity

Specificity was performed to check the interference from blank, placebo, degradation studies. Acid, base, peroxide, thermal, UV and water stress study conditions were performed. Stress study conditions were listed in Table-4. Figure-20 to 31 were represented the all stress study conditions for both test samples like Cefixime – Ornidazole samples and Cefixime – Moxifloxacin samples.

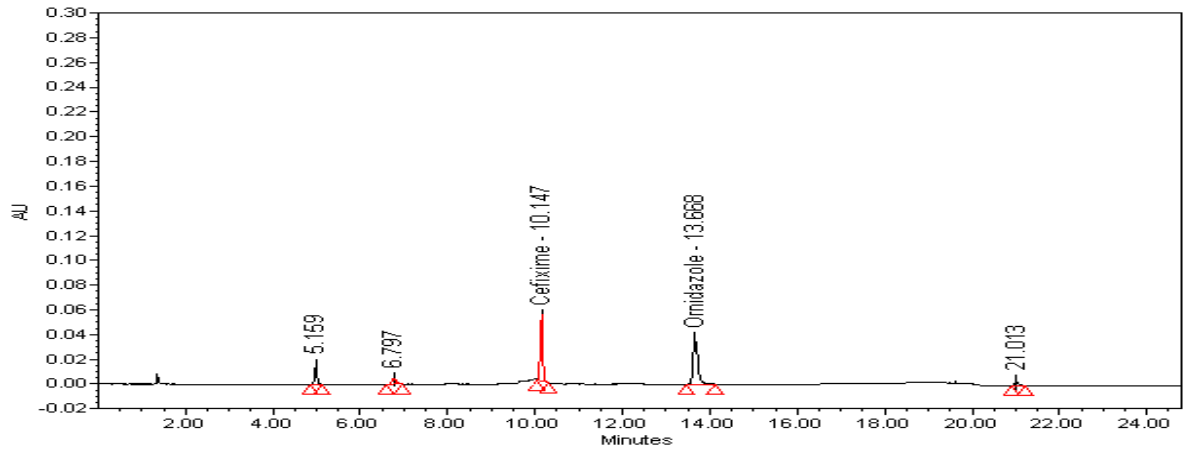

Fig.-20: Cefixime and Ornidazole Acid Stress Study Chromatogram

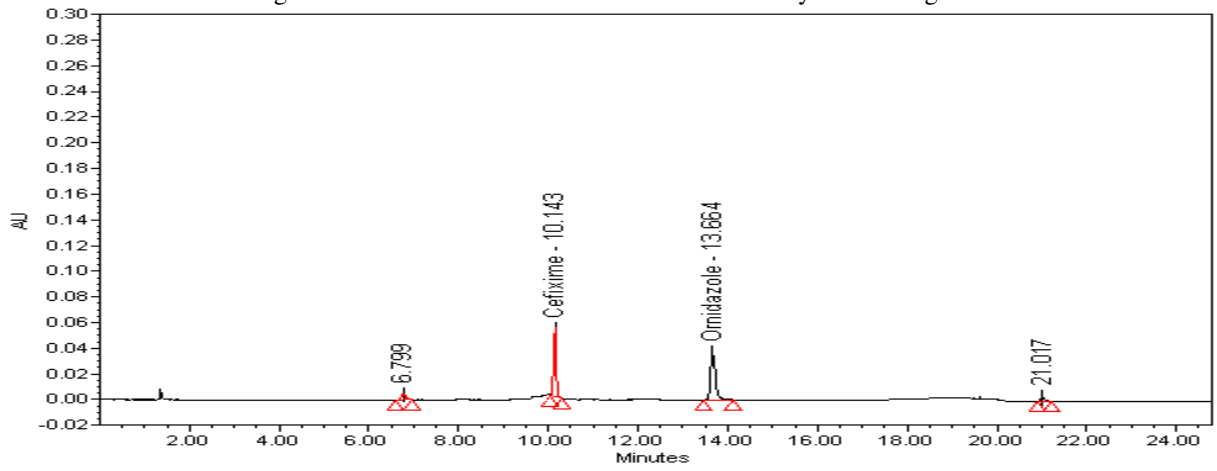

Fig.-21: Cefixime and Ornidazole Base Stress Study Chromatogram

Table-4: Specificity Stress Study Conditions

Cefixime Ornidazole Sample	Cefixime Moxifloxacin Sample
Acid stress/1N-60°C/60 minutes	Acid stress/1N-60°C/60 minutes

Base Stress/1N- 60°C/2 hrs	Base Stress/1N- 60°C/2 hrs
Peroxide stress/3%- 50°C/1 hrs	Peroxide stress/3%- 50°C/1 hrs
Water stress-60°C/3 hrs	Water stress-60°C/3 hrs
Thermal (80°C for 6 hrs)	Thermal (80°C for 6 hrs)
UV energy of 200-watt hrs/^{2}m	UV energy of 200-watt hrs/^{2}m

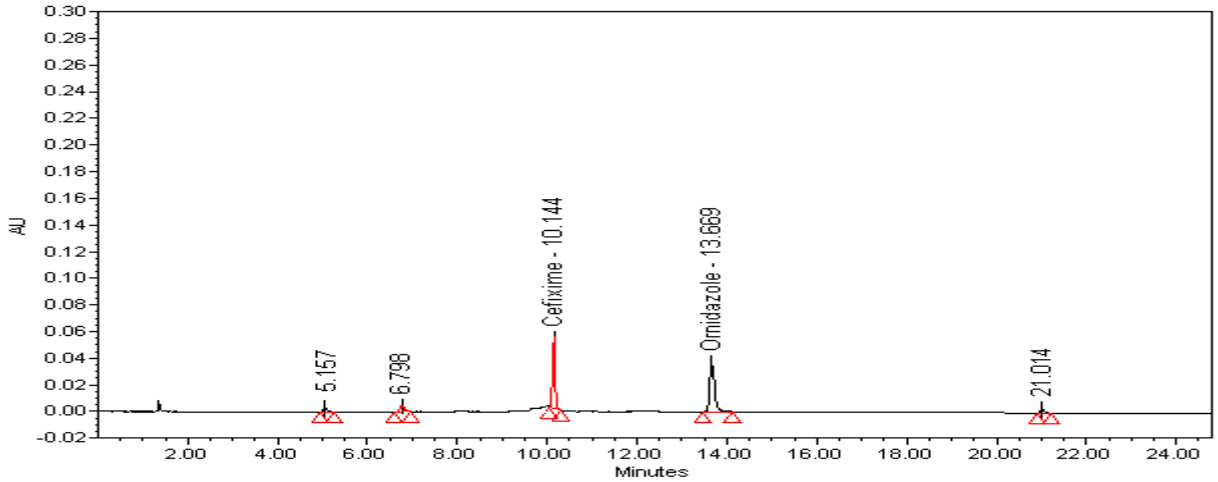

Fig.-22: Cefixime and Ornidazole Peroxide Stress Study Chromatogram

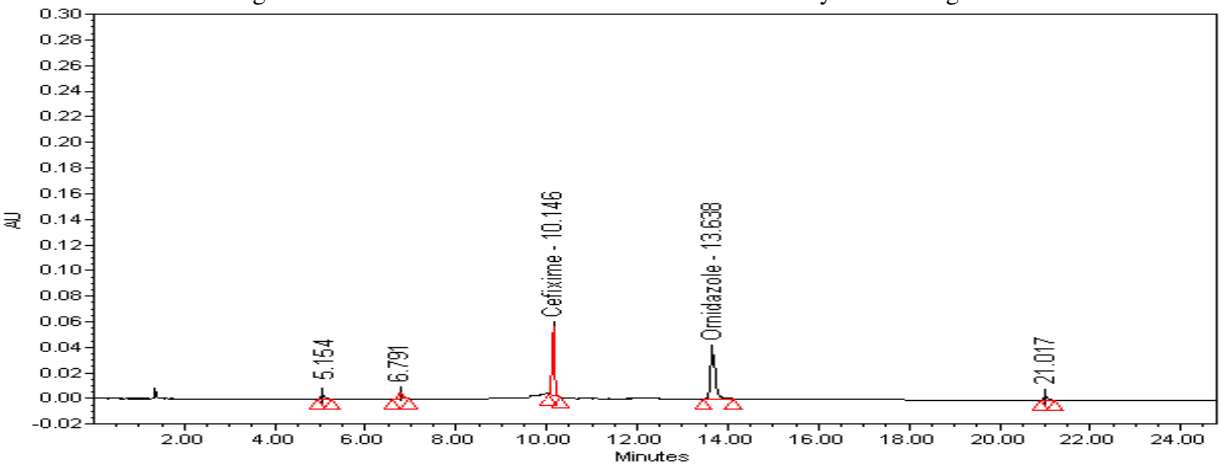

Fig.-23: Cefixime and Ornidazole Thermal Stress Study Chromatogram

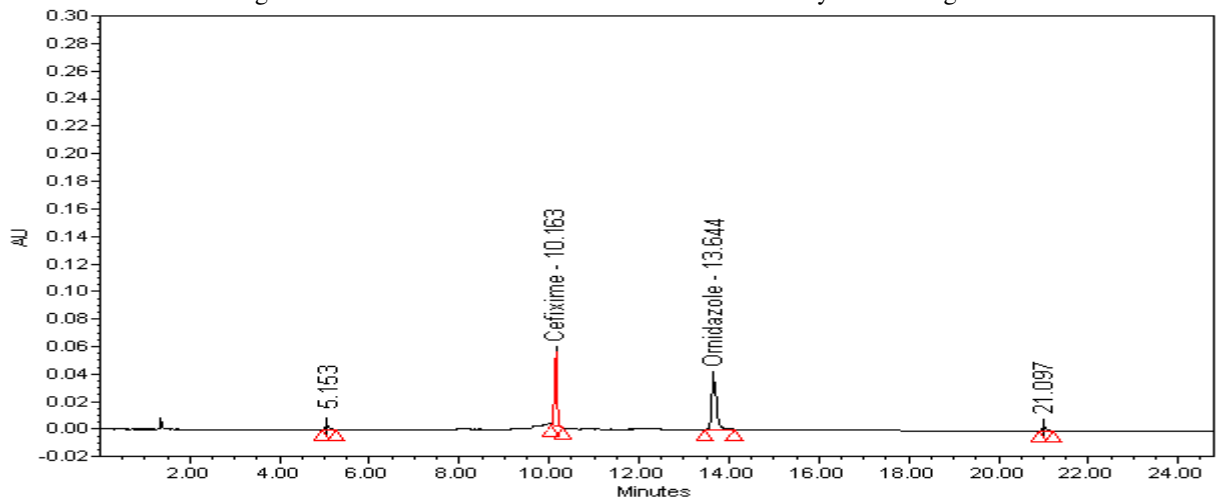

Fig.-24: Cefixime and Ornidazole UV Stress Study Chromatogram

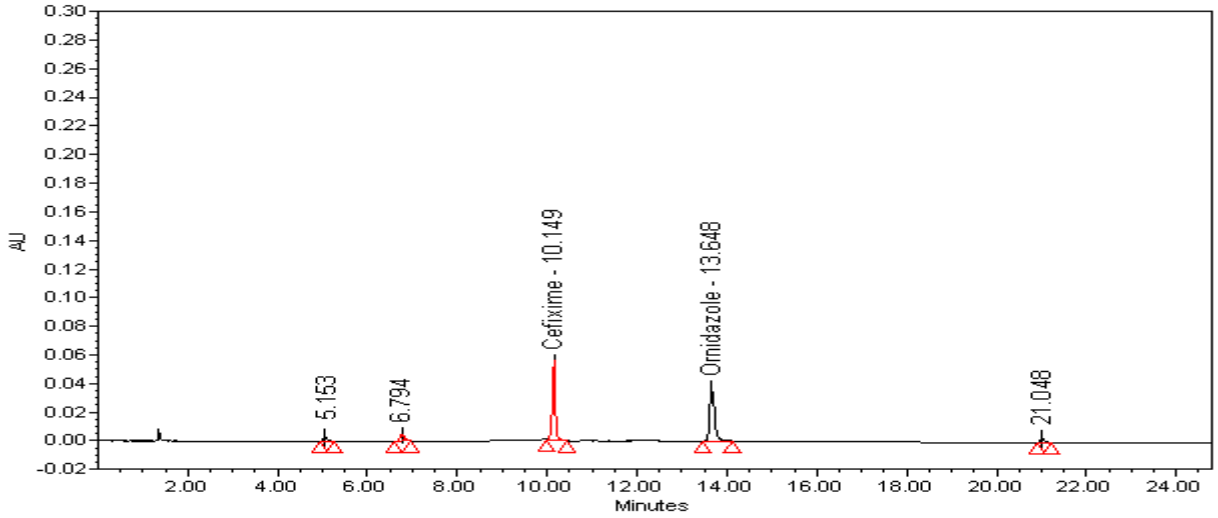

Fig.-25: Cefixime and Ornidazole Water Stress Study Chromatogram

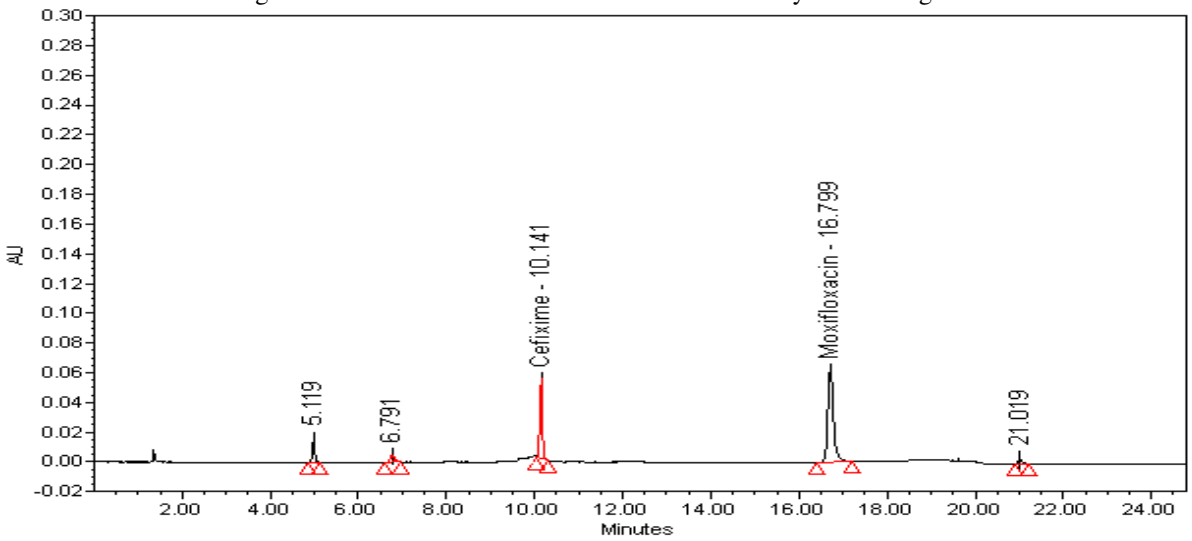

Fig.-26: Cefixime and Moxifloxacin Acid Stress Study Chromatogram

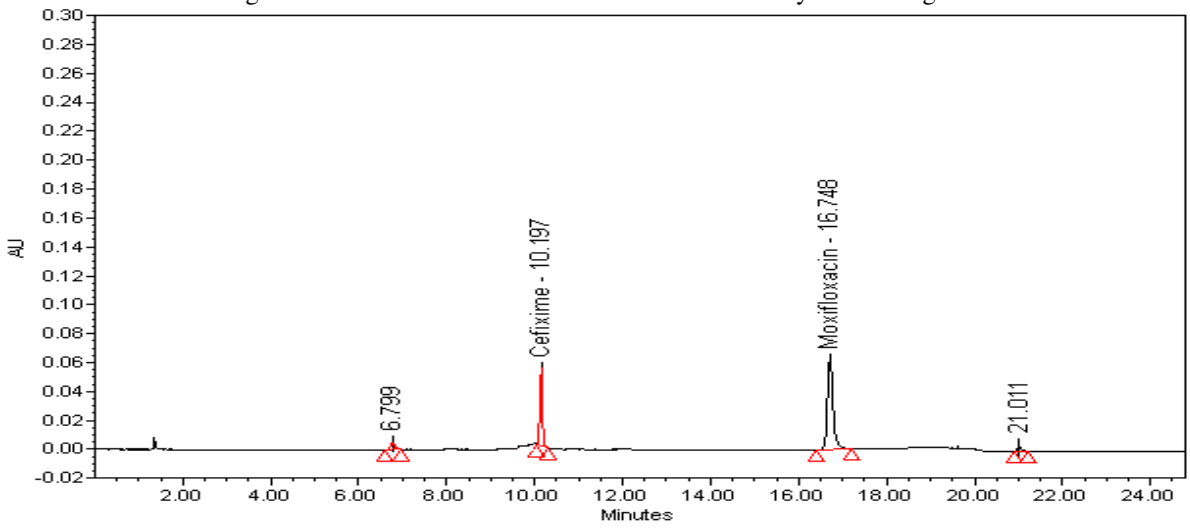

Fig.-27: Cefixime and Moxifloxacin Base Stress Study Chromatogram

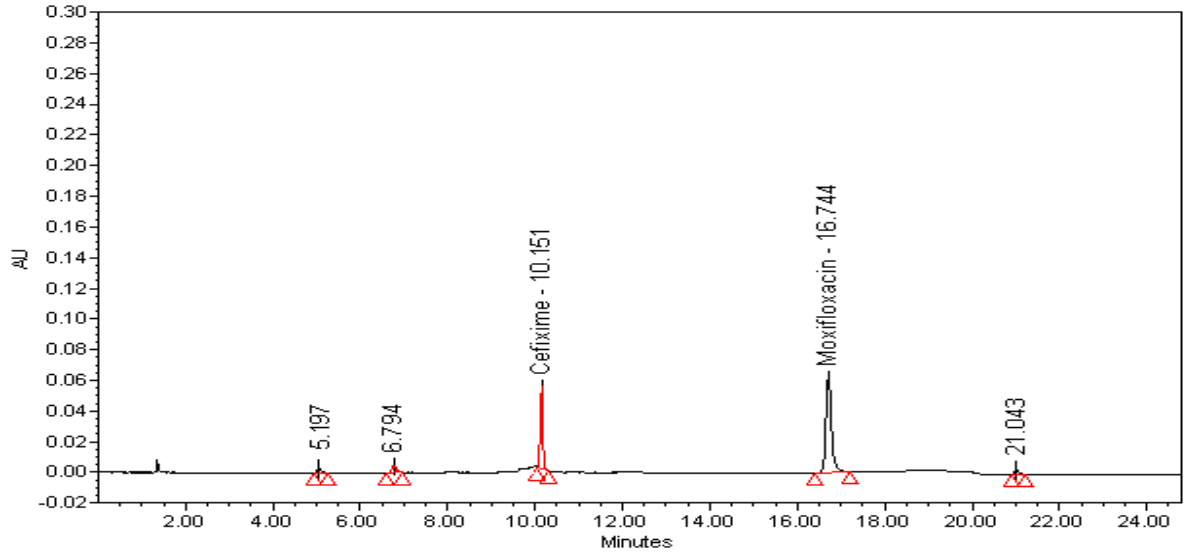

Fig.-28: Cefixime and Moxifloxacin Peroxide Stress Study Chromatogram

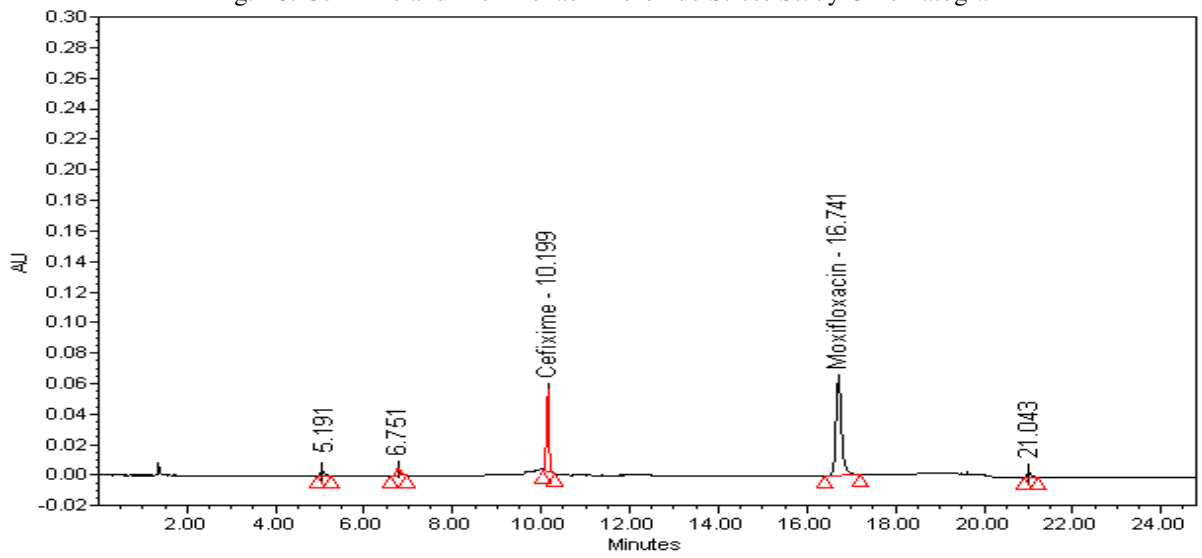

Fig.-29: Cefixime and Moxifloxacin Thermal Stress Study Chromatogram

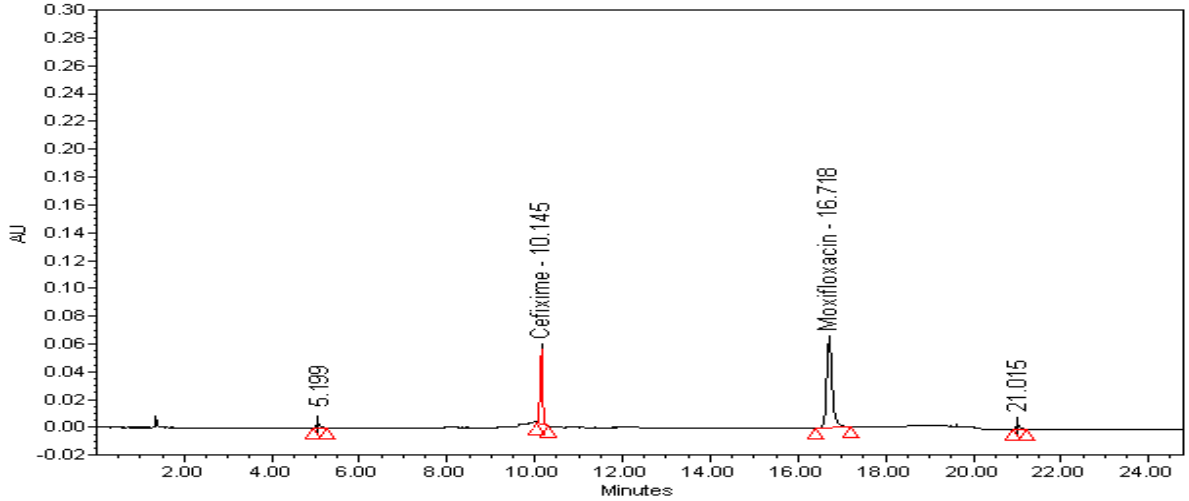

Fig.-30: Cefixime and Moxifloxacin UV Stress Study Chromatogram

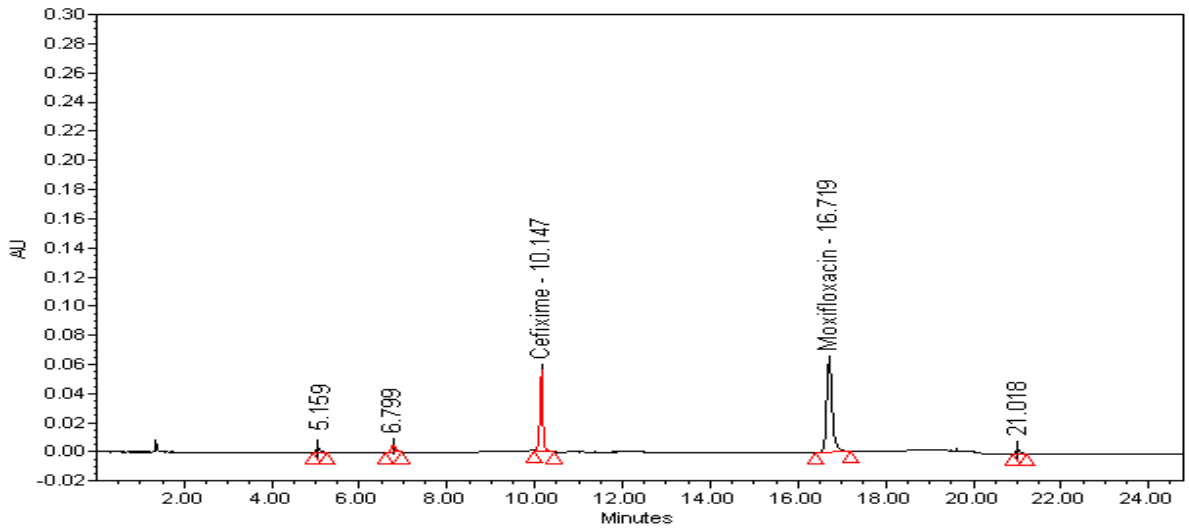

Fig.-31: Cefixime and Moxifloxacin Water Stress Study Chromatogram

Table-5: Specificity Results

Stress condition	Cefixime			Ornidazole			Moxifloxacin		
	Purity angle	Purity threshold	Pass/ fail	Purity angle	Purity threshold	Pass/ fail	Purity angle	Purity threshold	Pass/ fail
Acid	0.319	0.412	Pass	0.115	0.261	Pass	0.110	0.231	Pass
Base	0.301	0.431	Pass	0.101	0.271	Pass	0.124	0.246	Pass
Peroxide	0.261	0.494	Pass	0.132	0.259	Pass	0.125	0.263	Pass
Thermal	0.286	0.438	Pass	0.231	0.268	Pass	0.121	0.251	Pass
UV	0.291	0.461	Pass	0.142	0.246	Pass	0.191	0.235	Pass
Water	0.351	0.452	Pass	0.143	0.251	Pass	0.183	0.245	Pass

Table-6: Specificity Results

Peak RT (min)	Cefixime and Ornidazole samples degradation					
	Acid	Base	Peroxide	Thermal	UV	Water
5.1	1.45	NA	1.36	1.30	1.40	1.34
6.7	1.61	1.50	1.42	1.41	NA	1.40
21.0	1.30	1.43	1.38	1.46	1.39	1.43
Cefixime and Moxifloxacin samples degradation						
5.1	1.43	NA	1.39	1.39	1.40	1.29
6.7	1.29	1.38	1.40	1.42	NA	1.40
21.0	1.38	1.42	1.46	1.40	1.39	1.38

Linearity

Linearity was performed with freshly prepared different linearity level solutions. 50%, 75%, 100%, 125% and 150% linearity solutions were prepared and performed the linearity as per the ICH Q2 guidance documents. Figure-32 has represented the linearity overlay chromatograms. Figure-33 to 35 were represented the linearity graphs for Cefixime, Ornidazole, Moxifloxacin. Table-7 represented the linearity results.

Table-7: Linearity results

Linearity level	Cefixime		Ornidazole		Moxifloxacin	
	Conc.	Area	Conc.	Area	Conc.	Area
50%	10.2	89910	10.1	44521	10.1	113691

75%	15.1	183236	15.2	119650	15.0	225314
100%	20.1	286504	20	199672	20.2	363722
125%	25.3	395681	25.1	289631	25.3	492540
150%	30.2	505610	30.1	380124	30.0	625214
Correlation Coefficient.	0.99959		0.99919		0.99945	

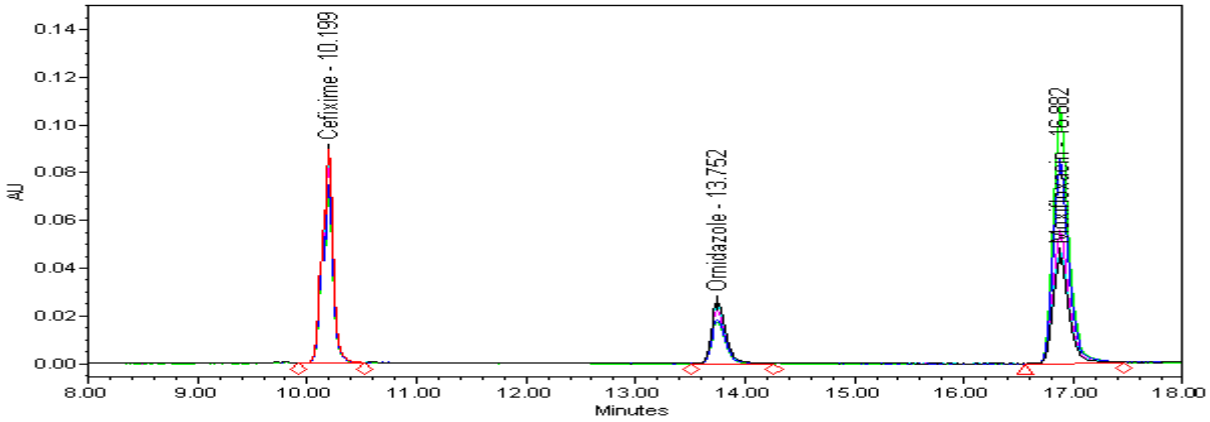

Fig.-32: Linearity Overlay Chromatogram

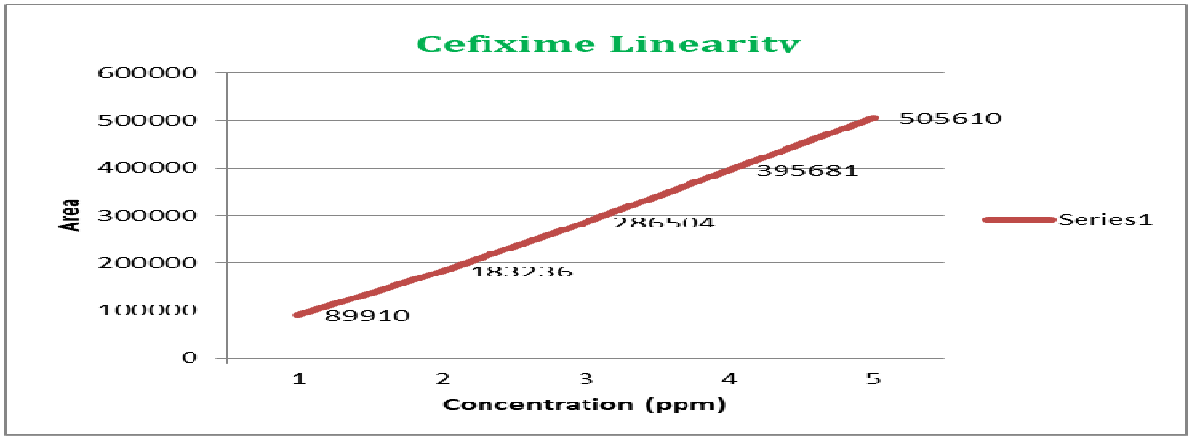

Fig.-33: Cefixime Linearity Graph

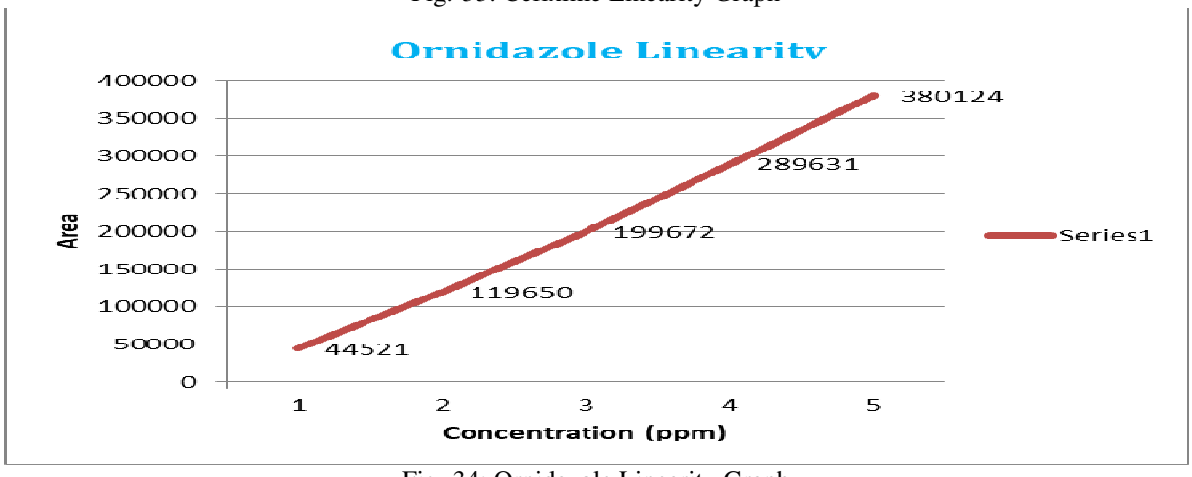

Fig.-34: Ornidazole Linearity Graph

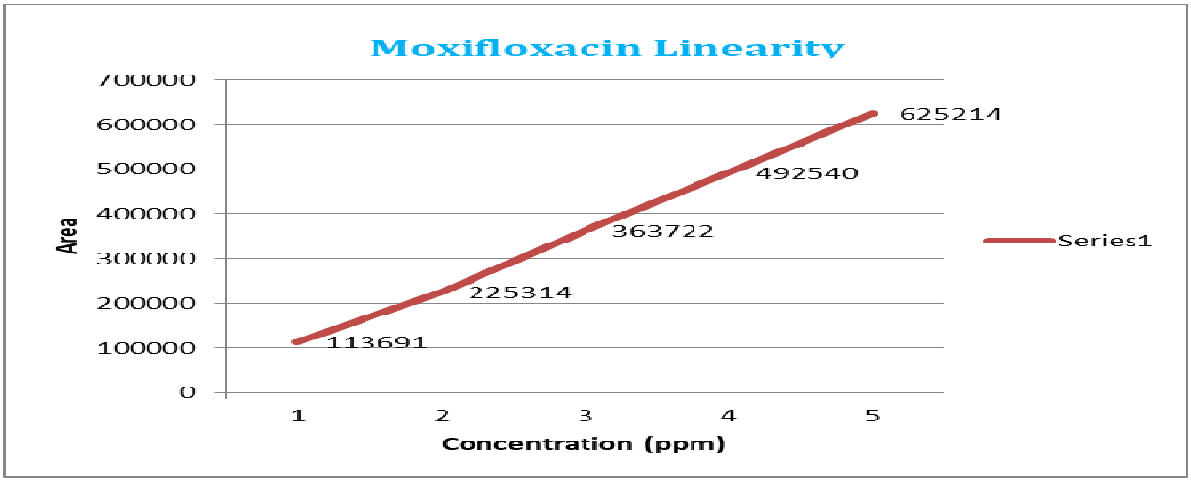

Fig.-35: Moxifloxacin Linearity Graph

Accuracy

Accuracy parameter was performed with 50%, 75%, 100%, 125% and 150% accuracy levels. 50% and 150% levels were performed with six replicate preparations and the remaining 75%, 100% and 125% were performed with three replicate preparations. Recovery results were calculated and found to be within the acceptable limits 98% to 102%. Table-7 represented the accuracy results.

Table-7: Accuracy Samples Preparations and Recovery Results

Recovery level	Sample Prepn.	Cefixime Recovery		Ornidazole Recovery		Moxifloxacin Recovery	
		% Recovery	Mean recovery/ %RSD	% Recovery	Mean recovery/ %RSD	% Recovery	Mean recovery/ %RSD
50%	1	99.6	100.31/0.55	100.3	100.30/0.47	100.2	100.40/0.51
	2	101.2		99.7		101.3	
	3	100.3		101.0		100.4	
	4	100.5		100.3		99.9	
	5	99.9		100.6		100.0	
	6	100.4		99.9		100.6	
75%	1	100.8	101.06/0.30	100.7	100.36/0.35	100.1	100.60/0.46
	2	101.0		100.0		100.7	
	3	101.4		100.4		101.0	
100%	1	99.9	100.26/0.40	100.6	100.63/0.35	100.4	100.46/0.60
	2	100.2		101.0		101.1	
	3	100.7		100.3		99.9	
125%	1	101.0	100.43/ 0.55	100.6	100.63/0.35	100.3	100.06/0.21
	2	100.4		100.3		100.0	
	3	99.9		101.0		99.9	
150%	1	100.3	100.48/0.37	99.9	100.16/0.44	100.4	100.28/0.32
	2	101.0		100.3		99.9	
	3	100.7		101.0		100.3	
	4	100.6		100.1		100.8	
	5	100.4		99.9		100.0	
	6	99.9		99.8		100.3	

Ruggedness

Ruggedness was performed for standard and sample solutions at refrigerator and room temperature conditions. Initially prepared two samples were kept at refrigerator and room temperature and performed the analysis at 12 hr and 36 hrs. Table-8 represented the solution stability results.

Table-8: Sample Solution Stability Results

Room Temperature								
Time interval	Cefixime Ornidazole Sample				Cefixime Moxifloxacin Sample			
	Cefixime		Ornidazole		Cefixime		Moxifloxacin	
	% Assay	% Diff.	% Assay	% Diff.	% Assay	% Diff.	% Assay	% Diff.
Initial-1	100.8	NA	100.0	NA	100.6	NA	99.9	NA
Intial-2	100.2		100.2		100.3		100.1	
12 hrs-1	100.2	0.6	100.4	-0.4	100.9	-0.3	100.3	-0.4
12 hrs-2	100.4	-0.2	100.8	-0.6	100.0	0.3	100.6	-0.5
36 hrs-1	101.1	-0.3	101.0	-1.0	100.4	0.2	100.0	-0.1
36 hrs-2	100.5	-0.3	100.6	-0.4	100.6	-0.3	100.5	-0.4

Robustness

Robustness was evaluated for mobile phase flow rate, column oven temperature variations. System suitability results were calculated and results were within the acceptable limits. Table-9 represented the robustness results.

Table-9: Flow Rate Variation, Temperature Variation System Suitability Results

Variation	Robust Parameters		RT (min)	5 inj. Area %RSD	USP Plate Count avg.	USP Tailing avg.
Flow Variation	Actual (1.0ml/min)	Cefi.	10.14	0.32	5681	1.12
		Orni.	13.60	0.25	5490	1.01
		Moxi.	16.70	0.21	5389	1.10
	Low (0.9ml/min)	Cefi.	10.23	0.40	5709	1.30
		Orni.	13.81	0.34	6100	1.41
		Moxi.	16.91	0.29	6081	1.13
	High (1.1ml/min)	Cefi.	9.95	0.32	5937	1.10
		Orni.	12.96	0.41	5890	1.15
		Moxi.	16.01	0.29	5687	1.31
Column Oven Temp.	Low 25°C	Cefi.	10.42	0.31	5909	1.25
		Orni.	13.91	0.28	6012	1.01
		Moxi.	16.98	0.43	6081	1.15
	High 35°C	Cefi.	10.10	0.40	5964	1.12
		Orni.	13.25	0.36	5937	1.32
		Moxi.	16.34	0.30	6106	1.30

CONCLUSION

Cefixime, Ornidazole and Moxifloxacin three components doesn't have the single HPLC method. Our objective was achieved with simple RP-HPLC method for the determination of three components in the single method. Optimized method was validated as per the ICH Q2 guidance with precision, accuracy, linearity, specificity, ruggedness and robustness. Validation parameters results found to be good and within the acceptable results. Hence, this method can be considered as stability indicating and used for routine quality evaluation of medicinal products.

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