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Review

# Stability Indicating method for Estimation of Mefloquine Hydrochloride in Pharmaceutical Formulation

**Smithhaa Mohod[1]*, Pranjal Wankhede[2], Vishesh Mohod[3], Saurav Kumar[4]**

[1]*Department of pharmaceutical Chemistry,S.V.P college of pharmacy, Hatta, Dist- Hingoli, Maharashtra, India-431705*

[2]*Emcure Pharmaceutical Ltd A-301,3rd Floor Ganga Osian Square, Wakad, Pune Maharashtra, India 411057*

[3]*Zim Laboratories limited, Kalmeshwar, Nagpur, Maharashtra, India – 441501*

[4]*Innovative college of Pharmacy, Greater Noida, Uttarpradesh, India 201308*

***Corresponding Author:***
*Smithhaa Mohod*

***Email:*** *NA*

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**Abstract:** A simple, selective, rapid, precise and accurate reverse phase high pressure liquid chromatogram method has been developed and validate stability indicating RP-HPLC method for the estimation of Mefloqine hydrochloride in pharmaceutical formulations. Used developed and validate Hplc method for force degradation study. On the basis of reversed phase -HPLC mode (analyte) stationary phase with C18 bonded phase I.e waters symmetry c18 ,250 mm x 4.6 mm,5u was selected .Column with mobile phase consisting of 1.5 gm of sodium hydrogen sulphate mono hydrate(25) and 75 ml of methanol ,Detection was carried out at 280 nm and flow rate was 0.7 ml/Min .The developed method was validated for linearity accuracy, precision, selectivity, specificity, forced degradation studies, robustness ruggedness. By using the develop and validate RP- hplc method expedient study was carried out which is necessary in this case because the concentration of drug in the tablet formulation is very less than the other exciepients.

**Keywords**: Mefloquine Hydrochloride, Rp -Hplc

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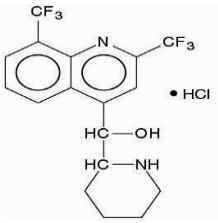
## Introduction:

Mefloquine Hydrochloride 4-Quinoline methanol,α-2-piperidinyl-2-8-bis(trifluoromethyl)- monohydrochloride, (R*,R*)-(±)-DL- erythro-α-2-piperidyl-2-8-bis (trifluoromethyl)-4- quinoline methanolmonohydrochloride. Methanolmonohydrochloride is an antimalarial agent.

It is having molecular formula $C_{17}H_{16}F_6N_2O$. HCl. It is soluble in lower alcohol( methanol, ethanol), dimethylformamide, methyl acetate, sparingly soluble in isopropanol, slightly soluble in in water. Mefloquine hydrochlorode is white to almost white crystalline powder .

A recent literature survey revealed that few methods are developed and validated for the Mefloquine hydrochloride. The present work describes development and validation in compliance with ICH guidelines .

**Mefloquine hydrochloride**




## Experimental

**Chemials and Reagents :**

Mefloquine hydrochloride used as reference standard was provided by Mission viva care, Pithampur,India. And was used without further purification.Methanol (Hplc grade) and sodium hydrogen sulphate mono-hydrate were purchased from Merck (Mumbai,India) . The water used was double glass distilled and membrane filtered HPLC grade water.Tablets of MFQH of brand name CANFAL 250mg (claimed to contain MFQH 250mg) manufactured by Lupin Pharmaceutical Ltd,India and placebo,prepared at Mission VIvacareLtd,R &D Department pithampur ,MP,India.

The MFQH Related substance-A ((R,S)-[2,8 bis (trifluromethyl) quinoline-4yl][(2R,S)-Piperidine- 2yl] methanol hydrochloride. Related substance -B ((R,S)-[2,8-bis(trifluromethylquinoline-4-yl] [[pyridine-2-yl]methanol and Related substance-C ((R,S)-[2,8-bis(trifluromethylquinoline-4-yl] [[pyridine-2-yl)methanone) were provided by Mission viva care Ltd,Pithampur,MP,India.

**Material and Methods:**

**Mobile phase**

Filtered and degassed mixture of buffer and methanol was prepared in the ratio of 25:75 were buffer was (1.5gm of sodium hydrogen sulphate mono hydrate in1000ml of water used and 0.45 µ nylon filter paper was used.

Chromatographic Conditions:

On the basis of reversed phase HPLC mode and number of carbon present in the molecule( analyte) stationary phase with C18 bonded phase i.e Waters Symmetry C18 250 mm x4.6mm,5µ was selected. Photo diode array detector was selected ,280 nm wavelength were selected as detection wavelength. The flow rate was 0.7ml/Min , and injection volume 10µl and at 25º C column temprature and run time 25 minutes.

Standard preparation :

Standard stock solution was prepared by dissolving 50 mg of MFQH reference standard to a 50 ml volumetric flask and dissolved and dilute up to the mark with diluent .pipette out 5ml of above solution in volumetric flask and make up volume with diluent

Assay procedure for commercial formulations :/

Twenty tablets were weighted and crushed to fine powder in to 50 ml volumetric flask ,mobile phase were added and sonicated until tablets were dissolved and kept aside to achieve at room temperature and made up volume with diluent . further diluted 5 ml of above solution and transfer to 50 ml of volumetric flask and made-up the volume with diluent .

Procedure: 10µl of standard preparation and sample preparation were separately injected and the chromatogram were recorded.

Linearity and Range :

The result of the method was found to be linear in the range of 50µg/ml to 150 µg/ml of MFQH and the peak areas recorded for all peaks and plotted peak verses concentration. Coefficient of correlation for MFQH was 0.9995.

.Results of linearity study are shown in Table 1 and Figure 1

Table 1: Results for Linearity Study

| Linearity Level | Standard Concentration | Concentration of MFQH (ppm) | Mean area (n = 3) | Regression Coefficient ($r^2$) |
|---|---|---|---|---|
| Level – 1 | 50% | 50 | 1852527 | 0.9995 |
| Level – 2 | 80% | 80 | 3051177 | |
| Level – 3 | 100% | 100 | 3705053 | |
| Level – 4 | 120% | 120 | 4389845 | |
| Level – 5 | 150% | 150 | 5557580 | |

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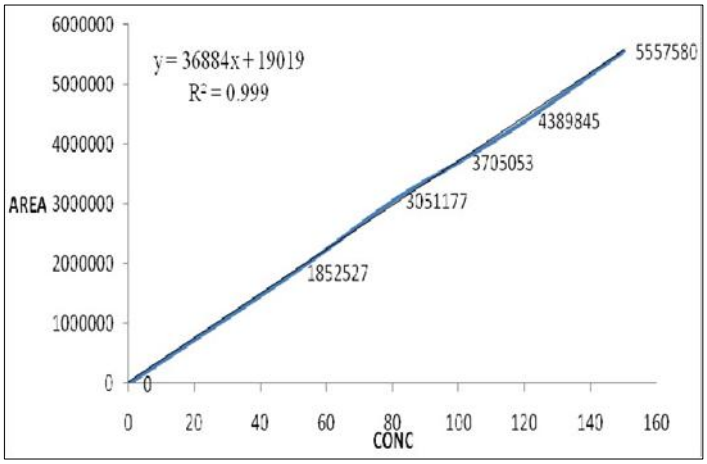


**Figure 1 Linearity of MFQH**

**Accuracy:**

The accuracy of the method was determined by recovery experiments. The recovery studies were carried out at the three levels of 50,100,and 150 % and percentage recovery were calculated and presented in the Table no 2 .

Recovery was within range of 100 ±2% which indicates accuracy of the methods standard and sample solutions.

**Precision :**

The accuracy of the method was demonstrated by interday and intraday version studies. The intra day studies 3 repeated injections of standard solutions were made in a day and the response of the factor of the drug peaks and percentage. RSD were calculated and found to not more than 0.12% of MFQH . In the inter day variations studies 3 repeated injections standard and sample solution were made on 3 consecutive days and response of the factor of drug peaks and percentage RSD were calculated and found not more than 0.24 %of MFQH . The data obtained indicates that the developed method is precise.

Results of accuracy study shown in **Table 02**

**Table2: Results for Recovery Studies**

| Level | Preparation | Amount Added (mg) | Amount Found (mg) | % Recovery | Mean % Recovery | % RSD |
|---|---|---|---|---|---|---|
| 50 % | Preparation-1 | 24.97 | 25.01 | 100.2 | | |
| | Preparation-2 | 25.01 | 25.00 | 100.0 | | |
| Level | Preparation-3 | 25.05 | 25.03 | 99.9 | 100.0 | 0.15 |
| 100 % | Preparation-1 | 50.12 | 48.53 | 96.8 | 97.0 | 0.26 |
| | Preparation-2 | 50.01 | 48.66 | 97.3 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Level | Preparation-3 | 49.86 | 48.38 | 97.0 | | |
| 150 % Level | Preparation-1 | 75.07 | 73.52 | 97.9 | 98.1 | 0.75 |
| | Preparation-2 | 74.98 | 74.13 | 98.9 | | |
| | Preparation-3 | 75.02 | 73.08 | 97.4 | | |

**Method Precision (Repeatability):**

Results of repeatability study shown in Table 3.

**Table 3: Results of Method Precision**

| **Sample Preparation** | **% Assay of MFQH** |
|---|---|
| Test solution -1 | 99.67 |
| Test solution -2 | 99.59 |
| Test solution -3 | 99.55 |
| Test solution -4 | 99.38 |
| Test solution -5 | 99.48 |
| Test solution -6 | 99.69 |
| **Mean** | **99.56** |
| **SD** | **0.12** |
| **% RSD** | **0.12** |

**Intermediate Precision (Ruggedness):**

**Results of ruggedness study are shown in Table 4.**

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**Table 4: Results for Intermediate Precision**

| Analysis performed during method precision study<br>Analyst: Analyst-I HPLC ID No.: EAR040<br>Make : Waters Symmetry, C18, 250 mm □ 4.6 mm, 5 □<br>Column serial number. : 0402471K | |
|---|---|
| **Sr. No.** | **% Assay of MFQH** |
| **Test solution-1** | 99.67 |
| **Test solution-2** | 99.59 |
| **Test solution-3** | 99.55 |
| **Test solution-4** | 99.38 |
| **Test solution-5** | 99.48 |
| **Test solution-6** | 99.69 |
| Analysis performed during intermediate precision study | |

| Analyst: Analyst-II HPLC ID No.: EAR039<br>Make : Waters Symmetry, C18, 250 mm □ 4.6 mm, 5 □<br>Column serial number : 0502481L | |
|---|---|
| **Test solution-1** | 99.44 |
| **Test solution-2** | 99.56 |
| **Test solution-3** | 100.05 |
| **Test solution-4** | 99.42 |
| **Test solution-5** | 99.64 |
| **Test solution-6** | 99.83 |
| **Mean of twelve samples** | **99.66** |
| **SD** | **0.24** |
| **% RSD** | **0.24** |

**Robustness:**

Results of robustness study are shown in **Table 05 to 17**.

**Table 5: Result for Flow rate 0.63 mL/min.**

| **Parameter** | **Test Solution** | **%Assay for MFQH** |
|---|---|---|
| Method Precision | 1 | 99.67 |
| | 2 | 99.59 |
| | 3 | 99.55 |
| | 4 | 99.38 |
| | 5 | 99.48 |
| | 6 | 99.69 |

| | | |
|---|---|---|
| Change in flow rate 0.63 mL/ min. | 1 | 99.65 |
| | 2 | 99.38 |
| **Mean** | | **99.55** |
| **SD** | | **0.12** |
| **% RSD** | | **0.12** |

**Table 6: Results for Flow rate 0.77 mL/min.**

| **Parameter** | **Test solution** | **%Assay for MFQH** |
|---|---|---|
| | 1 | 99.67 |
| | 2 | 99.59 |
| | 3 | 99.55 |
| | 4 | 99.38 |
| | 5 | 99.48 |
| | 6 | 99.69 |
| | 1 | 99.21 |
| | 2 | 98.99 |
| **Mean** | | **99.44** |
| **SD** | | **0.24** |
| **% RSD** | | **0.24** |

**Table 7: Results for Wavelength 278**

| **Parameter** | **Test solution** | **%Assay for MFQH** |
|---|---|---|
| Method Precision | **1** | 99.67 |
| | **2** | 99.59 |
| | **3** | 99.55 |
| | **4** | 99.38 |
| | **5** | 99.48 |
| | **6** | 99.69 |

| | | |
|---|---|---|
| Change in wavelength 278 nm. | **1** | 98.47 |
| | **2** | 97.65 |
| **Mean** | | **99.18** |
| **SD** | | **0.69** |
| **% RSD** | | **0.69** |

**Table 8: Results for Wavelength 282 nm.**

**4.2.3 Specificity:**

Specificity is the ability to assess unequivocally the analyte in the presence of components which may be expected to be present. Typically these might include impurities, degradents, matrix,etc.
Lack of specificity of an individual analytical procedure may be compensated by other supporting analytical procedure.

**Selectivity:**

**Placebo solution preparation:**

Prepared blank preparation, prepared placebo preparation, standard preparation, sample preparation for MFQH 250 mg tablet, related compound solution A, B, C and related compound spiked sample solution as per the method.
Weighed accurately 254 mg of placebo and transfer it into 50 mL volumetric flask add about 10 mL of diluent, sonicate at for about 10 min with intermittent shaking, keep to achieve room temperature make up the volume with diluent. Pipette out 5 mL of the above solution and transfer to 50 mL volumetric flask and make up the volume with diluent.

**Force degradation:**

Forced degration study was performed on placebo blend and MFQH tablet 250 mg. The degration study was carried out as per the tabulated below table

**Table 9: Forced Degradation Conditions**

| Sr. No. | Stress Study | Degrading Agents | Exposure Period |
|---|---|---|---|
| 1 | Acid Degradation | 5N HCl (5mL) | 60°C for 4 h |
| 2 | Base Degradation | 5N NaOH (5mL) | 60°C for 4 h |
| 3 | Oxidative Degradation | 50% $H_2O_2$ (5mL) | 60°C for 4 h |
| 4 | Heat Degradation (Solid state) | - | 60°C for 4 h |

**Stability Indication Method For Estimation Of Mefloquine Hydrochloride In Pharmaceutical formulation .**

| Sr. No. | Stress Study | Degrading Agents | Exposure Period |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 5 | Heat Degradation (Solution state) | - | 60°C for 4 h |
| 6 | Humidity Degradation | - | 75% RH for 4 h |
| 7 | Photolytic Degradation | UV/visible Light | 6 day |

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Peak purity is demonstrated by comparing purity angle with purity threshold .peak is considered as to be pure and purity criteria threshold which implies method to be specific. The peak due to the degradation product of placebo blend and MfQH tablet 250mg are found to be well resolved from MFQH peak , hence it is concluded that method is specific.
The peak due to degardation products of placebo blend and MFQH tablet 250 mg are found to be well resolved from the MFQH peak . Hence it is concluded that the method is specific.

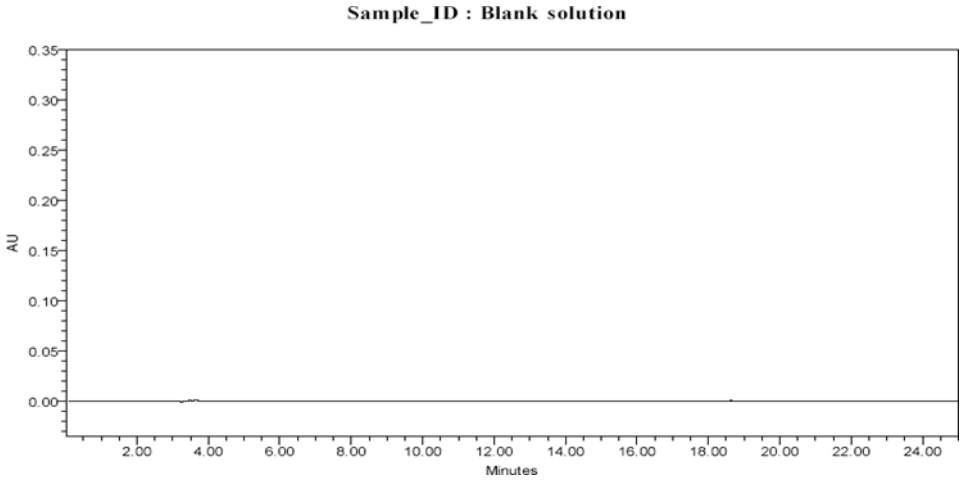


**Figure 2 Chromatogram of Blank**

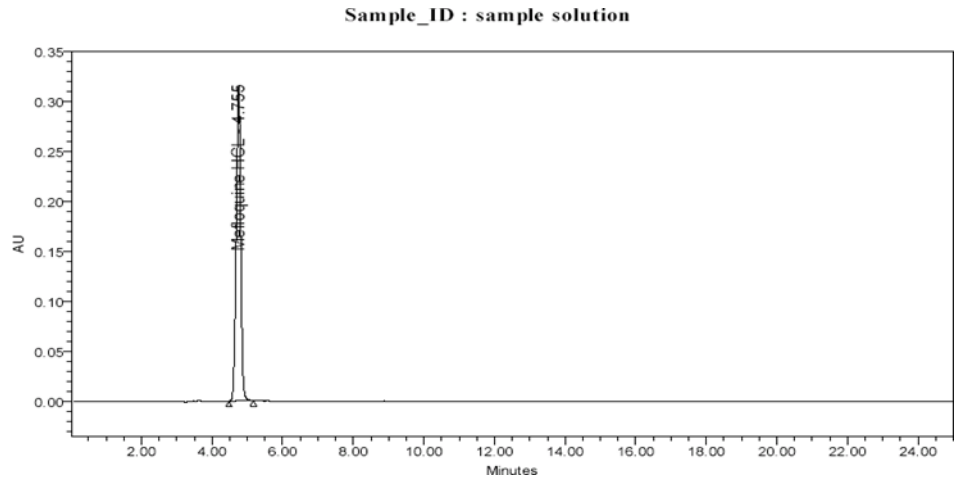

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**Figure 3Chromatogram of MFQH Sample Solution**

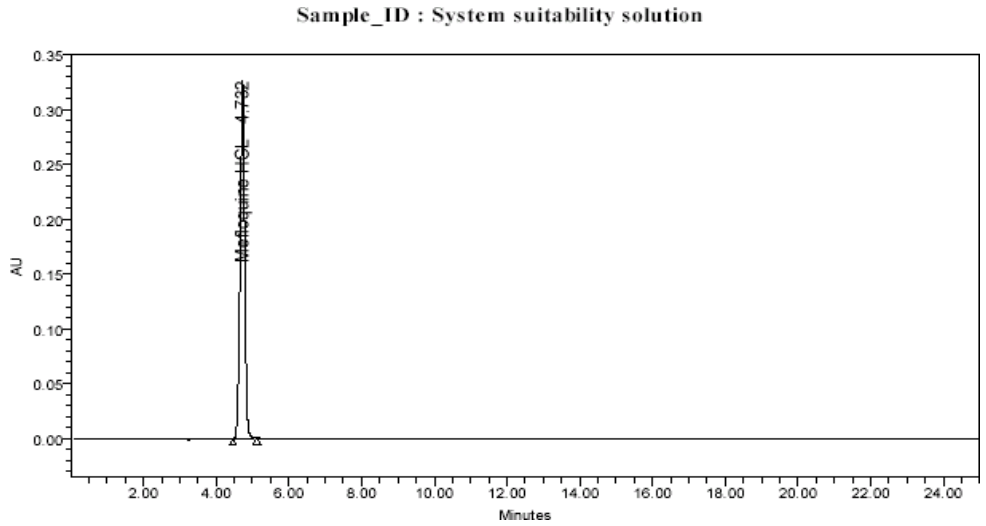


**Figure 4 Chromatogram of MFQH Test Solution**

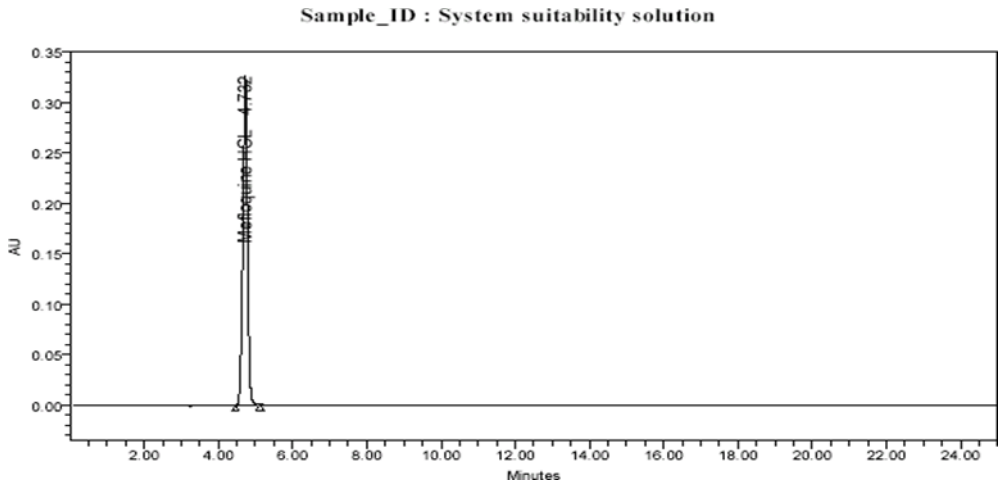


**Figure 5 Chromatogram of MFQH Test Solution II**

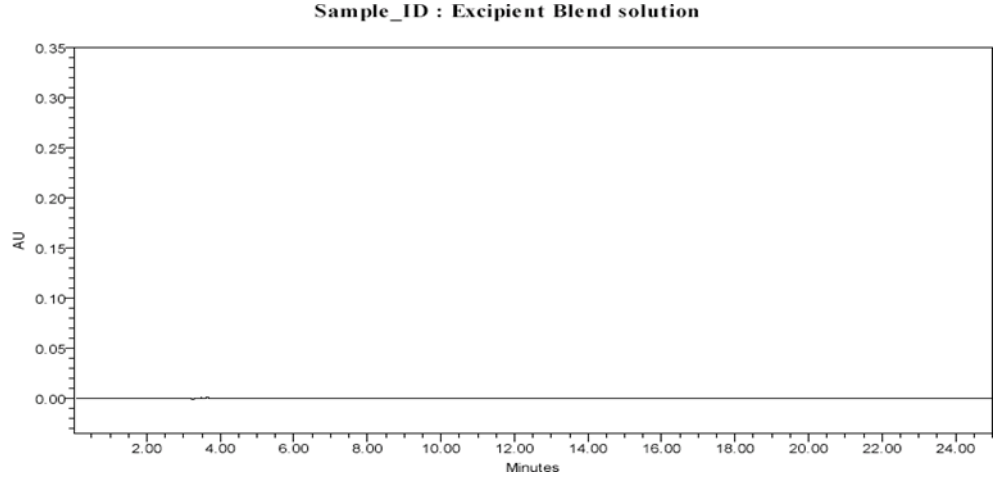

**Figure 6 Chromatogram of Placebo Solution**

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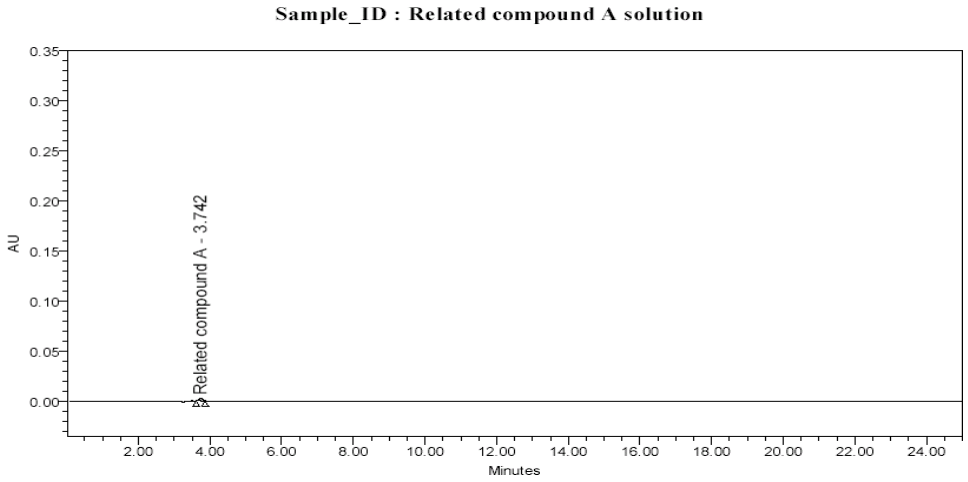


**Figure 7 Chromatogram of Related Compound-A**

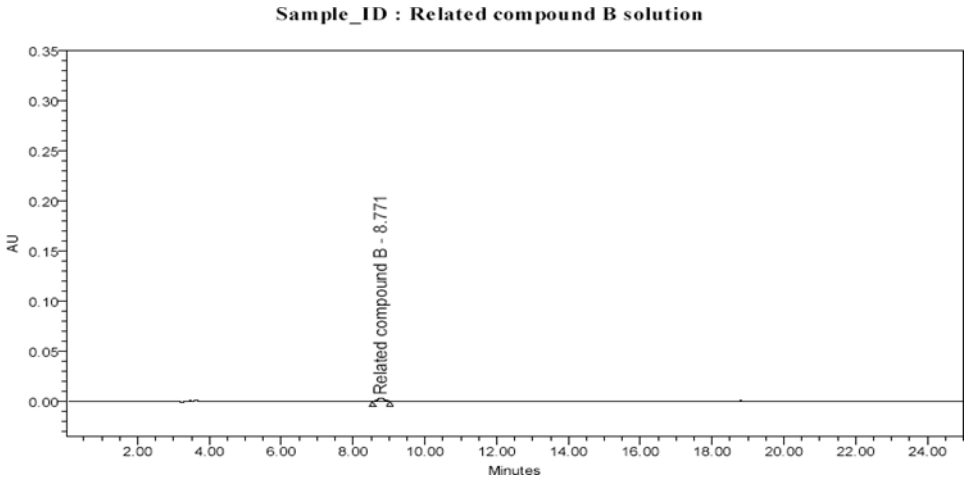


Figure 8 Chromatogram of Related Compound-B

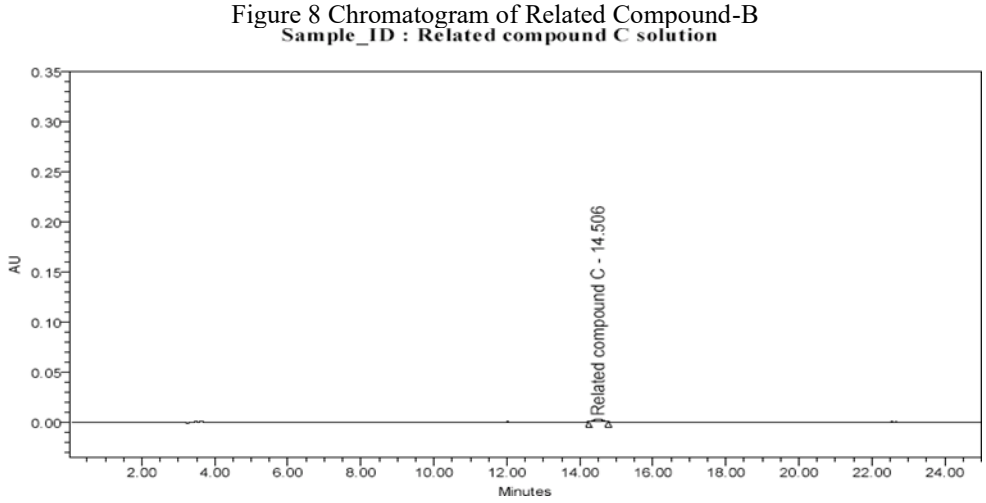


Figure 9 Chromatogram of Related Compound

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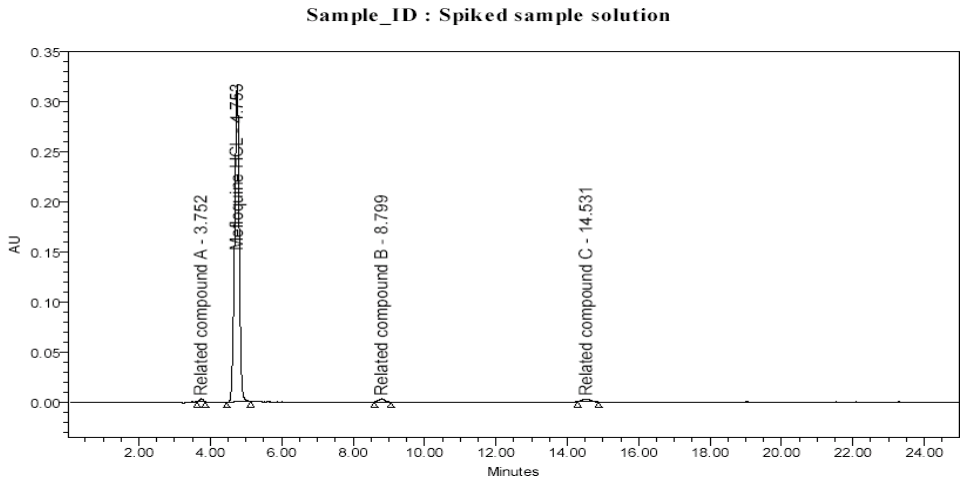


**Figure 10 Chromatogram of Spiked MFQH Sample Solution**

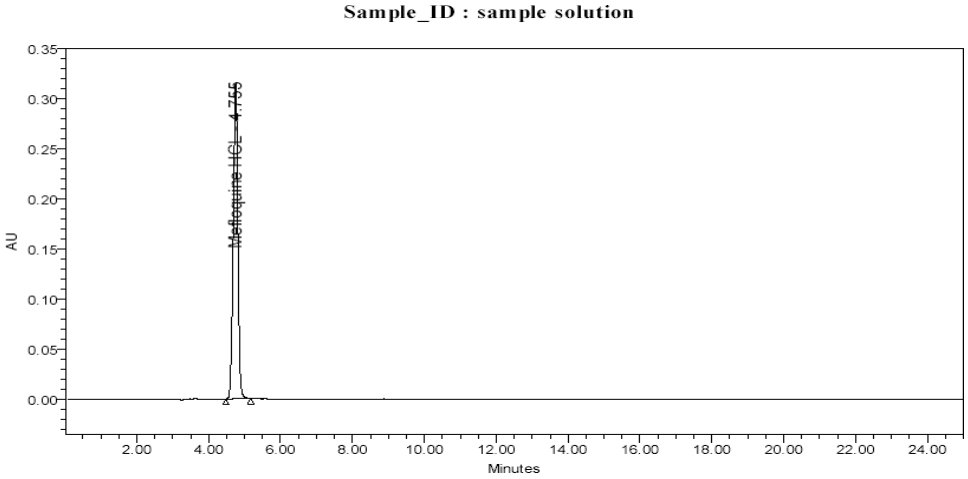


**Figure 11Forced Degradation MFQH System Suitability Solution.**

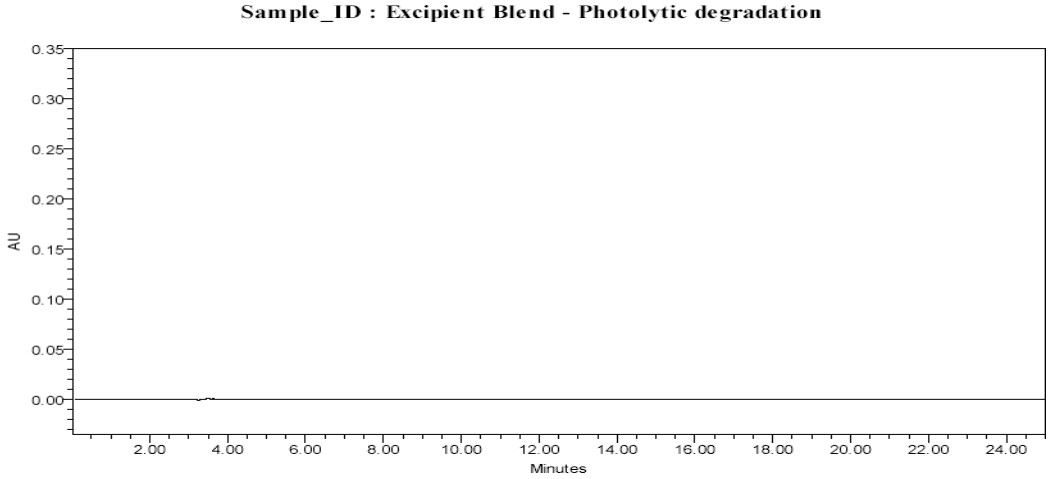


**Figure 12 Forced Degradation Placebo blend Photolytic Degradation**

**Table 8: Results Forced Degradation Study of MFQH Tablet 250 mg**

| Sr. No. | Stress Study | % Degradation (Approximate) | MFQH Purity Angle | MFQH Purity Threshold | Purity Criteria |
|---|---|---|---|---|---|
| 1 | Untreated Sample | -- | 71.162 | 90.156 | Pass |
| 2 | Acid Degradation | NIL | 70.187 | 91.157 | Pass |
| 3 | Base Degradation | 18.1 | 71.198 | 90.182 | Pass |
| 4 | Oxidative Degradation | NIL | 71.258 | 93.154 | Pass |
| 5 | Heat Degradation (Solid) | NIL | 70.157 | 92.155 | Pass |
| 6 | Heat Degradation (Solution state) | NIL | 71.118 | 91.132 | Pass |
| 7 | Humidity Degradation | NIL | 72.120 | 93.142 | Pass |
| 8 | Photolytic Degradation | NIL | 71.789 | 92.852 | Pass |

**Conclusion:**

Multidrug adminstration is associated with clinically significant interaction ,especially of narrow therapeutic index drugs, either at the pre -absorption and post absorption stage , This can limit the desired therapetic effect of either the drug molecule . The pharmaceutical dosage form is recetenly introduced in the Market for the treatment of malaria. Extensive liturature survey revelaed that various analytical method were devoleped for the estimation of MFQH but not yet stability indicting RP-HPLC method was developed for the MFQH in the bulk and pharmaceutical formulations . so the main aim of the present work was to developed a simple ,fast and accurte and precise stability indicating Reverse phase high performance liquid chromatography method .

**Result and Discussion:**

RP-Hplc method for determination of MFQH was developed % assay was found between 96.92-98.06, linierity was observed in the concentration range of 50-150µg/ml and corellation coeffiecient was found to be 0.9995. The recovery studies were carried out at 50,100 and 150% level and % recovery for MFQH was found . All the paeameters were passed as per compliance of the ICH guidelines.

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**References:**

**1)** Skoog DA, west DM , Holler JF, Fundamental analytical chemistry introduction 6th edition saunders college publication ,Landon ;1994,p.1:724-726.

**2)** Scott RPW .Liquid chromatography for analyst .vol 67 marcel Dekker.inc .New york ;1994.p 1 :4:1140- 1153:1172-1198.

**3)** Christan GD analytical Chemistry .4th ED JohnWiley and sons .United Kingdom; 1986 .p.1-6.

**4)** Kennedy JH , Analytical chemistry -Principles 2nd editions saunders college publication, Newyork 1990 .p.1-8.

**5)** Sharma BK instrumental Method of chemical analysis . 11 th edition ,Goel publishing House Meerat ;1991.p 1-9 .

**6)** Skoog DA ,Holler Fj ,Nieman TA principal of instrumental analysis 5th edition Thomson Books/Cole;- 2004.p.724-726.

**7)** Jeffery GH ,Mendharm J.Deenny CR,Vogel'S Texbook of quantitative Chemical Analysis ,5th edition Adition wesley Longman LTD; 1996 .p.216-218.

**8)** Jeffery GH ,Mendharm J.Deenny CR,Vogel'S Texbook of quantitative Chemical Analysis ,5th

edition Adition wesley Longman LTD; 1996 .p.219-221.

**9)** Parimmaoo M.text book of pharmaceutical.CBS publisher and Distributors . New Delhi ; 2000,p.277 .

**10)** Settle FA Handbook of instrumental Techniques for analytical chemistry .7th ED .prentice Hall publication ;2001.p.149-153.

**11)** Skoog DA, west DM , Holler JF, Fundamental analytical chemistry introduction 6th edition saunders college publication ,Landon ;1994,p.1:701-715.

**12)** Scott RPW.Liquid Chromatography for the analyst.vol67 Marcel dekker.Inc New york ;1994 .p-1140- 1198.

**13)** Wilard HH,merrit LL,Dean JA,settle FA ,Instrumental Method of analysis , 7th edition CBS Publishers and Distributors .New Delhi;1986 p 592-604.

**14)** Wilard HH,merrit LL,Dean JA,settle FA ,Instrumental Method of analysis , 7th edition CBS Publishers and Distributors .New Delhi;1986 p 532-534.

**15)** Sharma BK ,Instrumental method of chemical Analysis 18 th edition, Goel publishing House.Meerut; 1999.p-56-84.

**16)** Sethi PD High performance liquid chromatography-quantative analysis of Pharmaceutical Formulations.5th ED.CBS publications.New Delhi;2001.p 5.

**17)** Willard HH, Merritt LL, Dean JA, Settle FA. Instrumental Methods of Analysis. 7th Ed. CBS Publishers and Distributors. New Delhi; 1986. p. 532-534.

**18)** Jeffery GH, Mendharm J, Denney CR. Vogel's Textbook of Quantitative Chemical Analysis. 5th Ed. Adison Wesley Longman LTD; 1996. p. 132-133.

**19)** Skoog DA, Holler FJ, Nieman TA. Principles of Instrumental Analysis. 5th Ed. Thomson Books/ Cole; 2004. p. 15.

**20)** Meyer VR. Practical High Performance Liquid Chromatography. 4th Ed. John Wiley and Sons. Inc. NJ; 2004. p. 261-263.

**21)** Snyder LR. Kirkland JJ, Glajch JL. Practical HPLC method Development. 2nd Ed. John Wiley and Sons. Inc. NJ; 1997. p. 15.

**22)** The United States Pharmacopoeia – XXIV. Rockville; 1998. p. 1923

**23)** Meyer VR. Pitfalls and Errors of HPLC in Pictures. 2nd Ed. John Wiley and Sons; 2006. p. 6-9.

**24)** ICH. Draft Guideline on Validation of Analytical Procedures. Definition and Terminology. Federal Register; 1995. p. 60:11260.

**25)** Sethi PD. High Performance Thin Layer Chromatography-Quantitative Analysis of Pharmaceutical formulations. CBS Publishers and Distributors. New Delhi; p. 213

**26)** ICH Harmonized Tripartite Guideline. Validation of Analytical Procedure: Methodology. Q2B; 1996. p. 1-8.

**27)** US FDA Technical Review Guide: Validation of Chromatographic Methods. Center for Drug Evaluation and Research (CDER). Rockville. MD; p. 1993.

**28)** FDA. International Conference on Harmonization: Guideline on the Validation of Analytical Procedures: Methodology. Availability. Notice. Federal Register 62(96); p. 27463–27467 (19 May 1997).

**29)** Huber L. Agilent Technologies, Validation of Analytical Methods: Review and Strategy. LabCompliance; July 2001. p. 1-22.

**30)** United States Pharmacopeia, Validation of Compedial Methods. US Pharmacopeial Convention. Inc. Rockville. MD ; 2004, p. 2622-2625 (Asian Edition).

**31)** Strauch S, Jantratid E, Dressman JB, Junginger HE, Kopp S, Midha KK, Shah VP, Stavchansky S, Barends DM. J Pharm Sci. 2011, 100(1):11-21

**32)** Kiss A, Répási J, Salamon Z, Novák C, Pokol G, Tomor K. J Pharm Biomed Anal. 1994,12(7):889-93.

**33)** Rao A B, Murthy R S, J Pharm Biomed Anal. 2002,1; 27(6):959-965.

**34)** Mount D L, Patchen L C, Churchill F C, J Chromatogr, 1990, 27; 527(1): 51-58.

35) Pravinkumar Darji, Binit Patel, Arpan Chudasama, Praneeth Ivan Joel Fnu, Seshadri Nalla JCHR (2024) 14(2), 1702-1710| ISSN:2251-6727

36) Kandalkar, Ashish; Dhole, Rakesh; Jawarkar, Somkant; Patel, Ansar; Pawar, Dinesh; Wagh, Harshada; Pawar, Rakesh; More, Swapnil Journal of Namibian Studies, 2023, Vol 33, p3504
37) Raj V. Pachani, Tapaskumar M. Shah, & Dhruv Soni. (2021). “advances in peptide- and antibody-targeted nanocarriers for cancer therapy and imaging”. Journal of Population Therapeutics and Clinical Pharmacology, 28(01), 392-419. https://doi.org/10.53555/3sadmc24