

Analytical Method Development of Amodiaquine Hydrochloride in Marketed Formulation by UV Visible Spectrophotometry

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Abstract

In the present study, two simple, precise and economical UV methods have been developed for the estimation of Amodiaquine Hydrochloride in bulk formulation using methanol. Method A involved the measurement of UV absorbance in zero order derivative at 343 nm, while Method B involved the measurement of UV absorbance in first order derivative at 217.5 nm. Both methods, A and B followed Beer-Lambert's law with the drug in the concentration range of 10-70 µg/ml and correlation coefficient (r^2) 0.9998 and 0.9997, respectively. The limit of detection for zero order and first order was found to be 0.032 and 2.716 respectively. The limit of quantification for zero order and first order was found to be 0.097, 8.231 respectively. Outcomes of the experiments were found appropriate on statistical confirmation. Hence, suggested procedures can be effectively utilized for the assessment of Amodiaquine hydrochloride in regular analytical studies.

Keywords amodiaquine hydrochloride, first order derivative, UV Spectrophotometer, zero order derivative

Introduction

Amodiaquine hydrochloride is chemically described as 4-[(7-chloroquinolin-4-yl) amino]-2-[(diethylamino) methyl] phenol. It is an antimalarial medication of dipeptidylpeptidase-4 (DPP-4) inhibitor class [1-2]. Alike to chloroquine in arrangement and function, Amodiaquine is 4-aminoquinoline that has been employed as both an antimalarial and anti-inflammatory source for over 40 years. Although the process of plasmodicidal activity of Amodiaquine is debatable, it is supposed to deter the heme polymerase action like other

quinoline derivatives. This leads to the collection of free heme that is noxious to the parasites. The drug binds the free heme preventing the parasite from converting it to a less toxic form. This drug-heme compound is noxious and disturbs membrane activity. The drug is official in the Indian Pharmacopoeias and USP-NF [3-4]. However, the literature survey did not report any UV-Spectrophotometric method for the estimation of Amodiaquine hydrochloride in single dosage form, though methods are available for the combined form of drug [5-7]. Moreover, studies involving higher techniques in combination like HPLC [8, 6, 9], RP-HPLC [10-13], UPLC methods have been reported for the determination of Amodiaquine hydrochloride in plasma and urine of humans, rats and dogs. Thus, an attempt was made to develop two simple, accurate, rapid and precise UV spectrophotometric methods for the determination of Amodiaquine hydrochloride in tablet and pure form.

Methodology

The Amodiaquine hydrochloride of API reference standard was obtained as an experimental sample from Mangalam Drugs and Organics Ltd. Vapi, Gujarat. Methanol AR grade and double distilled water were used as solvents in the study. Chemicals and reagents involved in the study were of scientific grade.

Instrument

A Shimadzu UV-1700 UV/VIS Spectrophotometer loaded with the UV Probe software, spectral bandwidth of 1 nm and wavelength accuracy of ± 0.3 nm was used for the spectral measurements. For weighing and dissolving, 1 mg sensitive electronic balance (Vibra DJ-150S-S, Shinko

Table 1 Optical characteristics and parameters.

Parameters	Method A	Method B
Wavelength(nm)	343	217.5
Beers- Lambert's range (µg/ml)	10-70	10-70
Coefficient of correlation (r ²)	0.9998	0.9997
Regression equation :Y = mx + c		
a – Slope (m)	0.0101	0.00328
b – Intercept (c)	0.0013	0.00040
LOD	0.032	2.716
LOQ	0.097	8.231

LOD: Limit of detection; LOQ: Limit of quantitation

Denshi, Japan) and bath sonicator (Sarthak SUC-322) were used, respectively.

Preparation of Stock Solution

About 10 mg of Amodiaquine Hydrochloride was weighed accurately and transferred to 100 ml volumetric flask; 10 ml of methanol was added with vigorous shaking to completely dissolve the drug. Aliquots of the range 1 to 7 ml of standard stock solution of drug were taken in a series of 10 ml volumetric flask where volume was made up to the mark with distilled water, to make the concentration range of 10-70 µg/ml. The absorbance of each standard for zero order and first order were measured at 343 nm and 217.5 nm, respectively against the medium as a blank.

Preparation of Standard Drug Dilutions

From the stock solution of Amodiaquine Hydrochloride, appropriate volumes were pipetted out and transferred to 10 ml volumetric flask. The volumes were made up to the mark with distilled water to obtain the sample of desired concentration like 10, 20, 30, 40, 50 and 70 µg/ml.

Method A

A sharp peak at 343nm was observed in the zero order derivative spectra at n = 1 (Figure 1). Inbuilt software of the instrument was used to estimate the absorbance difference at n=1 (dA/dλ) which was directly proportional to the concentration of the standard mixture. The customary drug solutions were scrutinized in the zero order derivative spectra. A calibration curve was graphed for the absorbance difference (dA/dλ) versus the concentration of Amodiaquine hydrochloride. The coefficient of correlation (r²), slope and intercept

values obtained in this analysis are provided in Table 1.

Method B

In this method, a sharp peak at 217.5 nm was observed in the zero order derivative spectra at n = 1 (Figure 2). Inbuilt software of the instrument was used to estimate the absorbance difference at n=1 (dA/dλ) which was directly proportional to the concentration of the standard mixture. The customary drug solutions were scrutinized in the first order derivative spectra. A calibration curve was graphed for the absorbance difference (dA/dλ) versus the concentration of Amodiaquine hydrochloride. The coefficient of correlation (r²), slope and intercept values obtained in this analysis are provided in Table 1.

Detection limit and quantitation limit

The detection limit and the quantitation limit were based on the slope of the calibration curve and the standard deviation of Y- intercept of regression line.

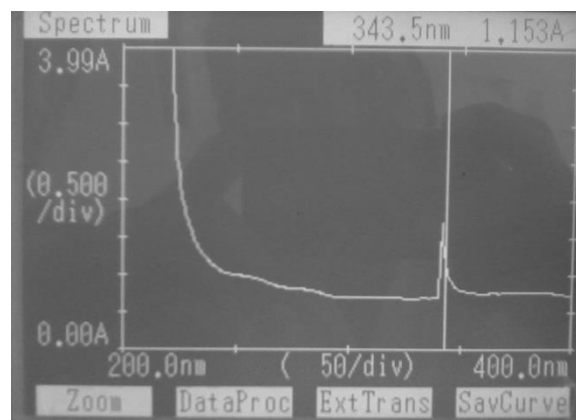


Figure 1. Spectrum by zero order derivative method

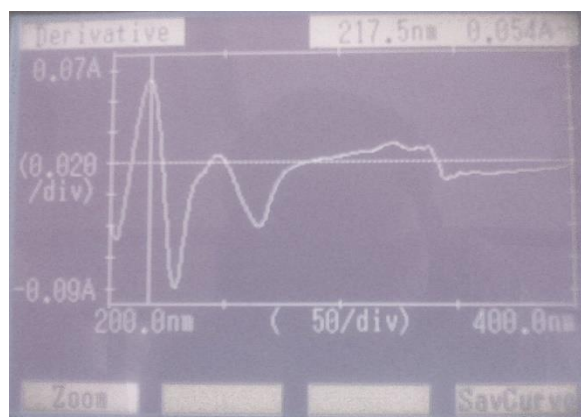


Figure 2. Spectrum by first order derivative method

Analysis of tablet formulation

For the estimation of Amodiaquine hydrochloride in tablet preparation by the two procedures, twenty tablets were weighed and ground into a fine powder. Tablet powder equivalent to 10 mg of Amodiaquine hydrochloride was weighed and transferred to 100 ml volumetric flask and dissolved in 10 ml of methanol. It was kept for ultra-sonication for 45 min, finally the volume was made up to the mark with distilled water that was then filtered through Whatman™ filter paper to get the tablet stock solution of concentration to 100 µg/ml. Several dilutions of the tablet mixtures were formulated and examined for six times. The concentrations were computed by employing the calibration curve for the two approaches.

Both the procedures were authenticated as stated by ICH guidelines [14-15]. Recovery experiments were performed at three distinct intensities i.e. 80%, 100% and 120% by totaling the pure drug (8, 10 and 12mg respectively) to formerly examined tablet powdered sample (10mg) according to ICH guidelines and percentage recovery was estimated as shown in table 2. All the techniques were legitimized for specificity, accuracy and linearity.

Results and Discussion

Both the approaches used in the experiment for the

assessment of Amodiaquine hydrochloride were established to be easy, profitable, unambiguous, accurate, quick and consistent. In both the procedures, Beer- Lambert's law was followed in the concentration range of 10-70µg/ml. The merits of standard deviation were reasonably small and the recovery experiments were close to 100% (Table 2). The derivative spectroscopic technique employed has the benefit that it detects the concealed peaks in the normal spectrum when the spectrum is not severe and it also removes the interference initiated by the excipients existing in the formulation. Hence the two procedures can be used for regular analysis of the drugs in quality control, R&D laboratories.

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References

- [1] S. C. Sweetman (2002). Martindale: The Complete Drug Reference, 33rd ed. London: Pharmaceutical press, <http://www.pharmpress.com>
- [2] The Merck Index, 13th ed. Whitehouse Station NJ: Merck & Co. Inc., 2003.
- [3] Indian Pharmacopoeia (2014). 7th ed.vol. 2, Ghaziabad: Indian Pharmacopoeia Commission.
- [4] USP (32) NF (27). Vol.2, Asian edition 2008: 1406-1407.
- [5] P. R. Rao and N. K.. Agarwal (2013). Analytical method development and validation of Artesunate and Amodiaquine hydrochloride in tablet dosage form by RP-HPLC. J. Res. Pharm. Biotechnol., **1**: 822-827.
- [6] A. Lawal, R. A. Umar, M. G. Abubakar and U. Z. Faruk (2012). Development and validation of

Table 2 Recovery studies.

S. No.	Tablet sample	Level of recovery (%)	Mean*	S.D.*	C.O.V.*	S.E.*
1	T1	80	100.14	0.1778	0.1775	0.1026
2		100	100.68	0.1607	0.1596	0.0928
3		120	100.63	0.1102	0.1095	0.0636

When *n: 3 at each level of recovery S.D.: Standard deviation

UV Spectrophotometric and HPLC Methods for Quantitative Determination of Chloroquine and Amodiaquine in Pharmaceutical Formulations. I. J. ChemTech Res., **4**: 669-676.

[7] M. T. Ansari, T. M. Ansari, A. Raza, M. Ashraf, M. Yar **(2008)**. Spectrophotometric Determination of Amodiaquine and Sulfadoxine in Pharmaceutical Preparations. Chem. Anal., **53**: 305-313.

[8] N. G. Rathod and M. V. Lokhande **(2014)**. Identification of impurities related to Amodiaquine Hydrochloride by using some analytical techniques. WJPR., **3**: 1739-1758.

[9] M. U. Phadke, V. K. Jadhav D. Patil, S. Narayankar, R. K. Jadhav and Y. K. Bansal **(2010)**. Development and Validation of Stability indicating UPLC Method for Determination of Related Impurities in Artesunate and Amodiaquine Fixed Dose Tablets. Der Pharmacia Lettre, **2**: 333-341.

[10] S. Gandhi, P. Deshpande, P. Jagdale, V. Godbole **(2010)**. A simple and sensitive RP-HPLC method for simultaneous estimation of Artesunate and Amodiaquine in combined tablet dosage form. J. Chem. Pharm. Res., **2**: 429-434.

[11] M. H. Odedara, S. D. Faldu and K. P. Dadhania **(2012)**. RP-HPLC Method for

Simultaneous Estimation of Artesunate and Amodiaquine HCL in their Combined Pharmaceutical Dosage Form. JPSBR., **2**: 114-117

[12] F. P. Modi and P. R. Patel **(2011)**. Formulation, Optimization & Evaluation of Fixed Dose Combination Moisture Barrier Film Coated Bilayer Tablet of Artesunate & Amodiaquine Hydrochloride. Int.J. PharmTech., **3**: 2124-2134.

[13] A. H. Panchal , L. M. Prajapati, A. K. Joshi and M. L. Kharodiya **(2014)**. Stability Indicating RP-HPLC Method For Simultaneous Estimation Of Artesunate And Amodiaquine HCL in their Combined Dosage Form. Int. J. Uni. Phar. biosci., **3**: 45-58.

[14] S. B. Lahane, U. A. Deokate and R. B. Nawale **(2014)**. A Stability Indicating HPLC Method for the Determination of Amodiaquine Hydrochloride. Int. J. Pharm. Sci., **28**: 196-199.

[15] Validation of Analytical Procedures, ICH Harmonised Tripartite Guideline **(1994)**. International Conference on Harmonization, OF Technical Requirements for Registration of Pharmaceuticals For HumanUSE, Geneva, October 1994, 1.