WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 5.990
Volume 4, Issue 5, 2370-2377. Research Article ISSN 2277– 7105

SPECTROPHOTOMETRIC DETERMINATION OF AN ANTIMALARIAL DRUG PRIMAQUINE IN BULK AND PHARMACEUTICAL FORMULATIONS

Manjusha D.Karad and Dr.V.D.Barhate*

Department of Chemistry, VES College of Arts Science and Commerce, Chembur Mumbai 400071, India.

Article Received on
15 March 2015,

Revised on 06 April 2015,
Accepted on 30 April 2015

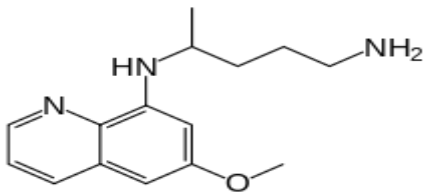
***Correspondence for Author**
Dr.V.D.Barhate
Department of Chemistry, VES College of Arts Science and Commerce, Chembur Mumbai 400071, India.

ABSTRACT

A simple, sensitive and accurate spectrophotometric method have been developed for the determination of primaquine in pure and dosage forms. Method is based on oxidation of the drug with 1, 10 phenanthroline producing orange colored chromogen which is measured at 520 nm. Beer's law is obeyed in the concentration range of 10-200 µg/mL for the developed method. The molar absorptivity and sandell sensitivity are found to be 22914 L $mol^{-1}cm^{-1}$ and 0.011µg/cm^2 respectively. The regression equation for primaquine was found to be y = 0.0041X + 0.0223and the correlation coefficient for the regression line was 0.999. Different experimental parameters affecting the color development and stability of colored product are carefully studied and optimized. The developed method could be successfully applied to pharmaceutical formulations. The results obtained are in good agreement with those obtained using standard method.

KEYWORDS: primaquine Spectrophotometry, dosage forms, 1, 10-phenanthroline (O-PHEN).

INTRODUCTION



Primaquine(PQ)

Primaquine [N-(6-methoxy quinoline-8-ly) Pentane-1,4-diamine] is an antimalarial drug that is very important for the radical cure of relapsing vivax or ovale malaria and it eliminates tissue infection. It is a member of the 8-aminoquinoline group of drugs and is often administered in combination with chloroquine.[1, 2] There are various analytical procedures for the assay of Primaquine, an HPLC[3, 4], facilitating metabolic and pharmacokinetic studies.[5] A capillary electrophoresis method has been developed that allows the separation and estimation of primaquine enantiomers in pharmaceutical formulations.[6] Other methods such as voltammetry[7], gas chromatography- mass spectrometry[8], and ultra-performance liquid chromatography[9] (UPLC) have involves the dissolution of the sample in anhydrous acetic acid with gentle heating. When cooled, the sample is titrated against perchloric acid[11], and the end point is determined potentiometrically. Many spectrophotometric methods have been described for the determination of primaquine phosphate. Some of these methods are comprised of coupling of primaquine phosphate with diazotized reagents[12, 13] to form an intensely- coloured azo dye. Other colorimetric methods are based on the reaction of primaquine with chloanily, 3-methyl-2-benzothiazolinone hydrazone or tetracyanoethylene[14, 15, 16] are reported. Some of these methods are time-consuming[12, 14] less sensitive[16], require organic solvents[12], buffer solution and pH control.[12, 14] In present investigation we developed simple accurate, precise and validated method for determination of primaquine in pharmaceutical preparations

EXPERIMENTAL

Instrumentation

An ELICO SL-159 model, 2nm high resolution, double beam, 1cm length quartz coated optics; Wavelength range 190-1100nm; High stability, linearity, precision instrument is used for all the spectral measurements. All chemicals and reagents used in the analysis are of analytical grade and doubly distilled water is used for the preparation of all the solutions.

MATERIALS AND METHODS

Preparation of Standard solution of drug

An accurately weighed 7.5mg of primaquine(PQ) is dissolved in distilled water and transferred in 250 mL volumetric flask diluted upto the mark.

Preparation of Reagents

0.241%(w/v)Fe (III) solution is prepared by dissolving 241mg of anhydrous ferric ammonium sulphate in 100mL of double distilled water, 0.991% (w/v) o-phenanthroline is

prepared by dissolving 991mg of the reagent in 100mL of alcohol and 0.15% (v/v) O-phosphoric acid solution is prepared by diluting 0.15 mL of laboratory reagent (AR Grade) of o-phosphoric acid to 100mL with distilled water.

Experimental Procedure

Different portions (1.0- 8.0mL, 25µg/mL) of standard PQ solution is delivered into a series of 25mL calibrated standard flask and then 1.0 mL of $5.0x10^{-3}$M of Fe (III) solution, 1.0mL of $5.0x10^{-2}$M o-phenanthroline are added successively.The total volume in each flask is brought to 16mL with distilled water. The flasks are kept on a boiling water bath for 20 minutes. The flasks are removed and cooled to room temperature.2.0mL of $2.0x10^{-2}$M of o-phosphoric acid is added and volume in each flask is made up to the mark with distilled water. The absorbance of the colored complex solution is measured after 5 minutes against a reagent blank prepared at 520nm(Fig.1). The amount of the PQ is computed from the appropriate calibration graph .(Fig.2)

Analysis of pharmaceutical sample

Tablets powdered equivalent to7.5 mg of the drug is weighed accurately and transferred into beaker and dissolved in distilled water by following standard method.The standard solution is filtered into 250ml standard flask and volume is adjusted upto the mark. Suitable aliquots of this solution used for the determination of primaquine contents by procedure describe earlier.

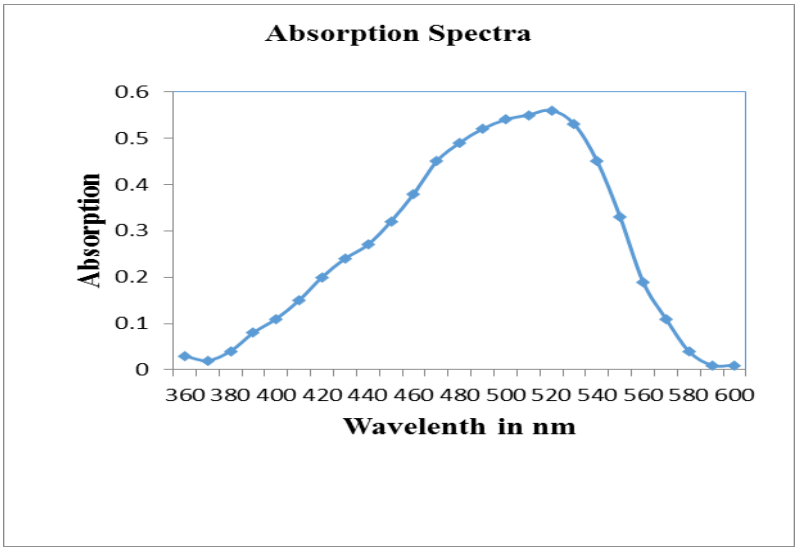


Fig.-1: Absorption spectra of primaquine with Fe (III) /O-PHEN

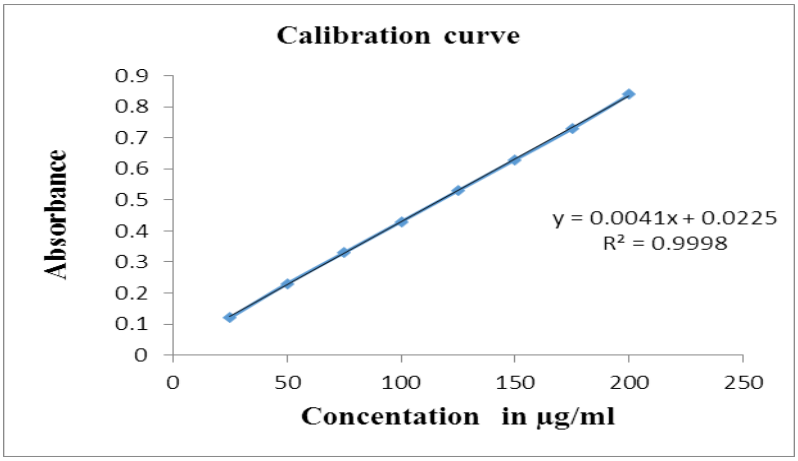


Fig.-2: Linear plot of primaquine with Fe (III)/O-PHEN. The calibration curve is found to be linear over the concentration range of 10-200ug/ml of primaquine.

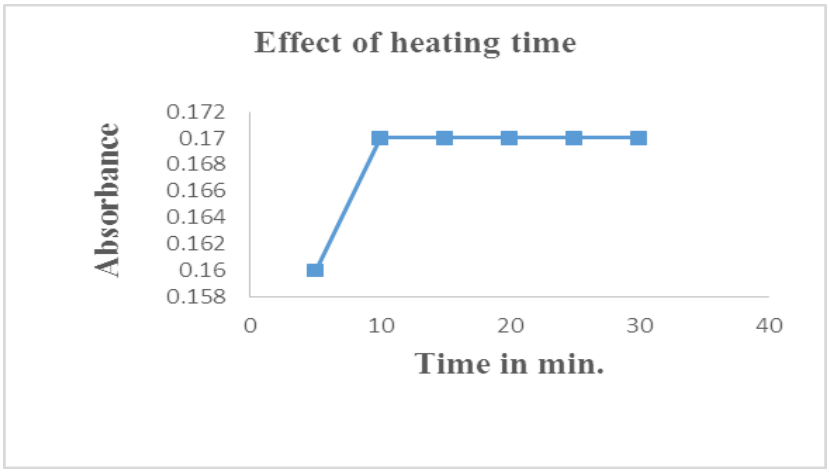


Fig.3 Effect of heating time on absorbance of developed system. 15 mimutes are sufficient fo full colour development hence 20 minutes time is selected for further studies.

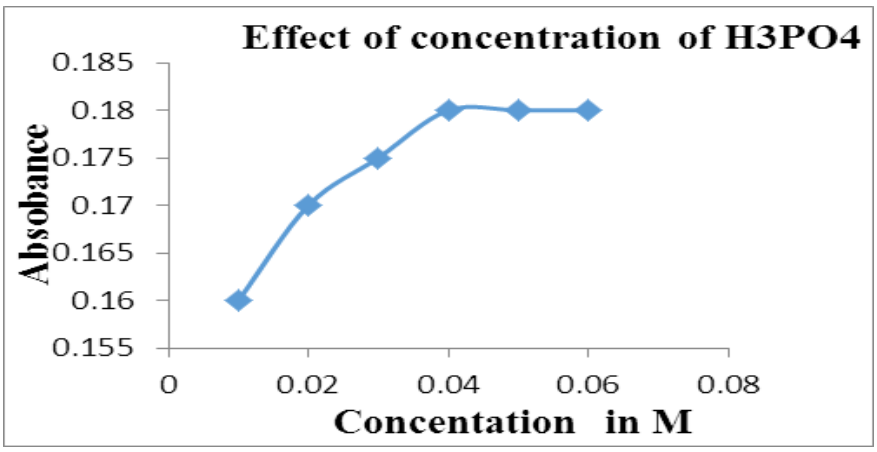


Fig.4 Effect of concentration of H_3PO_4 on colour development.Absorbance remains constant after 0.015M concentration of H_3PO_4.Hence 0.02M H_3PO_4 is usued for colour development and further studies.

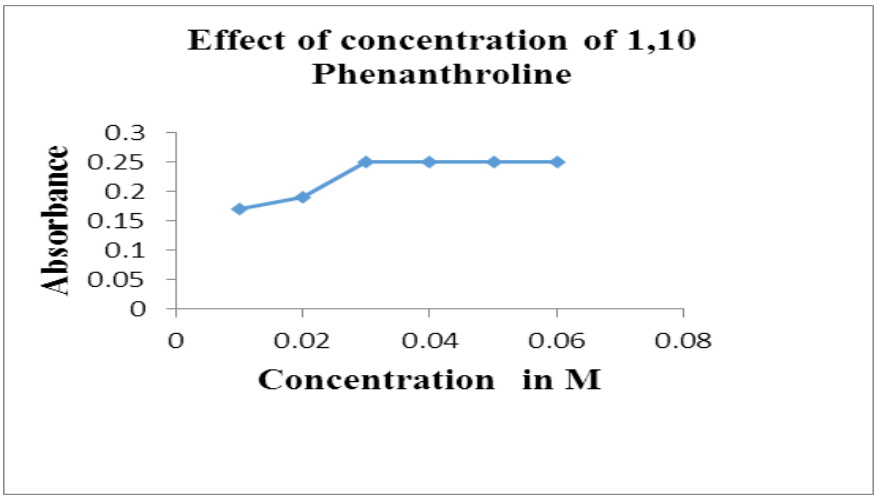


Fig.5 Effect of concentration of 1,10 phenanthroline on absorbance of developed system.

RESULTS AND DISCUSSION

In order to test whether the colored product formed in this method adhere to Beer's law, the absorbance at maximum wavelength of a series of eight concentrations are plotted against concentration of the drug in µg/mL (Fig2). Beer's law is obeyed within the limits 10-200 µg/mL of primaquine , molar absorptivity and sandell sensitivity is found to be 22914 L $mol^{-1}cm^{-1}$ and 0.0113 µg /cm^2. Regression analysis of the Beer's law plots at λ_{max} reveals a good correlation.The graphs show negligible intercept and are described by the regression equation y = 0.0041X + 0.0223 (where Y is the absorbance of 1 cm layer, b is the slope, a is the intercept and C is the concentration of the measured solution in µg/mL). The high molar absorptivity of the resulting colored complex indicate the high sensitivity of the method.

Precision of the developed method is ascertained from the absorbance values obtained by actual determination of ten replicates of a fixed amount of the test in total solution. The percent of relative standard deviation and Variation from mean at 95% level confidence limit percent are calculated for the developed method. To determine the accuracy of the method, three different amounts of drug sample within the linearity limits are prepared and analyzed by the developed method. The percent recoveries of the drug by this method is found to be within the range which indicates that the developed method is accurate. Optical characteristics, linear regression parameters, precision and accuracy of the proposed method is shown in Table-1. The method have been successfully applied for the determination of primaquine in pharmaceutical preparations.

Table-1; Optical characteristics, Regression parameters, Precision and Accuracy of the proposed method.

Parameter	Method
Maximum Wavelength λ_{max}	520 nm
Beer's Law Limits µg/mL	10-200
Sandell's Sensitivity (µg/cm^2 /0.0001 Absorbance)	0.011
Molar Absorptivity Lt/mole/cm	22914
Slope(b)[a]	0.0041
Intercept(a)[a]	0.020
Standard Deviation on intercept(S_a)	.0047
Standard Deviation on slope (S_b)	4.47×10^{-5}
Correlation Coefficient (r)	0.999
Standard Deviation (S)	0.369
%Relative Standard Deviation	0.737
Variation from mean at 95% level confidence limit	±0.264
Limit of Detection (LOD)µg/mL	.1915
Limit of Quantification (LOQ)µg/mL	.5801

[a]Regression equation Y=a+bC, Where Y stands for absorbance and C is concentration in µg/mL [b]%Relative standard deviation is calculated for ten determination.

The proposed method has been used for the analysis of primaquine.The result obtained are comparable with stanadard method[21] (Table- 2).

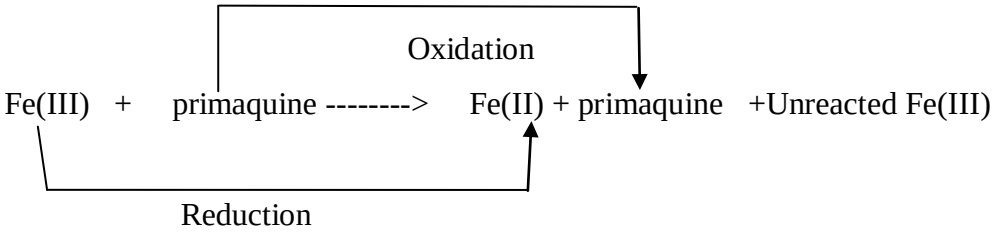
Table-2: Analysis of Pharmaceutical Formulations of primaquine

Drug	Manufacturing company	Labelled amount(mg)	*Amount found by Proposed Method	*Amount found by Referrence Method
Primaquine phosphate tablet	HAB Pharmaceutical and research Ltd.	7.5	7.48	7.47

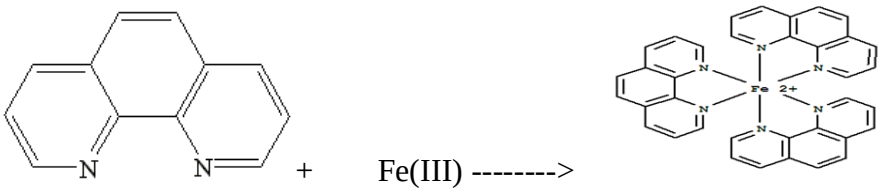
*Average of three determinations

Scheme of coloured product

Ferric salt converts into a ferrous salt upon oxidation and can be easily detected by the usual reagent ophenanthroline. The reduction product is tris complex of Fe (II), well known as ferroin. The colored product of the reaction is given below



Unreacted Fe(III) + O-Phosphoric Acid --------> Fe(III)-O-phosphoric Acid Complex



CONCLUSIONS

The developed method is simple, sensitive, accurate and reproducible. This method can be successfully applied for the analysis of pharmaceutical formulations in any laboratory.

ACKNOWLEDGEMENTS

The authors are thankful to Principal VES College of Arts Science and commerce, Chembur for providing laboratory facilities**.**

REFERENCES

1. A. R. Gennro, Remington: The Science and Practice of Pharmacy, (Wolters Kluwe Company, Philaadelphia), 20th Edn., 2000; 1547.
2. H. Hitner and B. Nagle, Basic Pharmacology, (Glenco, New York), 4th Edn., 1999; 2317.
3. Y. R. Kim, H. J. Kuh, M. Y. Kim, Y. S. Kim, W. C. Chung, S. I. Kim and M. W. Kang, Arch. Pharm. Res., 2004; 27: 576.
4. V. K. Dua, P. K. Kar, R. Sarin, and V. P. Sharma, J. of Chrom., 1996; 93: 675.
5. B. Anula, L. M. Tripathi, S. L. Khan, B. L. Tekwani, D. Nanayakkara, W. Gul, M. A. ElSholy and I. A. Khan, Chromatographia, 2006; 64: 429.
6. A. A. ElBashir, B. Saad, A. S. Mohmed Ali, M. I. Saleh, J. of AOAC Intern., 2008; 91: 536.
7. M. L. P. M. Arguelho, M. V. B. Zanoni and N. R. Stradiotto, Anal. Lett., 2005; 38: 1415.
8. I. Brondz, A. B. Fialkov, and A. Amirav, J. Chromatogr. A., 2009; 5: 824.
9. V. G. Dongre, P. P. Karmuse, P. R. Pilla and A. Kumar, J. of Pharm. and Biomed. Analysis, 2008; 46: 236.

10. British Pharmacopeia on CD-ROM (System Simulation Ltd, the stationary office, London) 3rd Edn., 2000.
11. A. D. Skoog, and D. M. West, Fundamental of Analytical Chemistry, (Rinehart and Winston, New Work) 3rd Edn., 1976; 736.
12. J. K. Baker, J. D. McChesney and L. Jorge, Bulletin of the World Health Organization, 1985; 63: 887.
13. S. M. Hassan, M. E. S. Metally and A. M. A. Cuf, Anal. Lett., 1982; 5: 213.
14. S.T. Sulaiman and D. Amin, Intern. J. Environ. Anal. Chem., 1985; 18: 1.
15. B. S. Sastry, E. V. Rao, M. K. Tumuru and C. S. Sstry, Indian J. of Pharm. Sci., 1986; 48: 190.
16. F. A. Ibrahim, A. El-Brashy and F. Belal, Mikrochim. Acta, 1989; 1: 321.
17. S. A. Rahim, N. D. Ismail and W. A. Bashir, Mikrochim. Act, 1986; 111: 417.
18. A. K. Ahmed, Y. I. Hassan and W. A. Bashir, Analyst, 1987; 112: 97.
19. Aitha Vijaya Laxshmi Asian Journal Of Pharmaceutical And Clinical Research, 5th January 2013.
20. A.Bisham Babu,G.RAMU,S.Venkata RAO,T.Neeharika and C.Rambabu RASAYAN J.Chem., 2011; 4(2): 336-342.
21. Ferial Mahmood El-Samman, Asma Natiq Al-Irhayim and Enam Ahmed Hamdoon Pak. J. Anal. Environ. Chem., 2011; 12(1 & 2): 55-60.