International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.11 No.10, pp 202-205, 2018

Validated Visible Spectrophotometric Methods for Quantification of Rifaximin in Bulk and Pharmaceutical Dosage form

P.G.Sunitha*, E.Senthilkumar, G.Divya, R.Ravikumar, S.Sounthirarajan

Department of Pharmaceutical Chemistry, College of Pharmacy, Madras Medical College, Chennai-600 003, India

Abstract : Two simple, sensitive and precise colorimetric methods A and B were developed for the estimation of Rifaximin in bulk drug as well as in pharmaceutical dosage form. Method A is based on the formation of a wine red colored chromogen of Rifaximin with Sodium nitroprusside in the presence of sodium hydroxide which has absorption maximum at 498nm. Method B is based on the formation of a red colored chromogen with Sodium hydroxide which has absorption maximum at 456nm. The proposed methods are statistically validated and found to be useful for the routine determination of Rifaximin in tablets.
Keywords : Rifaximin, Colorimetry, Tablets, Validation.

Introduction

Rifaximin is an oral antibiotic with broad spectrum of action that acts locally in the gastrointestinal tract with minimal systemic adverse effects. It is practically not absorbed and reaches high concentrations in the human intestine, where it is active against many enteropathogens.Chemically Rifaximin is 2S,16Z,18E,20S,21S,22R, 23R,24R,25S,26S,27S,28E-5,6,21,23,25 pentahydroxy27- methoxy-2,4,11,16, 20,22,24,26 octa- methyl -2,7-epoxypentadeca-[1,11,13] trienimino) benzofuro [4,5-e] pyrido [1,2 benzimidazole 1,15(2H)-dione,25-acetate) [1]. The empirical formula is $C_{43}H_{51}N_3O_{11}$ and its molecular weight is 785.9. It acts by binding to the β-subunit of bacterial DNA dependent RNA polymerase resulting in inhibition of bacterial RNA synthesis and bacterial growth[2]. Rifaximin is used as an antibiotic for the treatment of traveler's diarrhea and irritable bowel syndrome[3].Rifaximin does not have spectrophotometric method in the ultraviolet region described in official compendiums. In the literature, an article which describes a spectrophotometric method in the ultraviolet region has been found; however this method uses buffer and methanol[4] and also by chromatographic methods like HPLC[5], HPLC-TMS[6] and LC-ESI-MS in human plasma[7] . In Method A, RFX reacts with sodium nitroprusside in the presence of sodium hydroxide to form a wine red chromogen which absorbs intensely at 498nm. In method B, RFX forms a red colored chromogen with alkali solution, which exhibited λ_{max} at 456nm. The method is alternative and comparable in specificity and accuracy to chromatography methods, which although highly specific and accurate, are more time consuming, performed

DOI= http://dx.doi.org/10.20902/IJCTR.2018.111024

in several steps and are rather expensive. The above analytical methods validation were performed as per ICH guidelines[8].

Materials and Methods

Instrumentation :

All spectral and absorbance measurements were made on UV-Visible spectrophotometer model-LMSP-UV 1900s .

Reagents

Sodium nitro prusside-2% w/v

Sodium hydroxide solution(1M)

Preparation of standard solution

A 1 mg/ml stock solution of RFX was prepared by dissolving 100 mg of drug in 100 ml of ethanol.

Sample preparation

Twenty tablets were weighed and powdered. A quantity equivalent to 25 mg of RFX was weighed accurately, transferred to a beaker, dissolved in ethanol, filtered through whatmann filter paper No. 1 into a 25 ml volumetric flask and made up to volume with ethanol to get a concentration of 1mg/ml.

Method A

Appropriate aliquots of RFX were pipetted out into a series of 10 ml volumetric flasks. To each flask 2 ml of sodium nitroprusside and 1ml of sodium hydroxide were added, mixed thoroughly and made up to volume with ethanol. The λ_{max} of the wine red coloured chromogen was found to be 498nm (Figure-1).The absorbance of wine red coloured chromogen was measured at 498nm against the reagent blank. The calibration curve was constructed by plotting concentration versus absorbance.

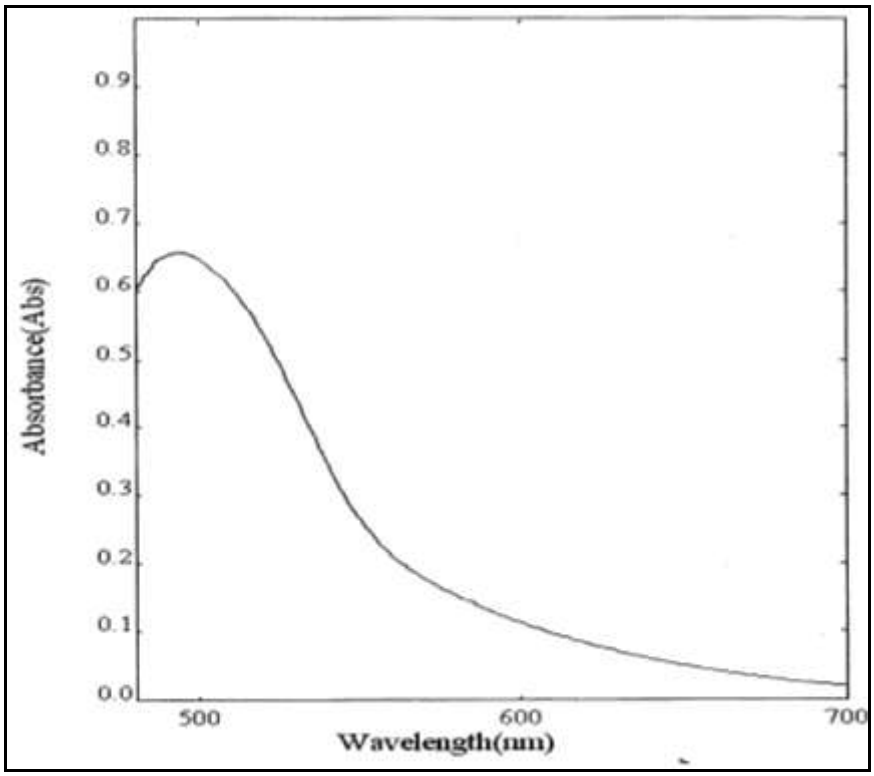

Figure 1. λ_{max} of RFX by Method - A

Method B

Appropriate aliquots of RFX were pipetted out into a series of 10 ml volumetric flasks. To each flask 1ml of sodium hydroxide was added, allowed to stand for 15 mins and then made up to volume with ethanol. The λ_{max} of the red colored chromogen was found to be 456nm (Figure-2). The absorbance of the red colored chromogen was measured at 456nm against the reagent blank. The amount of RFX was computed from the calibration curve obtained by plotting concentration versus absorbance.

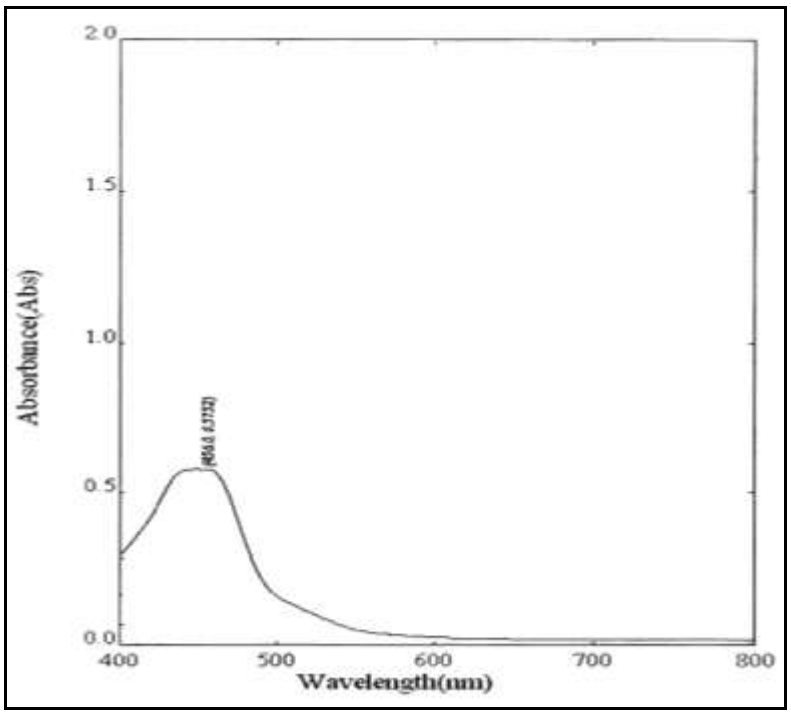

Figure 2. λ_{max} of RFX by Method - B

Sample Analysis

Pharmaceutical formulation of RFX was successfully analyzed by the proposed methods. Appropriate aliquots were subjected to the above methods and the amount of the RFX was estimated. The results of sample analysis are furnished in table- 2.

Results and Discussion

The optical characteristics such as absorption maxima, Beer's law limits, Molar absorptivity and Sandell's sensitivity are furnished in table-1. The regression characteristics like slope (b), intercept(a), correlation coefficient(r), percent relative standard deviation(%RSD) and standard error (SE) obtained from different concentrations were calculated and the results are summarized in table-1.

To study the accuracy and reproducibility of the proposed methods, recovery experiments were carried out by adding a known amount of drug to pre-analyzed sample and the percentage recovery was calculated. The results are furnished in table-2.The results indicate that there is no interference of other ingredients presents in the formulation. Thus, the proposed methods are simple, sensitive, precise, accurate and reproducible and useful for the routine determination of RFX in bulk drug and its pharmaceutical dosage form.

Table 1: Optical Characteristics, Precision and Accuracy of the proposed methods

Parameter	Method A	Method B
λ_{max} (nm)	498nm	456nm
Beer's law limit(µg/ml)	20-120	20-120
Molar absorptivity ($Lmol^{-1}cm^{-1}$)	7.740×10^3	9.875×10^3
Sandell's sensitivity (µg/cm²/0.001 absorbance unit)	0.0248	0.0479
Regression equation(*y)		
Slope(b)	0.00933	0.01173
Intercept(a)	0.018734	0.027864
Correlation co-efficient (r)	0.9994	0.9994
% RSD	0.0115	0.0108
Standard error(SE)	0.0182	0.0172

*y = a+bc where c is the concentration of RFX in µg/ml.

Table 2: Assay and Recovery of RFX in the dosage form (Tablets)

Method	Labelled amount (mg)	Amount obtained (mg)*	Percentage recovery**
A	400mg	397.67mg	98.97
B	400mg	398.6mg	99.89

Average of six determinations* * Average of three determinations*

Acknowledgements

We are thankful to the Department of Pharmaceutical Chemistry, Madras Medical College, Chennai-03, for providing the instrumentation and laboratory facilities.

References

1. Maryadele N.J.O., An Encyclopedia of Chemicals, Drug and Biologicals, The Merck Index, Division of Merck and Co. Inc., Merck Research Laboratories, 14th edition, White house Station,NJ, USA,2006.
2. Bass N.M, Mullen K.D. and Sanyal A., "Rifaximin treatment in hepatic encephalopathy," The New England Journal of Medicine, 2010,362(12),1071– 1081.
3. Pimentel M, Lembo A, Chey W.D, Zakko S, Ringel Y et al., Rifaximin therapy for patients with irritable bowel syndrome without constipation, The New England Journal of Medicine, 2011, 364(1),22- 32.
4. Sudha T, Anandakumar K, Hemalatha P.V, Ravikumar V.R and Radhakrishnan., Spectrophotometric estimation methods for Rifaximin in tablet dosage form., International Journal of Pharmacy and Pharmaceutical Sciences, 2010,2(1),43–46.
5. Rao K.N,Ganapaty S and Rao A.L., RP-HPLC determination of rifaximin in bulk drug and pharmaceutical formulations, Int J Pharm, 2013, 3(1), 7-13.
6. Zhang X, Duan J, Li K, Zhou L and Zhai S., "Sensi- tive quantification of rifaximin in human plasma by liquid chromatography-tandem mass spectrometry," Journal of Chromatography B, 2007, 850(1),348–355.
7. Challa B.R, Kotaiah M.R and Chandu B.R., "HPLC method for determination of rifaximin in human plasma using tandem mass spectrometry detection, East and Central African Journal of Pharmaceutical Sciences, 2010, 13, 78-84.
8. International conference on harmonization (ICH). Q2 (R1), Text on validation of Analytical procedures, Geneva, Switzerland,2005.

*****