OriginalArticle

ISSN Print 2231 – 3648
Online 2231 – 3656

NEW VISIBLE SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF EMTRICITABINE IN BULK DRUGS AND THEIR FORMULATIONS

*Imam pasha S,Taqui Mohammed, Nikhila V, Tirupathi D, Shravankumar A, Gopi T
*Nizam College of Pharmacy, Deshmukhi, Pochampalli (M),
Near Ramoji Film City, Nalgonda, A.P, India – 508284.

Abstract

A simple, sensitive and economical spectrophotometric method was developed for the determination of Emtricitabine in pharmaceutical formulations. This method is based on the separation of colored chloroform layer by the reaction of drug with mordant black 3 , which absorbs maximally at 543 nm. Beer's law is obeyed at a concentration range of 5-90 mcg/ml for method. This method has been successfully applied for the assay of the drug in pharmaceutical formulations.

Keywords: Emtricitabine, Mordant black-3, Spectrophotometry.

Introduction

Emtricitabine (FTC), with trade name Emtriva (formerly Coviracil), is a nucleoside reverse transcriptase inhibitor (NRTI) for the treatment of HIV infection in adults and children.chemically it is a 4 amino5fluoro1[(2*S*,5*R*)2(hydroxymethyl)-1,3-oxathiolan-5-yl]1,2dihydropyri -midin-2-one.[2]The drug works by inhibiting reverse transcriptase, the enzyme that copies HIV RNA into new viral DNA. By interfering with this process, which is central to the replication of HIV, emtricitabine can help to lower the amount of HIV, or "viral load", in a patient's body and can indirectly increase the number of immune system cells.[5, 6, 7]

The drug has been determined by variety of analytical techniques such as Development and Validation ofSpectrophotometric Method for Estimation ofEmtricitabine in Tablet Dosage Form(Nagaraju P.T.*,K. P. Channabasavaraj, Shantha Kumar P). Two simple, precise and economical UV methods have been developed for the estimation of Emtricitabinein bulk and pharmaceutical formulations.

Author for Correspondence:
Imam pasha S,
Nizam College of Pharmacy, Deshmukhi,
Pochampalli (M), Nalgonda, A.P, India – 508284.
Email:impazam@gmail.com

Emtricitabine has the absorbance maxima at 241.1nm (Method A), and in the first order derivative spectra, Showed zero crossing at 241.1nm, with a sharp peak at 232.7nm when n=1 (MethodB) .Drug followed the Beer 's Lamberts range of 5–30 µg/ml for the Method A&B .The limits of detection wer e found to be 0.0684 µg/ml and 0.185 µg/ml for Method A and Method B respectively. The limit of quantification for Method A and Method B were found to be 0.207µg/ml and 0.555 µg/ml respectively. Results of analysis were validated statistically andby recovery studies and were found to be satisfactory. Application of UV spectrometric method for estimation of Emtricitabine in bulk and capsule. (Hemlata M. Nimje*, Rajesh J. OswalMahesh B. Fadake).A simple, rapid and accurate spectrophotometric method has been developed for quantitative estimation of Emtricitabine in bulk and capsule. In distilled water Emtricitabine exhibits absorption at 280.0 nm and method obeys Beer's law at the concentration range of 1-50 µg/mL. The percentage label claim was found in the range of 98-102%.Simultaneous determination of Emtricitabine and Tenofovir by area under curve and Dual wavelength spectrophotometric method. Two methods for the simultaneous determination of Emtricitabine and Tenofovir by spectroscopy have been developed. These two simple, accurate and precise methods

include Area under the Curve (AUC) method and Dual Wavelength Method. This paper describes simple and sensitive spectrophotometric method. it includes, the separation of colored chloroform layer by the reaction of drug with mordant black 3 which absorbs maximally at 543 nm.

Materials and Methods

Apparatus

Ultraviolet-Visible-Spectrometer SHIMADZU-1700 with 1 cm matched quartz cells was used for all spectral measurements.

Reagents and standards

All the chemicals used were of analytical grade. Mordant black 3 200 mg of mordant black 3 was dissolved in 15ml of methanol and 85ml of distilled water was added in a 100 ml volumetric flask. potassium hydrogen phthalate buffer pH(2.4) Accurately weighed quantity of 4.0846 gms of potassium hydrogen phthalate was dissolved in 100ml distilled waterto 25ml of this solution 21.1ml of 0.2M HCl was added and diluted to 100ml with distilled water to obtain a pH of 2.4.

Procedure

Preparation of standard solution of Emtricitabine

A Standard stock solution containing 1mg/ml was prepared by dissolving 10mg of Emtricitabine in 10 ml of distilled water. From this, a working standard solution containing 100µg/ml was prepared.

Method

Recommended procedure for the determination of Emtricitabine in bulk drug – Aliquots of standard drug solution of Emtricitabine 0.5-9.0 ml are taken and transferred into a series of 250ml of separating funnels. To each funnel 2ml of 0.2%w/v Mordant black 3 and 4ml of the buffer solution was added. Reaction mixture was shaken gently for 5min. then 10ml of chloroform was added to each of them. The contents are shaken thoroughly for 5 min and allowed to stand, so as to separate the aqueous and chloroform layer. Colored chloroform layer was separated out and absorbance was measured at 543nm against reagent blank and the concentration was measured using calibration curve.

Procedure for the assay of Emtricitabine in pharmaceutical formulations

The method was extended for the determination of Emtricitabine from Emtriva formulations. The total contents of 20 Emtricitabine capsules were of powder and the powder equivalent to 100mg was dissolved in 100 ml of dstilled water. The above solution was further diluted and analyzed as described, in the above mentioned method for bulk drug. The procedure was repeated three times with Emtriva formulations.

Results and Discussion

Emtricitabine being a base, it forms an ion –association complex with an acidic dye,Mordant black 3 which is extractable into chloroform from the aqueous phase.The protonated nitrogen(positive charge) of the drug molecule in acid medium is expected to attract the oppositely charged part (negative charge) of the dye and behave as a single unit being held together by electrostatic attraction. Based on the analogy, the structures of ion-association complexes.

Reaction Mechanism

The ion-association complex was formed by the reaction of drug with Mordant black 3.

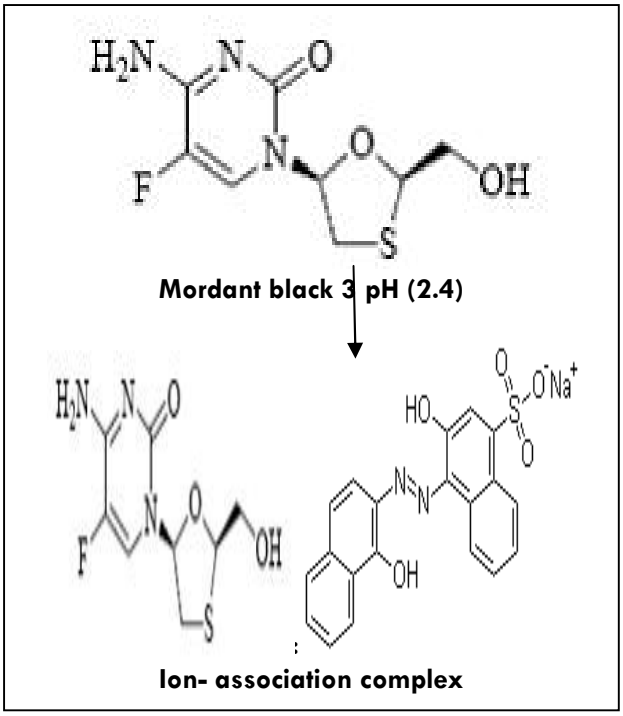

Table 01:Optical characteristics & precision

Parameters	Method
λ_{max} (nm)	543
Beer's law limits	5-90 mcg/ml
Molar absorptivity	1.895 x 10^6(l/mol.cm)
Sand ell's sensitivity	0.133(mcg/ml/cm^2/0.001 absorbance unit)
Regression Equation* (Y)	
Slope (m)	0.0007
Intercept (c)	0.0069
Correlation Coefficient(r)	0.9987
Precision** (%Relative Standard Deviation)	0.01732
Standard error of mean	0.0317

Y= bC + a

Where C is the concentration of Emtricitabine in mcg/ml and Y is the absorbance at the respective λ_{max}**for eight measurements.

Table 02: Evaluation of Emtricitabine in pharmaceutical dosage forms

Formulation (Brand)	Labeled Amount (mg/cap)	Amount Obtained By Proposed method	% Recovery** ±S.D
Emtricitabine	200	99.5	100.1±0.023
Emitriva	200	100.4	99.8±0.013
Truvda	200	100.1	100.6±0.037

**Average ± S.Dof eight determinations.

Conclusion

A simple visible spectrophotometric method for the determination of Emtricitabine in pure and its dosage forms was developed. The absorbance of the chromogen was measured at maximum absorbance of 543nm against the corresponding reagent blank. The method is found to be simple, precise, economic, and less time consuming. The method has also been statistically evaluated and the results obtained are accurate, precise and free from the interferences of other additives present in the formulation.

Acknowledgement

1.Global college of pharmacy, Moinabad,R.Rdist for providing research facilities.

2.Mr.K.Ramakrishna,Quality control department manager,Endovenpvtlimited.Balanagar,Hyderabad for providing the sample of pure Emtricitabine.

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