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A REVIEW ON ANALYTICAL METHODS FOR ESTIMATION OF EMTRICITABINE AND TENOFORVIR ALAFENAMIDE FUMARATE IN PHARMACEUTICAL DOSAGE FORM

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ABSTRACT

This review article is intended to highlight the analytical methods of Emtricitabine and tenoforvir alafenamide fumarate in individual as well as combined pharmaceutical dosage form. Emtricitabine and tenoforvir alafemide fumarate play an important role in HIV infection. Emtricitabine is a nucleoside reverse transcriptase inhibitor (NRTI) and Tenoforvir alafenamide fumarate is a nucleotide reverse transcriptase inhibitor and a prodrug of tenofovir. Now these days these drugs are easily available in the market in their individual form as well as in their combined dosage form .Various analytical methods have been reported for the estimation of these drugs in their individual form as well as in their combined dosage form.

KEYWORDS: HIV infection, RP-HPLC, Mobile Phase, Column, Wavelength, Flow rate.

INTRODUCTION TO ANALYTICAL METHOD

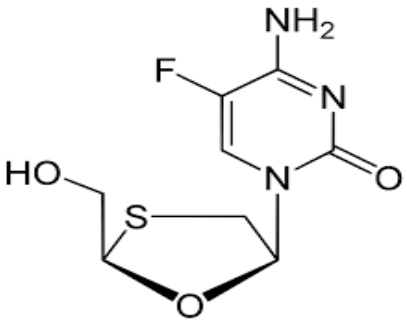
There are various analytical methods are used now these days for the estimation .Various analytical methods like potentiometer, HPLC, aqueous and non-aqueous titrations are used in the field of analysis. Aqueous and non-aqueous titrations are also used in the field of analysis. But now these days HPLC plays an important role in the field of analysis for the quantitative determination. HPLC is referred as high pressure liquid chromatography which is a separation technique based on the solid stationary phase and liquid mobile phase. Chromatography is mass transfer process involve adsorption. The active component of the column is adsorbent which is granular material of solid particles (silica, polymers). The

principle of separation in the normal phase mode and reverse phase mode is adsorption in which the substances travel /separate according to their relative affinities. Now these days HPLC plays an important role in the field of pharmaceutical analysis for the separation of various substances from the mixture of substances.[1]

Introduction to Drug Profile

Emtricitabine

Emtricitabine with trade name Emtriva is a nucleoside reverse transcriptase inhibitor (NRTI) for the prevention and treatment of HIV infection in adults and children.[23]



Emtricitabine

IUPAC Name: 4-amino-5-fluoro-1-[(2R, 5S)-2(hydroxymethyl)-1, 3-oxathiolan-5-yl]-1, 2dihydropyrimidin-2-o

Molecular formula: C8H10FN3O3S.

Molecular Weight: 247.248 g/mol.

Solubility: Soluble in ACN, Water, and Methanol.

Pka: 14.29.

Mechanism of action: Emtricitabine works by inhibiting reverse transcriptase, the enzyme that copies HIV RNA into new viral DNA. Emtricitabine is a synthetic nucleoside analogue of cytidine. It is phosphorylated by cellular enzymes to form emtricitabine 5'-triphosphate, which is responsible for the inhibition of HIV-1 reverse transcriptase.

Reported Methods of emtricitabine

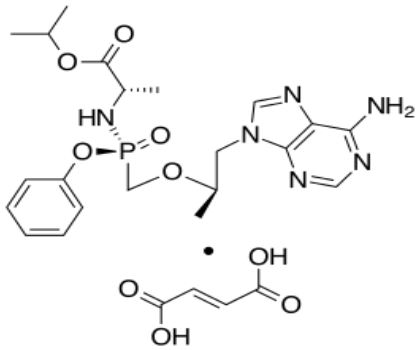
Sr.no	Drug	Method	Brife introduction	Ref.no
1	Emtricitabine(capsule)	HPLC	Mobilephase:Composition of buffer:acetonitrile(85:15%v/v) Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:280nm	[1]
2	Emtricitabine(capsule)	HPLC	Mobilephase:0.03 potassium dihydrogen phosphate (pH4.86±0.002):acetonitrile :methanol(40;20:20%v/v) Column:Phenomenex (250×4.6mm,5µm) Flow rate:1ml/min Wavelength:260nm	[2]
3	Emtricitabine(Tablet)	RP-HPLC	Mobilephase:Acetonitrile:0.03KH4PO4 (pH3.2)(85:15%v/v) Column:C18(250×4.6mm,5µm) Flow rate:0.8ml/min Wavelength:260nm	[3]
4	Emtricitabine and Tenoforvir disoproxil fumarate	RP-HPLC	Mobilephase:Acetonitrile:phosphate buffer(60:40%v/v) Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:270nm	[4]
5	Emtricitabine and Tenoforvir	RP-HPLC	Mobilephase: methanol: water(70:30%v/v) Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:273nm	[5]
6	Emtricitabine and Tenoforvir disoproxil fumarate	RP-HPLC	Mobilephase:Disodium hydrogen phosphate :Acetonitrile(50:50%v/v) Column:C18(250×4.6mm,5µm) Flow rate:0.4ml/min Wavelength:260-280nm	[6]
7	Emtricitabine and Tenoforvir disoproxil fumarate	RP-HPLC	Mobilephase:Acetonitrile: methanol: water(30:50:20%v/v) Column:C18(250×4.6mm,5µm) Flow rate:0.6ml/min Wavelength:258nm	[7]
8	Emtricitabine and Tenoforvir alafenamide fumarate	RP-HPLC	Mobilephase:Acetonitrile:phosphate buffer(20:80%v/v)pH:3 Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:259nm	[8]
9	Emtricitabine, Bictegravir and Tenoforvir alafenamide fumarate	RP-HPLC	Mobilephase:Buffer phosphoris dihydrogen phosphate B)Methanol:water buffer(70:30%v/v),pH:3.2 Column:C18(250×4.6mm,5µm)	[9]

			Flow rate:1.5ml/min Wavelength:265nm	
10	Emtricitabine, Tenoforvir disoproxil fumarate, Elvitegravir, Cobicistate	RP-HPLC	Mobilephase:A)Acetonitrile:water buffer(55:45%v/v) B)potassium dihydrogen orthophosphate,pH:2.5 Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:250nm	[10]
11	Emtricitabine, Efavirenz and Tenoforvir disoproxil fumarate	RP-HPLC	Mobilephase:Acetonitrile:Ammonium acetate buffer(50:50%v/v) Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:260nm	[11]
12	Emtricitabine, Tenoforvir disoproxil fumarate and Rilpivirine	RP-HPLC	Mobilephase:Acetonitrile:ammonium acetate Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:265nm	[12]
13	Emtricitabine Tenoforvir, Cobicistat, Elvitegravir	RP-HPLC	Mobilephase:0.01NKH2PO4: Acetonitrile:(43:57%v/v) Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:270nm	[13]
14	Emtricitabine Tenoforvir disoproxil fumarate and Efavirenz	RP-HPLC	Mobilephase:Acetonitrile: 0.03M KH2PO4 in water pH:3.2 orthophosphoricacid (60:40%v/v) Column:C18(250×4.6mm,5µm) Flow rate:0.8ml/min Wavelength:260nm	[14]
15	Emtricitabine, Tenoforvir and Efavirenz	RP-HPLC	Mobilephase: methanol :Triethylamine, pH:4(70:30%v/v) Column:Thermosil(100×4.6mm,5µm) Flow rate:1ml/min Wavelength:260nm	[15]
16	Emtricitabine, Tenoforvir disoproxil fumarate, Cobicistat, Elvitegravir	RP-HPLC	Mobilephase: 0.1%Trifluoroacetic acid buffer and acetonitrile (60:40%v/v) Column:intertsil ODS3v(250×4.6mm,5µm) Flow rate:1.2ml/min Wavelength:242nm	[16]
17	Emtricitabine, Tenoforvir, Efavirenz	HPLC	Mobilephase:methanol and buffer(pH;4.5)-gradient:0-10min(90%),10-22min(35%),22-25min(90%) Column:zorbox SBCN(250×4.6mm,5µm) Flow rate:1.5ml/min	[17]

			Wavelength:260nm	
18	Emtricitabine, Tenoforvir disoproxil fumarate, Elvitegravir, Cobicistate	RP-HPLC	Mobilephase:0.1% trifluoracetic acid :Acetonitrile(90:10%v/v) Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:240nm	[18]
19	Emtricitabine in capsule	HPLC	Mobilephase: orthophosphoric acid :Acetonitrile(88:12%v/v) Column:C18(100×4.6mm,5µm) Flow rate:1ml/min Wavelength:280nm	[25]
20	Emtricitabineand tenoforvir disoproxil fumarate	RP-HPLC	Mobilephas:Acetonitrile :methanol:water(30:50:20%v/v) Column:C18(150×4.6mm,5µm) Flow rate:1ml/min Wavelength:258nm	[26]
21	Emtricitabineand tenoforvir disoproxil fumarate	RP-HPLC	Mobilephas:orthophosporic acid (pH2.5 with NOaH solution): methanol (30:70v/v) Column:C18(150×4.6mm,5µm) Flow rate:1ml/min Wavelength:272nm	[28]
22	Emtricitabine, tenofovir disoproxyl fumarate, cobicistat and elvitegravir	HPLC	Mobilephas:o0.1%TFA: acetonitrile Column:C18(250×4.0mm,5µm) Flow rate:1.5ml/min Wavelength:242nm	[30]

Tenoforvir alafenamide fumarate

TAF trade name Vemlidy is a nucleotide reverse transcriptase inhibitor and a prodrug of tenofovir. It was developed by Gilead Sciences for use in the treatment of HIV infection and chronic hepatitis B, and is applied in the form of Tenofovir alafenamide fumarate(TAF).[23]



Tenoforvir alafenamide fumarate

IUPAC Name: Isopropyl (2S)-2-[[[(1R)-2-(6aminopurin-9-yl)-1-methyl-ethoxy] methyl-phenoxyphosphoryl] amino] propanoate.

Molecular formula: C21H29N6O5P.

Molecular Weight: 476.466 g/mol.

Solubility: Soluble in methanol, slightly Acetonitrile and water.

Pka: 11.36.

Mechanism of action Tenofovir alafenamide fumarate (TAF) is a nucleotide reverse transcriptase inhibitor (NRTI) and a novel ester prodrug of the antiretroviral tenofovir. Following oral administration, TAF is converted in vivo to tenofovir, an acyclic nucleoside phosphonate (nucleotide) analoge.[22]

Reported Methods of Tenoforvir alafenamide fumarate

Sr. No	Drug	Method	Brife Introduction	Ref.no
1	Tenoforvir	HPLC	Mobile phase: A)5%Acetonitrile in 25mM phosphate buffer: 5mM t-butly ammonium bromide B)60% acetonitrile in 25mM phosphate buffer :5mMt-butly ammonium bromide pH-6 Column:XDB C18(100×4.6mm,3.5µm) Flow rate:2ml/min Wavelength:260nm	[19]
2	Emtricitabine and Tenoforvir alafenamide	RP-HPLC	Mobile phase:Methanol:distill water (60:40%v/v) pH:3 Column:C18 (250×4.6mm,5µm) Flow rate:1ml/min Wavelength:260nm	[20]
3	Emtricitabine andTenoforvir alafenamide fumarate	RP-HPLC	Mobile phase:Acetonitrile:phosphate buffer (80:20%v/v) Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:259nm	[8]
4	Emtricitabine and Tenoforvir alafenamide	RP-HPLC	Mobile phase:orthophosphoric acid +acetonitrile :water(30:70v/v) Column:C18 (250×4.6mm,5mµ) Flow rate:1ml/min Wavelength:273nm	[21]
5	Emtricitabine and Tenoforvir alafenamide fumarate	RP-HPLC	Mobile phase:Formic acid in water: methanol(45:55v/v) Column:C18(250×4.6mm,5µm) Flow rate:1ml/min Wavelength:260nm	[22]
6	Lamivudine, Tenoforvir alafenamide and Dolutegravir	RP-HPLC	Mobile phase:0.05M phosphate buffer pH:6.2: acetonitrile Column; C18(250×4.6mm,5µm) Flow rate ;1ml/min Wavelength:260nm	[23]
7	Tenoforvir disoproxil fumarate and	RP-HPLC	Mobile phase:Acetonitrile :water(70:30v/v),p.H3.5 adjust with orthoposphoric acid	[24]

	emtricitabine		Column; C18(250×4.6mm,5µm) Flow rate :1.5ml/min Wavelength:270nm	
8	Tenoforvir disoproxil fumarate and rilpivirin	RP-HPLC	Mobile phase:Acetonitrile: phosphate buffer (60:40v/v) Column; C18(150×4.6mm,5µm) Flow rate ;1ml/min Wavelength:260nm	[27]
9	Lamivudine and Tenoforvir disoproxil fumarate	RP-HPLC	Mobile phase: phosphate buffer (with ortho phosphoric acid pH:60): methanol Column; C18(250×4.6mm,5µm) Flow rate ;1ml/min Wavelength:260nm	[29]
10	Emtricitabine and tenoforvir disoproxil fumarate	RP-HPLC	Mobile phase: Methanol: phosphate buffer (65:35v/v) Column; C18(250×4.6mm,5µm) Flow rate ;1ml/min Wavelength:260nm	[31]
11	Emtricitabine and tenoforvir disoproxil fumarate	RP-HPLC	Mobile phase: Acetonitrile: phosphate buffer (60:40v/v) Column; C18(250×4.6mm,5µm) Flow rate ;1ml/min wavelength:260nm	[32]

CONCLUSION

Emtricitabine and Tenoforvir alafenamide fumarate play an important role in the many HIV infection. These drugs are available in the market in many formulations with their different dose. Many methods have been reported for the estimation of this method can simply and suitably take up for regular quality control analysis of Emtricitabine and Tenofovir in pure and its pharmaceutical dosage forms. So there is need to develop a suitable, accurate and validated method for their simultaneous estimation in combined dosage form.

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