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A REVIEW ON PIROXICAM, VENLAFAXINE IN BULK AND FORMULATION BY USING DIFFERENT ANALYTICAL METHODS

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ABSTRACT

The review article deals with the estimation of NSAIDS like piroxicam and antidepressants like venlafaxine in bulk and varied dosage forms by using different analytical techniques. Piroxicam is a chemically unique, long-acting, strong anti-inflammatory /analgesic drug that is now available for the treatment of arthritis and other inflammatory infections. Determination and estimation of piroxicam, venlafaxine by using different analytical methods like UV-Visible spectrophotometer, High Performance Liquid Chromatography [HPLC], High performance thin layer chromatography [HPTLC], Liquid chromatography -Mass Spectroscopy [LC-MS], Gas chromatography [GC].

Keywords: Antidepressants, NSAIDS, Piroxicam, Venlafaxine, Chromatography

INTRODUCTION:

Nonsteroidal anti-inflammatory drugs, or NSAIDs, are the most prescribed pain relievers. NSAIDs are a highly successful medicine class for pain and inflammation, but they are also known to cause gastrointestinal bleeding, cardiovascular side effects, and NSAID-induced nephrotoxicity. Nonsteroidal anti-inflammatory medications (NSAIDs) are a class of analgesics and anti-inflammatory pharmaceuticals that are widely used to treat pain, inflammation, and other conditions in humans, as well as fever.

These medications have a low acidity substance with pK values between 3-6 because of their carboxylic groups or ketoenol tautomeric structure **[3]**. These medications inhibit Cyclooxygenases (COXs) enzymes, which are rate-determining enzymes for prostaglandins and other prostanoids synthesis, such as thromboxane's **[1]**.

PIROXICAM

Piroxicam [4-hydroxy-2-methyl-N-(2-pyridyl)-H-1,2-benzothiazine-3-carboxamide-1,1-di-oxide] is a potent non-steroidal anti-inflammatory and analgesic agent of molecular weight (C15H13N3O4S=331.35 g/mol) **[2]**. Piroxicam, a non-selective nonsteroidal anti-inflammatory medication (NSAID), binds to and chelates both isoforms of cyclooxygenases (COX1 and COX2), halting phospholipase A2 activity and the conversion of arachidonic acid into prostaglandin precursors at the rate-limiting cyclooxygenase enzyme step. Piroxicam inhibits neutrophil activation, which contributes to its overall anti-inflammatory benefits **(Figure 1)**.

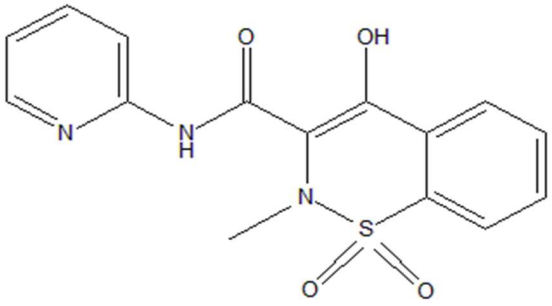

Figure 1: Structure of Piroxicam

ANTIDEPRESSANTS

Antidepressants are drugs that can help with depression, social anxiety disorder, anxiety disorders, seasonal affective disorder, dysthymia, or mild persistent depression, among other things**.** They try to address chemical imbalances in the brain's neurotransmitters, which are thought to be the cause of mood and behavior abnormalities **[4]**.

VENLAFAXINE

Venlafaxine is a bicyc1ic phenylethylamine derivative which inhibits presynaptic reuptake of noradrenaline (norepinephrine), serotonin (5-hydroxytryptamine; 5-HT). This facilitates neurotransmission by prolonging the engagement of these neurotransmitters with postsynaptic receptor sites. The etiology of depressive illness has been linked to dysregulation of these neurotransmitters **[5]** **(Figure 2)**.

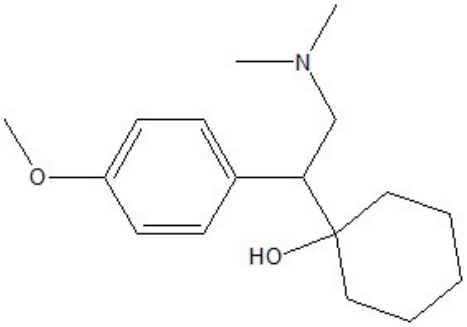

Figure 2: Structure of Venlafaxine

Table 1: Methods for the determination of piroxicam, venlafaxine by UV

S. No.	DRUG	APPLICATION	DESCRIPTION	REF.NO
1.	Piroxicam in cyclodextrin complexes	Inclusion complex	Detection wavelength: 334nm Solvent: acetonitrile Linearity:2.0 µg/ml,6.0 µg/ml, 10.0 µg/ml	[6]
2.	Piroxicam	Formulation	Detection wavelength:200-500nm Solvent: water Linearity :10-20 mg/L	[7]
3.	piroxicam	Impurity in bulk material, suppositories	Detection wavelength:240,244nm Solvent: ethanol Column:5x10 $^{-5}$ M	[8]
4.	Piroxicam, zolmitriptan	Formulation	Detection wavelength:320nm Solvent: water Linearity: Piroxicam:2,4,6,8,10 µg/ml Zolmitriptan:1,2,3,4,5µg/ml	[9]

Table 2: Methods for the estimation of piroxicam, venlafaxine by HPLC method

S. No.	DRUGS	DESCRIPTION	REF.NO.
5.	Piroxicam	Detection wavelength:240nm Column: Phenomenex Luna C18 Mobile phase: A :10mMm potassium dihydrogen orthophosphate pH 3.0 B: acetonitrile Flow rate:1.0ml/min Linearity:1-5µg/ml	[10]
6.	piroxicam	Detection wavelength:486nm Column: Hypersil Gold ,5-µm 150x4mm column Mobile phase: Trifluoroacetic acid: acetonitrile 60:40 (v/v) Flow rate:1.1ml/min Linearity:0.25,0.5,1,2.5,5,10,25µg/ml	[11]
7.	Piroxicam	Detection wavelength:360nm Column: SB-C_{18} Eclipse (150x4.6;5µm) reversed phase stainless steel column Mobile phase: acetonitrile: water (50:50v/v) Flow rate:0.5ml/min Linearity:5-90 µg/ml	[12]
8.	Piroxicam	Detection wavelength:363nm Column: 5µm CN (spherisorb) microbore column Mobile phase: acetonitrile: water mixture (6: 94, v/v) Flow rate:0.5ml/min Linearity:0.05-10µg/ml	[13]
9.	Piroxicam	Detection wavelength:247nm Column: Spherisorb NH_2 (250mmx4.6mm) Mobile phase: Buffer: methanol (40:60 v/v)	[14]

		Flow rate:1.0ml/min **Linearity: 1.15 × 10^{-5} M**	
10.	**Piroxicam**	**Detection wavelength:230nm** **Column: C $_{18}$ column** **Mobile phase: Methanol: water (70:30v/v)** **Flow rate:2.0ml/min** **Linearity:0.5,1.0,1.5,2.0,2.5,3.0µg/ml**	**[15]**
11.	**Piroxicam**	**Detection wavelength:361nm** **Column: Reversed phase C_{18} column** **Mobile phase: Methanol-10mm phosphate buffer pH 2 (45:55v/v)** **Flow rate:1.5ml/min** **Linearity:0.02-20µg/ml**	**[16]**
12.	**Piroxicam**	**Detection wavelength:254nm** **Column: Reversed-phase C 1 8 column** **Mobile phase: aqueous buffer/methanol (55:45 v/v)** **Flow rate:1.2ml/min** **Linearity:1 -150µg/ml**	**[17]**
13.	**piroxicam**	**Detection wavelength:360nm** **Column: Kromasil C18 column** **Mobile phase: acetonitrile:20 mM phosphate buffer pH 3.1 (50:50, v/v)** **Flow rate:1.0ml/min** **Linearity:0.05,0.1,0.15,0.2,0.5,1.0,1.5,2.5µg/ml**	**[18]**
14.	**venlafaxine**	**Detection wavelength:225nm** **Column: Kromasil KR 100-5C18 column** **Mobile phase: Acetonitrile: methanol (90:10v/v)** **Flow rate:1.0ml/min** **Linearity:200µg/ml**	**[19]**
15.	**venlafaxine**	**Detection wavelength:228nm** **Column: Ascentis C18 column (150 mm × 4.6 mm)** **Mobile phase: 30% acetonitrile in 20mM phosphate buffer pH 6.5** **Flow rate:1.0ml/min** **Linearity:1.05-10.5µg/ml**	**[20]**
16.	**venlafaxine**	**Detection wavelength:235nm** **Column: Kromasil 100-5C18 column** **Mobile phase: 60% methanol: acetonitrile (95:5v/v)** **Flow rate:0.7ml/min** **Linearity:0.5-25 ng/µl**	**[21]**
17.	**Venlafaxine, Duloxetine, Fluoxetine, Paroxetine**	**Detection wavelength:235nm** **Column: Inertsil ODS -3 Column** **Mobile phase: Acetonitrile: ammonium acetate (41:59 v/v)** **Flow rate:1.3ml/min** **Linearity:0.1-20 ng/ml**	**[22]**
18.	**Venlafaxine**	**Detection wavelength:228nm** **Column: Ascentis C18 column (150 mm × 4.6 mm)** **Mobile phase: 30% acetonitrile in 20 mM potassium phosphate buffer** **Flow rate:1.0ml/min** **Linearity:1.05-10.5 µg/ml**	**[23]**
19.	**Venlafaxine**	**Column: CHRIOBIOTIC V** **Mobile phase: 30 mmol/l ammonium acetate–methanol (15:85, pH 6.0)** **Flow rate:1.0ml/min** **Linearity:5.0-400 ng/ml**	**[24]**
20.	**Venlafaxine**	**Detection wavelength:229nm** **Column: Zorbax XDB C-18 column** **Mobile phase: 62% water containing 0.05 M potassium dihydrogen phosphate, 28% methanol, and 10% isopropyl alcohol** **Flow rate:1.0ml/min** **Linearity:5-1000 ng/ml**	**[25]**
21.	**Venlafaxine**	**Detection wavelength:226nm** **Column: C-18 column** **Mobile phase: Acetonitrile: phosphate buffer** **Flow rate:1.0ml/min**	**[26]**

		Linearity:1-1000ng/ml	
22.	**Venlafaxine**	**Detection wavelength:229nm Column: Spherisorb S5 C8 analytical column Mobile phase: acetonitrile–phosphate buffer (30:70, v/v) Flow rate:1.4ml/minLinearity:0.2-4µg/ml**	**[27]**
23.	**Venlafaxine**	**Detection wavelength:229nm Column: Supelcosil LC-8DB column Mobile phase: 20% acetonitrile in 0.1 M ammonium acetate Linearity:10-500ng/ml**	**[28]**
24.	**Piroxicam, 5-hydroxy piroxicam**	**Detection wavelength:353nm Column: CNW C_{18} RP (250 mm × 4.6 mm, 5 µm) Mobile phase: Acetonitrile:Trifluoro acetic acid (62:38v/v) Flow rate:1.0ml/min Linearity:1.50-2.50µg/ml**	**[29]**

Table 3: Methods for the estimation of venlafaxine by HPTLC

S. No.	DRUGS	DESCRIPTION	REF.NO
25.	**Venlafaxine**	**Mobile phase: butanol–acetic acid–water 6:2:2 (v/v) Linear range:100–600 ng per band Correlation coefficient (r) ± SD 0.9984 ± 0.0004**	**[30]**

Table 4: Methods for the estimation of venlafaxine by LC-MS/MS

S. No.	DRUGS	DESCRIPTION	REF.NO
26.	**Venlafaxine**	**Column: C18 (150x4.6mm) Mobile phase: 10mM ammonium formate: methanol (20:80 v/v) Flow rate: 0.800 ml/min**	**[31]**

Table 5: Methods for the estimation of venlafaxine by UPLC-MS

S. No.	DRUGS	DESCRIPTION	REF.NO
27.	**venlafaxine**	**Column: BEH Shield RP18 (1.7 mm, 100 mmx 2.1 mm) Mobile phase: water containing 2mM ammonium acetate: acetonitrile (20:80% v/v) Flow rate: 0.3ml/min Ion source: electrospray ionization**	**[32]**

Table 6: methods for the estimation of venlafaxine by Gas chromatography

S. No.	DRUGS	DESCRIPTION	REF.NO.
28.	**Venlafaxine, viloxazine, imipramine, desipramine, sertraline, amoxapine**	**Linearity: 100-2000ng/ml Solvent: methanol Column: Chem Elut CE 1010 columns Flow rate :1.5ml/min**	**[33]**

Table 7: Methods for the estimation of Piroxicam, Venlafaxine by combined UV, HPLC methods

S. No.	DRUGS	DESCRIPTION FOR UV	DESCRIPTION FOR HPLC	REF. NO.
29.	**Piroxicam**	**Wavelength range:480nm Mobile phase:Phosphate buffer: ethanol, 90:10, v/v.**	**Wavelength range: 254nm Mobile phase: phosphate buffer (pH 7.0, 0.05 M): methanol, 60:40, v/v**	**[2]**
30.	**Piroxicam**	**Wave length :333nm Linearity:10.0-100.0µg/ml**	**Column: LiChroCART@125-4 Mobile phase: methanol:(buffer solution citric acid-dibasic sodium phosphate pH 3.0) 55:45 ratio**	**[34]**
31.	**Venlafaxine**	**Wave length:225nm Linearity:50 -160µg/ml Regression coefficient :0.999**	**Column: C_{18} Mobile phase: phosphate buffer (pH: 3.6)-acetonitrile (60: 40, v/v) Flow rate:1ml/min**	**[35]**

Table 8: Method for the estimation of venlafaxine by HPLC-MS/MS

S. No.	DRUGS	DESCRIPTION	REF.NO.
32.	Venlafaxine	Column: vancomycin chiral column (5 mm, 250x4.6 mm) Flow rate:1.0ml/min Mobile phase: methanol-water containing 30 mmol/L ammonium acetate (8:92 v/v) Lower limit of quantification:0.28ng/ml	[36]

CONCLUSION

This review article examined about the techniques obtained for the estimation of piroxicam, venlafaxine in bulk and pharmaceutical dosage forms. Various spectroscopic methods like UV Spectroscopy, Chromatographic techniques like HPLC, HPTLC and hyphenation techniques like LC-MS/MS, HPLC-MS/MS, UPLC-MS, combined UV and HPLC method are established. Among all the techniques HPLC with UV detection was widely used by using methanol, acetonitrile, phosphate buffer as mobile phases. For compounds separation and detection 0.5-2.0 ml/min flow rate is maintained. This article can be more favorable for more analytical investigations.

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