

First Order Derivative UV Spectroscopic Method Development and Validation of Vonoprazan Fumarate in Bulk and Tablet Dosage Form

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Abstract

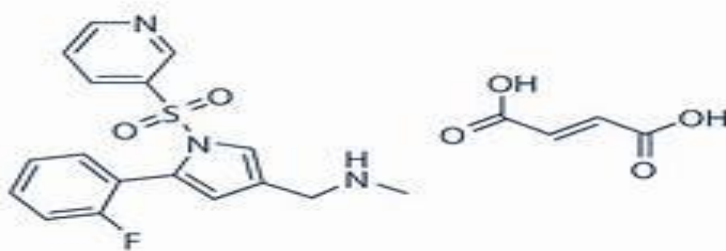
The simple First Order Derivative UV Spectroscopic Method was developed for the determination of Vonoprazan in bulk and tablet dosage form. The method involved in first order derivative. In first order the wavelength selected was 216 nm. The method was found to be linear between the range of 20-100 µg/ml for Vonoprazan in Distilled Water. The First-order derivative method was successfully applied for the assay of Vonoprazan in bulk and tablet dosage form and validated as per ICH guidelines

Keywords: Vonoprazan, First order, UV Method, Distilled Water

1. Introduction

Vonoprazan fumarate, chemically. 1-[5-(2-fluorophenyl)-1-pyridin-3-ylsulfonyl]-1H-pyrrol-3-yl]-N-methylmethanamine fumarate[1]. It is a first-in-class potassium-competitive acid blocker (P-CAB). Vonoprazan fumarate is primarily metabolized by CYP3A4 and is eliminated through renal and faecal route [2].

Figure. 1 Chemical Structure of Vonoprazan Fumarate [3]



On literature survey, no method was reported for the estimation of vonoprazan fumarate. So, we have developed a novel, simple, rapid, accurate, precise, economical and highly sensitive UV spectrophotometric method (First Order Derivative) for assay of Vonoprazan fumarate in bulk form according to ICH guidelines. The developed method was validated as per ICH norms [4-5].

2. Materials and Methods

Instrumentation

The instrument used in the present study was Shimadzu double beam UV/Visible spectrophotometer (Model UV- 1700) with spectral band width of 1 nm. All weighing was done on electronic balance (Model Shimadzu AUX -220).

Reagents and Chemicals

Analytically pure sample of Vonoprazan fumarate was supplied by Dhamtec Pharma and consultants, Navi Mumbai, Maharashtra. The Pharmaceutical dosage form used in this study was Vonacid tablet contains equivalent to 10 mg of vonoprazan per Tablet

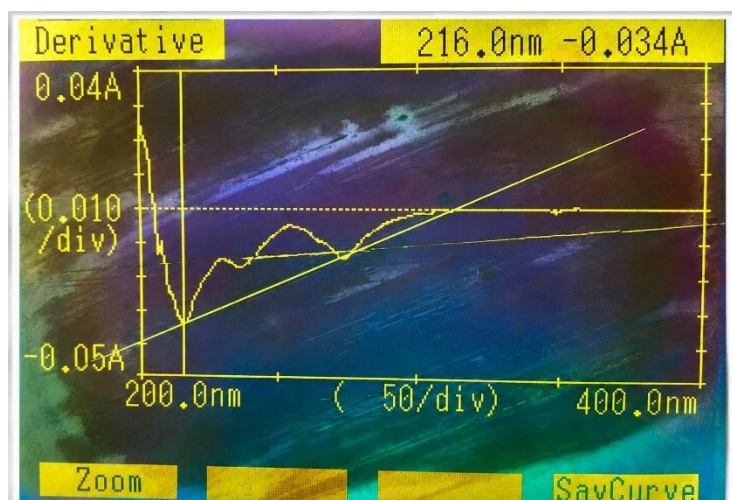
Preparation of stock standard solution

Standard stock solution of Vonoprazan ($200 \mu\text{g/ml}$) was prepared by dissolving Vonoprazan fumarate equivalent to 10 mg of Vonoprazan in 50 ml of distilled water.

Method First order derivative method

In this method, solution of Vonoprazan ($10 \mu\text{g/ml}$), was prepared by appropriate dilution of standard stock solution with distilled Water and scanned in the spectrum mode from 400 nm to 200 nm. The absorption spectra thus obtained were derivatized for first order. From the first spectra of this drug, wavelength selected for quantitation were at 216 nm for Vonoprazan and the first order derivative spectra of vonoprazan are shown in Figure.2

Figure. 2 The First Order Derivative Spectra of Vonoprazan Fumarate



Analysis of Marketed Tablet Formulation

For the estimation of drug in commercial formulation, twenty tablets containing equivalent to 10 mg of Vonoprazan was weighed and average weight was calculated. An accurately weighed portion of powder

sample equivalent to 10 mg was transferred into a 50 ml clean dry volumetric flask containing 30 ml of Distilled water. The contents of the flask were sonicated for 10 min, and the volume was made up to the mark with a further quantity of the Distilled water to get a stock concentration of Vonoprazan. Further pipette 2 ml of the above stock solution into a 10 ml volumetric flask and the volume was made up to the mark with the Distilled Water to get 40 $\mu\text{g/ml}$ of Vonoprazan. The concentration of Vonoprazan was determined by measuring absorbance of sample solution in first order derivative by using 216 nm. Concentration of Vonoprazan in the diluted solution was obtained from calibration curves. Amount of Vonoprazan fumarate in mg/tab was then calculated, by multiplying the concentration obtained with dilution factor.

Validation

The proposed methods were validated as per ICH guidelines.

Linearity

Different aliquots of 1.0-5.0 ml of Vonoprazan were transferred into series of 10 ml volumetric flasks, separately and the volume was made up to the mark with distilled water to get concentrations 20 ,40 ,60 ,80 and 100 $\mu\text{g/ml}$, respectively. The absorption spectrum was recorded at 216 nm in first order derivative. The absorption spectrum was derivatized to get first order and recorded the absorbance in first order at 216 nm.

Accuracy

To the reanalysed sample solutions, a known amount of standard stock solution was added at different levels i.e. 50, 100 and 150 %. The solutions were reanalysed by the proposed method.

Precision

The reproducibility of this method was determined by analysing tablet at different time intervals on same day in triplicates (Intra-day assay precision) and powdered on three different days (Inter-day assay precision).

3. Result and Discussion

The method discussed in the present work provide a convenient and reliable way for quantitative determination of Vonoprazan in tablet formulation. The wavelength selected for first order was 216 nm. This method show good linearity in the concentration between 20-100 $\mu\text{g/ml}$ and correlation coefficient is 0.9999 the calibration curve was shown in figure 3 Percentage label claim for Vonoprazan in tablet analysis was found to be 99.30 % in first order derivative method as shown in Table 1. Percentage recovery for Vonoprazan was found between 99.24 to 100.64 % in first order derivative with standard deviation well below 2 indicating accuracy of these methods as shown in Table 2. Intra-day and Inter-day precision studies were carried out by analysing tablet formulation, three times on the same day and on three different days, respectively Table 3. Standard deviation and coefficient of variance for intra-day and inter-day precision studies was satisfactorily low indicating high degree of precision and reproducibility of these methods.

Table 1: Quantification of Vonoprazan

Sample No	Label Claim	Amount Present	% Purity	Mean Purity*	SD%	%RSD
1	10	9.94	99.42	99.30	0.8011	0.8068
2	10	9.88	98.80			
3	10	9.81	98.18			
4	10	9.88	98.80			
5	10	10.06	100.60			
6	10	10.00	100.00			

*Mean of six observation value

Table 2: Accuracy Analysis of Vonoprazan

Sample	% Concentration	Sample Amount (µg/ml)	Amount Added (µg/ml)	Estimated Amount (µg/ml)	Average % Recovery*	SD	% RSD
Vonoprazan	50	40	20	59.80	99.40	0.9900	0.9950
	100	40	40	80.51	100.64	1.0901	1.0915
	150	40	60	99.24	99.24	0.8601	0.8668

*MEAN OF THREE OBSERVATIONS (3)

Table 3: Inter & Intra Day Analysis of Vonoprazan

S.No	Label claim	% Purity		SD		% RSD	
		Intra day	Inter day	Intra day	Inter day	Intra day	Inter day
1	10	98.80	100.6	1.2220	0.9908	1.2300	0.9980
2	10	101.27	98.80				
3	10	99.42	98.18				
4	10	100.04	99.42				
5	10	98.80	100.04				
6	10	98.18	98.18				

Report of Different Analyst & Instrument

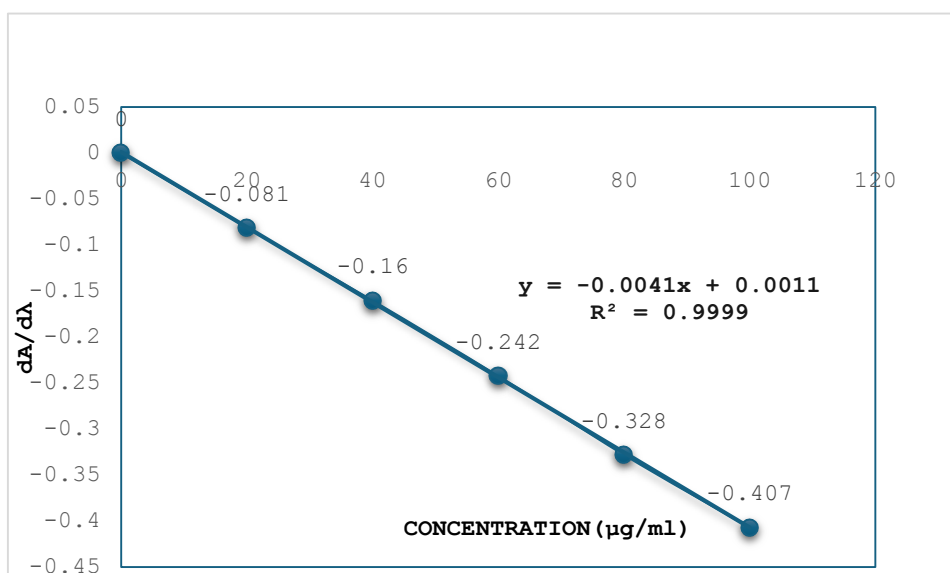
Sample	Types of Ruggedness	Average %*	SD	%RSD
Vonoprazan	Analyst 1	99.31	0.5254	0.5290
	Analyst 2	99.00	1.0405	1.05600
	Instrument 1	99.11	0.4180	0.4217
	Instrument 2	99.50	1.0868	1.0922

*Mean of six observations

Optical Characteristics of Vonoprazan

Parameter	First Order Method
Regression equation($y=mx+c$)	$Y=-0.0041x + 0.0011$
Correlation co-efficient	0.9999
Slope(m)	0.0041
Intercept(c)	0.0011
SE of intercept	0.002
LOD ($\mu\text{g/ml}$)	1.688
LOQ ($\mu\text{g/ml}$)	5.117

**Figure 3: CALIBRATION CURVE OF VONOPRAZAN AT 216nm
(FIRST ORDER DERIVATIVE METHOD)**



CONCLUSION

The proposed UV spectroscopic method (first order derivative) employed here proved to be simple, economical, rapid, precise and accurate. Thus, these can be used for routine estimation of vonoprazan in tablet dosage form.

Reference

1. <https://www.cleantchemlab.com>
2. <https://en.wikipedia.org/wiki/Vonoprazan>
3. <https://www.medkoo.com/products/6630>
4. Code Q2A -Text on Validation of Analytical Procedure Methodology Step-3 Consensus Guideline, ICH: Harmonised Tripartite Guideline, 2005.
5. Code Q2B - Text on Validation of Analytical Procedure Methodology Step-3 Consensus Guideline, ICH Harmonised Tripartite Guideline, 1994.