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Research article

Quantitative analysis of favipiravir in bulk and pharmaceutical dosage forms using UV visible spectrophotometer

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ABSTRACT

The main aim of this study is to develop a rapid and cheap Ultraviolet (UV) spectrophotometric method for the estimation of Favipiravir (400mg) in tablets and validate as per International Conference on Harmonization (ICH) guidelines. The developed method uses the solvent Ethanol: Water (30:70) for the assay of Favipiravir whose λmax was found to be 231nm. In this method, Favipiravirshows linearity in the range 2-10 µg/ml. The accuracy was carried out by using standard addition method and the precision is ascertained by calculating the relative standard deviation. A cheap and rapid UV spectrophotometric method was developed and validated for the estimation of Favipiravir and hence it can be used for the routine pharmaceutical analysis.

Keywords: Favipiravir, Validation, ICH, UV spectrophotometer, Assay.

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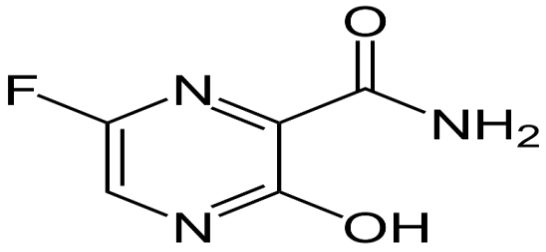
INTRODUCTION

Favipiravir belongs to the class of antiviral agents; it is a prodrug that was initially used for the treatment of influenza. Chemically it is 5-fluoro-2-oxo-1*H*-pyrazine-3-carboxamide and has a molecular weight of 157.10. It acts by selectively inhibiting viral RNA polymerase thereby arresting viral replication. Recently, it was repurposed as a treatment for COVID 19 and was found to be quite effective [1-4].

Even though it is widely used in Influenza A and B, it has good efficacy against influenza strains that are resistant to neuramidase inhibitors. It is also used for the treatment of Ebola and certain other viruses [5-7].

Figure 1: Structure of Favipiravir [5]



Literature survey indicated that a simple and accurate UV-Vis spectrophotometric method for favipiravir was not yet developed, others methods including HPLC technique were available so far [8]. In our study, we intended to develop a simple method and carry out validation parameters as per ICH guidelines [9-10].

MATERIALS AND METHODS

All the chemicals (Ethanol, distilled water) used in the study were of AR grade. The absorbance values were measured using a double beam UV-Visible spectrophotometer (SHIMADZU 1800).

Preparation of standard stock and working standard solutions

About 0.1 g of Favipiravir pure drug was accurately weighed and carefully transferred into a 100 ml volumetric flask. Twenty ml of ethanol was added, and shaken until the drug was completely solubilized. The solution was made up with distilled water and was labelled as Standard stock solution (1000 mcg/ml). From this solution, 5 ml was pipetted out and transferred to a 50 ml volumetric flask and made up with distilled water and labelled it as working standard solution (100 mcg/ml).

Determination of absorption maxima (λ_{max})

From the100 mcg/ml solution, 0.5 ml was pipetted out and added into a 10 ml standard flask and made up with water to yield 5 mcg/ml solution. The resultant solution was scanned over UV range against distilled water as blank to estimate the λ_{max}

Validation parameters

Construction of calibration curve

The calibration curve was established by preparing suitable aliquots. Appropriate dilutions were made to produce concentration range of 2-10 mcg/ml by taking aliquots of 0.2, 0.4, 0.6, 0.8, 1.0 to series of 10 ml standard flasks from working standard solution and made up with water. Absorbances of all the solutions were recorded at 231 nm.

Limit of detection and Limit of quantitation

Using the calibration curve, LOD and LOQ for favipiravir can be determined. The formulas employed were:

LOD = 3.3 x Standard deviation /Slope

LOQ = 10 x Standard deviation /Slope

Accuracy

Accuracy of the proposed method was determined by adopting standard addition method. To 10 mcg/ml of pre-analyzed favipiravir sample, a known amount of drug was added to yield a solution of concentration, 15, 20 and 25 mcg/ml. The percentage recovery was calculated for each sample.

Precision

Precision was carried out by analyzing three different concentrations (4.6.8 mcg/ml) six times on the same day (Intraday) and three consecutive days (Interlay). The % relative standard deviation (RSD) was calculated.

Assay of tablet formulation

Fabiflu 400 tablets were purchased from local pharmacy. About 10 tablets were weighed and the average weight was determined. The tablets were powdered using mortar and pestle and an amount equivalent to 0.1 g of drug was taken in a 100 ml standard flask and about 20 ml of ethanol was added and the volume was made up with distilled water. The solution was shaken for 20 minutes. Filter the solution through Whatman filter No.41 and label the solution as Test stock solution. Make appropriate dilutions to get 10 mcg/ml.

RESULTS AND DISCUSSION

Figure 2: Determination of absorption maxima (λ_{max})

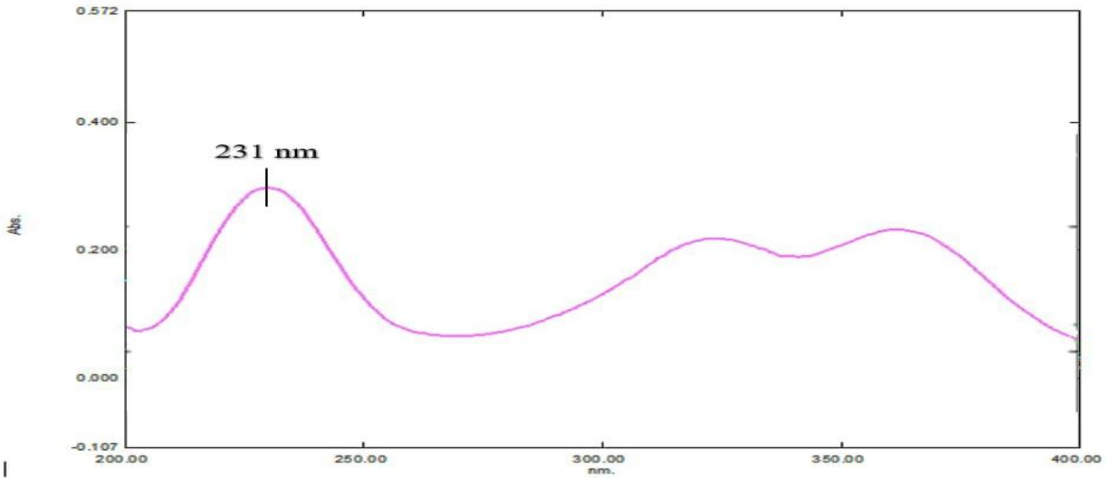


Figure 3: Calibration curve of Favipiravir at 231 nm

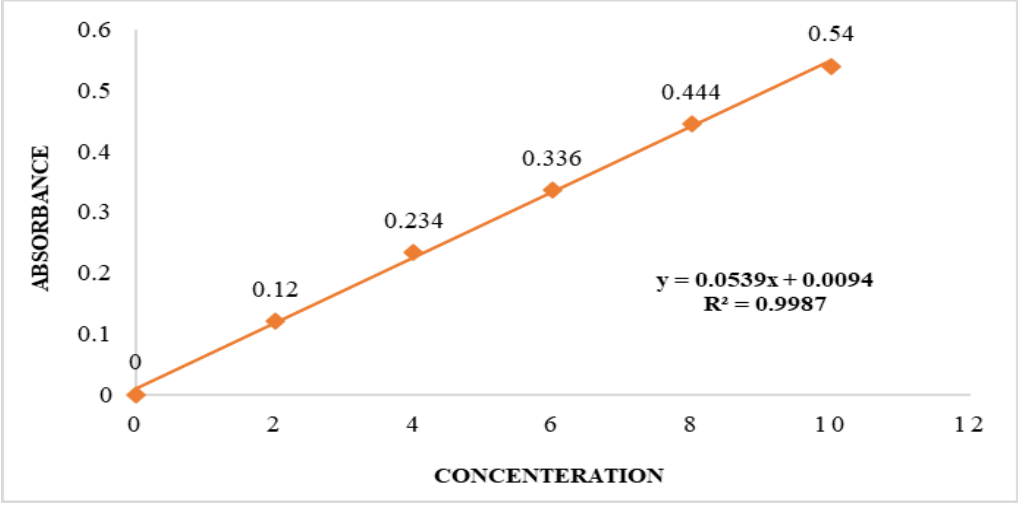


Table 1: Optical characteristics and other parameters

Parameters	Findings of Favipiravir
λ_{max} (nm)	231
Beer Lambert's range (mcg/ml)	2-10
Correlation coefficient (r^2)	0.9987
Regression equation	0.0539x + 0.0094
Slope	0.0539
Intercept	0.0094
Detection limit (mcg/ml)	0.092
Quantitation limit (mcg/ml)	0.282

Table 2: Intraday Precision

Concentration (mcg/ml)	Absorbance	RSD (%)
	0.446	
8	0.449	0.56
	0.442	
	0.443	
	0.444	
***RSD** – Relative standard deviation*		

Table 3: Intraday precision

Days	Absorbance	RSD (%)
1	0.446	0.78
	0.450	
	0.443	
2	0.446	0.34
	0.443	
	0.444	
3	0.446	0.46
	0.447	
	0.443	
***RSD** – Relative standard deviation*		

Table 4: Accuracy

Amount of sample (mcg/ml)	Amount of known drug added (mcg/ml)	Amount of drug recovered (mcg/ml)	% Drug recovered	Mean % recovered
10	5	14.88	99.2	
	5	14.92	99.46	99.42
	5	14.94	99.60	
10	10	19.95	99.75	
	10	19.90	99.50	99.91
	10	20.10	100.5	
10	15	24.74	98.96	
	15	24.93	99.72	99.29
	15	24.80	99.20	

Table 5: Assay of Tablets

Tablet	Label claim (mg/tablet)	Amount Estimated (mg/tablet)	Purity (% w/w)
Fabiflu 400 ®	400 mg	398.56	99.64

The λ_{max} of favipiravir was found to be 231 nm (Figure 2). The calibration curve of favipiravir is presented in Figure 4.The calibration curve was obtained with r^2 value of 0.9987, indicating a linear correlation between concentration and absorbance. (Table 1). The proposed method showed linearity in the range of 2-10 mcg/ml.

For the intraday and interlay precision, The % RSD values were found to be within permissible limits, indicating that the developed method is precise (Table 2,3). The obtained accuracy values were represented in Table 4 and the method was found to be accurate.

The commercial tablet formulation was assayed and the % purity was found to be within 98 – 103%. (Table 5).

The proposed method was found to be accurate and precise. The validated method has been successfully applied for the quantitative estimation of Favipiravir tablet formulation. The results obtained are equivalent to the amount indicated on the labels of the tablets.

CONCLUSION

A simple, accurate, precise and highly sensitive UV spectrophotometric method for quantitative estimation of Favipiravir in bulk and pharmaceutical dosage forms was developed and can be adopted in routine quality control testing of Favipiravir.

Conflict of interests:

No conflict of interest

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