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Research Article

Development and Validation of UV Spectrophotometric Method for Estimation of Felodipine Using Green Solvent in Tablet Formulation

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Abstract

In the present work simple fast, accurate precise and robust method for analysis of felodipine in its tablet dosage form is reported. Present method is developed by using less toxic and green solvent. Method is simple as requires no tedious sample preparation and hence can be used for routine analysis of felodipine in its tablet formulation. Method is developed at wavelength of maximum absorbance 363.5 nm. The relative absorbance of the drug found to be proportional to the drug concentration in the linear ranges of 05 - 50 μgmL^{-1} for felodipine. The performance of the developed method was evaluated in terms of Standard deviation and relative standard deviation to find out the significance of proposed methods over the reference spectrophotometric method. Tablet formulations were successfully analyzed using the proposed method.

Keywords: Felodipine; Spectrophotometric Analysis; Method Validation; ICH

Introduction

Felodipine is calcium channel blocker class of drug used in the treatment of myocardial infraction, heart failure. Felodipine decreases arterial smooth muscle contractility and subsequent vasoconstriction by inhibiting the influx of calcium ions through voltage-gated L-type calcium channels. Felodipine binds to a number of calcium-binding proteins, exhibits competitive antagonism of the mineral corticoid receptor, and blocks calcium influx through voltage-gated T-type calcium channels [1,2]. Felodipine may be used to treat mild to moderate essential hypertension [3,4]. Chemically felodipine is 3, 5-Pyridinedicarboxylic acid 4-(2, 3-dichlorophenyl)-1, 4-dihydro-2, 6-dimethyl, ethyl methyl ester with formula: $C1_8H_{19}C_{12}NO_4$. For analysing felodipine various methods like HPLC capillary electrophoresis, LC-MS and UV spectrophotometric method using solvents which are harmful for environment are reported [5]. Colorimetric analysis methods [6] have been reported so far for determination of felodipine alone and its combination with other drugs. However, HPLC and CE equipments are expensive. Moreover, these techniques may suffer from some other disadvantages such as high maintenance and acquisition cost, time-consuming analysis, requirement for sample pre-treatment, and in some cases low sensitivity [7-9]. That is why these methods are time consuming and tedious. Further, most of the reported spectrometric methods involves use of environment harmful solvents. Therefore, in present work a new simple spectrophotometric method was proposed using environment friendly green solvent for rapid analysis of felodipine in its formulation.

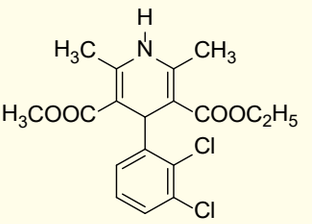

Figure 1: Chemical structure for Felodipine.

Materials and Methods

Instruments

All UV spectrophotometric measurements were carried out using Shimadzu 1600 UV spectrophotometer (Japan) equipped with, deuterium and tungsten lamp, photomultiplier tube detector and 1 cm quartz cell. Slit width for both monochromators were set at 1.5 nm. The spectrometer is connected to a PC computer loaded with the UV PROBE software.

Reagents and chemicals

All solvents were of analytical-reagent grade, and purified whenever necessary. Felodipine was generously supplied by Yarrow Chemicals, Mumbai. Tablets containing felodipine was purchased from the local market.

Preparation of Standard Solutions

Accurately weighed 10 mg of powdered drug was transferred to 100 mL volumetric flask. To this about 20 mL of ethanol was added and contents of the flask were shaken to effect the solution. Finally volume in the flask was made up to the mark by using ethanol.

Preparation of Sample Solution

Twenty tablets were weighed, finely powdered and mixed thoroughly. An accurately weighed amount of the powder equivalent to 10 mg of drug was transferred into a 100 mL volumetric flask, dissolved in about 10 mL ethanol and resultant mixture was allowed to sonication for 15 minutes, diluted to the mark with ethanol. Mixed well and filtered; the first portion of the filtrate was rejected. Further dilutions with the same solvent were made to obtain sample solution containing the specified concentration for each drug as mentioned under the preparation of standard solutions.

General Analytical Procedure

Absorbance of all solutions prepared is recorded in following manner. About 4 mL of each solution was transferred to quartz cell and absorbance of each solution was recorded at 363.5 nm.

Experimental

Linearity

To assess linearity of analytical method, series of standard solutions of drug exhibiting concentration 5 - 50 μgmL^{-1} were prepared in separate 10 mL volumetric flask by diluting suitable volume of stock solution using ethanol as solvent. Absorbance of all solutions was recorded at wavelength of maximum absorbance 363.5 using ethanol as blank.

Accuracy

Accuracy of method was done by spiking known amount of drug in to sample solutions and recovery study was done. To ensure the accuracy, known amounts of pure drug (80%, 100%, and 120%) were added to the sample solution and these samples were reanalysed by the proposed method and also % recovery was determined.

Precision

Precision of an analytical procedure expresses the closeness of agreement (degree of scatter) between a series of measurements obtained from multiple sampling of the same homogeneous sample under the prescribed conditions. Precision was assessed inter and intra-day by recording absorbance of six different drug solutions of concentration 50 μgmL^{-1}.

Ruggedness

Analysis of an homogeneous sample in different laboratories, by different analysts, under prevalent environmental conditions using the specified parameters.

Robustness

The ability to remain unaffected by small but deliberate variations in method parameters- evaluates reliability. Provides an indication of the reliability of the method during normal usage.

Results and Discussion

A novel UV spectrophotometric method for analysis of FLDP is developed by using least harmful solvent ethanol for routine analysis. The given method is found to be linear in the concentration range of 5 - 50 μgmL^{-1}. Standard calibration curve was obtained by plotting the absorbance against its concentration measured at wavelength 363.5 nm. The regression coefficient was found to be 0.9948 and slope was found to be 0.0097 (Table 1).

Sr.	Concentration (μgmL^{-1})	Absorbance
1	5	0.0349
2	10	0.0719
3	15	0.1137
4	20	0.1530
5	25	0.2186
6	30	0.2586
7	35	0.3058
8	40	0.3580
9	45	0.3995
10	50	0.4787

Table 1: Linearity data for the developed method.

Accuracy was done by recovery method at 80, 100 and 120 percent level. It has been observed that recoveries of 99.36, 99.208 and 100.23% were observed at 80, 100 and 120% level respectively. Furthermore % RSD of 0.261, 0.80 and 0.02 which are less than 2.

% Recovery Level	Conc. Added (μgmL^{-1})	Conc. Found (μgmL^{-1})	Recovery (%)	RSD (%)*
80% of test conc.	9.0	8.943	99.36	0.361
100% of test conc.	10.0	9.910	99.108	0.80
120% of test conc.	12.0	12.02	100.23	0.02

Table 2: Results of accuracy data obtained from recovery study.

The intra-day and inter-day precision study of the developed method confirmed adequate sample stability and method reliability where all the Relative Standard Deviation were below 2 %

	Intra-day precision		Inter-day precision	
Sr.	Concentration (μgmL^{-1})	Absorbance	Concentration (μgmL^{-1})	Absorbance
1	50	0.3640	50	0.3842
2	50	0.3624	50	0.3829
3	50	0.3667	50	0.3822
4	50	0.3947	50	0.3923
5	50	0.3651	50	0.3876
6	50	0.3723	50	0.3876
7	50	0.3708	50	0.3869
8	Mean	0.3708	Mean	0.3869
9	SD	0.006	SD	0.002
10	% RSD	1.6	% RSD	0.51

Table 3: Inter and intra-day precession data for developed method.

Analysis of an homogeneous sample in different laboratories, by different analysts, under prevalent environmental conditions using the specified parameters. In order to check ruggedness of the method six different standard solutions of analyte were prepared of concentration of 20 μgmL^{-1} followed by recording of absorbance by two different analyst. SD and RSD were determined. RSD was to be 0.48 and 0.73 respectively for analyst 1 and analyst 2. Results are summarised in table 4.

Sr.	Concentration (μgmL^{-1})	Absorbance	
		Analyst 1	Analyst 2
1	20	0.4072	0.4018
2	20	0.4012	0.4069
3	20	0.4186	0.4096
4	20	0.4112	0.4012
5	20	0.4020	0.4118
6	20	0.4117	0.4162
7	20	0.4086	0.4095
8	Mean	0.4086	0.4095
9	SD	0.002	0.003
10	% RSD	0.48	0.73

Table 4: Ruggedness data for the developed method.

Robustness is one of the important method validation parameter assessed by recording absorbance of different standard solutions at wavelength 363.5 nm and 364 nm that is small change in wavelength of maximum absorbance. Standard Deviation 0.003 and Relative Standard Deviation is 0.75% was found to be (Table 5).

Sr.	Concentration (μgmL^{-1})	Absorbance	
		At 363.5 nm	At 364 nm
1	20	0.4342	0.4336
2	20	0.3748	0.3731
3	20	0.4285	0.4281
4	20	0.3700	0.3702
5	20	0.4130	0.4080
6	20	0.3858	0.3854
7	20	0.4011	0.3997
8	Mean	0.4011	0.3997
9	SD	0.003	0.003
10	RSD	0.74	0.75

Table 5: Robustness data for developed method.

Conclusion

Felodipine is antihypertensive drug from the calcium channel blocker class. As HPLC and UV method were available using little toxic and environment harmful solvents like methanol. Hence in the present work comparatively less toxic and environment friendly green solvent was used for the development of UV spectrophotometric method for determination of felodipine in its tablet dosage form. The developed method is validated according ICH guidelines, method is fast, accurate, precise and robust. Present method can be therefore used for routine analysis of felodipine in bulk and in tablet. Method involves no tedious sample preparation requirements and hence it is simple and fast.

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