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Novel spectrophotometric method for the estimation of Nisoldipine in bulk and pharmaceutical dosage forms

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ABSTRACT

A new, simple and sensitive spectrophotometric method in ultraviolet region has been developed for the determination of nisoldipine in bulk and in pharmaceutical formulations. Nisoldipine exhibits absorption maxima at 237 nm. Developed method obeyed the Beer's law in the concentration range of 4 - 40 µg/mL. The method is accurate, precise and economical. The proposed method has been applied successfully for the analysis of the drug in pure and in its tablet dosage forms. In this method, there is no interference from any common pharmaceutical additives and diluents. The % recovery is greater than 99.86 – 100.67%, this shows that the method was free from the interference of excepients. The results of the tablet analysis were validated with respect to accuracy (recovery), linearity, limit of detection and limit of quantization were found to be satisfactory.

Keywords: UV Spectrophotometry, Nisoldipine, Tablet.

INTRODUCTION

Nisoldipine,(±)3-isobutyl-5-methyl-1,4-dihydro-2,6-dimethyl-4-(2-nitrophenyl) pyridine-3,5-dicarboxylate, is a second generation of dihydropyridine calcium antagonist[1-2], which has a selective arteriolar vasodilatation but shows negligible effects on the other vessels and myocardium[3]. The role of calcium antagonists after acute myocardial infarction is less well defined and their safety in the setting of coronary heart disease has been a matter of controversy[4-5]. Nisoldipine is not official in any pharmacopoeia. Literature survey revals only few analytical methods that have been developed for its determination of nisoldipine in human plasma has been mainly determined using liquid or gas chromatography with mass spectrometry, following a liquid–liquid extraction[6-7]; Hence it was thought worth while to develop simple spectrophotometric method for the same.

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MATERIALS AND METHODS

Instrumentation

A Shimadzu UV/visible double beam spectrophotometer (model 1700) with 1 cm matched quartz cells were used for all the spectral measurements.

Reagents

Double distilled ethyl alcohol was used. Authentic sample of Nisoldipine was gifted by Exela Pharmsci. Pvt. Ltd (Bangalore, India) and First Horizon Pharmaceutical Corporation (Alpharetta, USA).

Preparation of Standard Stock Solutions and calibration Curve

About 100 mg of Nisoldipine (pure) was accurately weighed and dissolved in 30 mL ethanol. The solution was sonicated for 30 minutes. The solution was filtered through Whatman filter paper, volume of the filtrate made up to 100 mL with ethanol (1 mg/mL).. 10 mL of the stock solution was diluted to 100mL with ethanol. Aliquots of 0.4 -2.0 mL of the diluted solution was further diluted to 10 mL with ethanol and the absorbance was measured at 237 nm using ethanol as blank (Fig.No.1 overlain spectra) and area under curve was measured between 232- 237 nm.

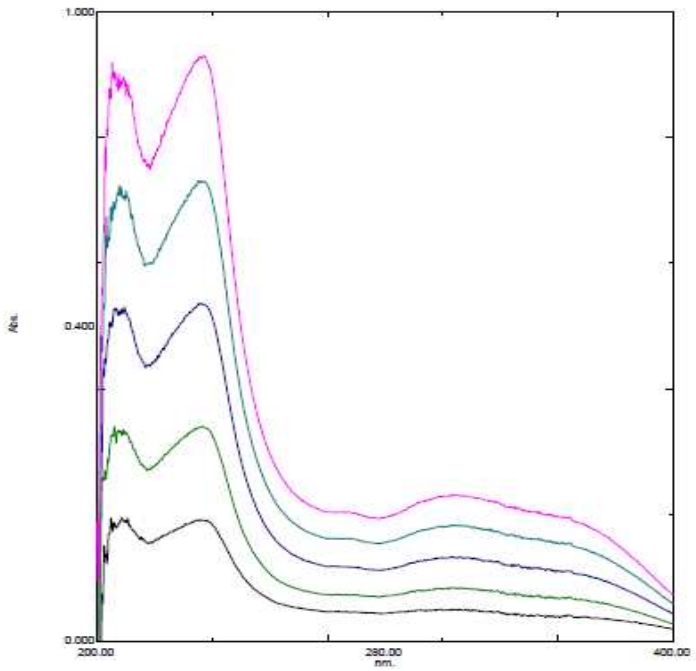

Fig.No.1 Overlain spectra of standard sample.

Preparation of Sample Solution and Formulation analysis

Twenty tablets of Nisoldipine (SULAR) containing 40 mg were accurately weighed and powdered. Weigh accurately a quantity of the powder equivalent to 0.1 gm of nisoldipine and suspended in 30 mL of ethanol. The solution was sonicated for 30, minutes. The solution was filtered through Whatmann filter paper. The residue was washed with 10 mL portions of ethanol three times and total volume of the filtrate was made up to 100 mL with ethanol (1 mg/mL). 10 mL of the above solution diluted to 100 mL with ethanol. Volume of sample was equal to beer's law range was taken and diluted to 10 mL and absorbance measured at 237 nm and area under curve was measured between 232- 237 nm.

The amount of nisoldipine present in the sample was computed from the calibration curve and area under curve calibration curve.(table.no. 1). The experiments were repeated six times to check its reproducibility.

Table. No. 1. Result of Analysis in Marketed Formulation

No	Label Claim Mgm	Amount found* mgm	%Estimated *	S.D *	R.S.D *
1	40	40.038	100.09	0.08258	0.2062
2	40	40.024	100.06	0.0383	0.3455

*Where * indicates mean of six determinations.*
1 = Absorption Maxima method.
2 = Area Under Curve method.

Validation:

The methods were validated with respect to accuracy linearity, limit of detection (LOD) and limit of quantitation (LOQ).

Accuracy (recovery test):

To ascertain the accuracy of proposed methods, recovery studies were carried out by standard addition method at three different levels (80%, 100% and 120%). Percent recovery for Nisoldipine, by all the methods, was found in the range of 99.86 – 100.67%.(Table no.2 & 3)

Table No.2: Recovery study data.(Absorption Maxima Method)

No	Fixed Amount(mcg)	Amount Added.(mcg)	Amount Estimated (mcg)	%Recovery*	S.D*	RSD*
1	10	8	18.01	100.5	0.0554	0.3076
2	10	10	19.99	99.95	0.0820	0.4102
3	10	12	21.99	99.95	0.0820	0.3728

*Where * indicates mean of six determinations.*

Table No.3: Recovery study data.(Area Under Curve Method)

No	Fixed Amount(mcg)	Amount Added.(mcg)	Amount Estimated (mcg)	%Recovery*	S.D*	RSD*
1	10	8	17.98	99.88	0.1507	0.8381
2	10	10	20.13	100.67	0.3752	1.8635
3	10	12	21.97	99.86	0.1483	0.6750

Where * indicates mean of six determinations

Table. 4. Optical Characterstics and Other Parameters

No.	Parameter	Absorption Maxima Method	Area under curve Method
1	λ_{max} (nm)	237	237
2	Beer's law limits (µg/mL)	4 - 40	4 – 40
3	Sandell's sensitivity (µg / cm^2 / 0.001 absorbance unit)	0.0224	0.0489
4	Slope (b)	0.0467	0.0208
5	Intercept (a)	-0.0154	-0.0042
6	Correlation coefficient (r^2)%	0.9972	0.9927
7	Range of errors		
	Confidence limits with 95%	100.09 ± 0.07238	100.06 ± 0.1212
	Confidence limits with 99% level	100.09 ± 0.0951	100.06 ± 0.1593
8	LOD(µg/ml)	0.4631	0.4727
9	LOQ(µg/ml)	1.543	1.5757

Linearity:
The linearity of measurement was evaluated by analyzing different concentration of the standard solution of nisoldipine. Beer-Lambert's concentration range was found to be 04 - 40 µg/mL.

Limit of detection (LOD) and limit of quantitation (LOQ):
The LOD and LOQ of nisoldipine were determined by using standard deviation of the response and slope approach as defined in International Conference on Harmonization (ICH) guidelines.The LOD and LOQ was found to be as in table no.4

RESULTS AND DISCUSSION

The optical characteristics such as absorption maxima, Beer's law limits, and Sandell's sensitivity are presented in Table 4. The regression analysis using method of least squares was made for the slope (b), intercept (a) and correlation coefficient(r) obtained from different concentrations and the results are summarized in Table 4. The percent relative standard deviation and percent range of error (95% and 99% level of confidence limits) calculated from the six measurements are shown in Table 4. The result showed that the above method have reasonable precision. The result obtained with the proposed methods for the dosage forms (Table 1) confirms the suitability of the method

Interference studies revealed that the common excipients and other additives are usually present in the tablet dosage forms did not interfered at their regularly added levels.

CONCLUSION

The proposed methods were found to be simple, sensitive, selective, accurate, precise and economical. The UV method and can be used in the determination of nisoldipine in bulk drug and its pharmaceutical dosage forms (tablets) in a routine manner.

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