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Research Article

NEW SPECTROSCOPIC DETERMINATION OF NIFEDIPINE USING HYDROTROPIC SOLUBILIZATION

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ABSTRACT

A simple, safe and sensitive method of spectroscopic determination of Nifedipine in UV region was developed using 40 % sodium salicylate solution as hydrotropic solubilizing agent. Nifedipine showed λ-max at 350 nm and beer's law was obeyed in the concentration range of 20 – 100 µg/ml. The results of content analysis for tablet dosage forms obtained by the proposed method compared with Indian Pharmacopoeial method. The proposed method was statistically validated as per ICH guidelines. The percentage content and percentage recoveries estimated for Nifedipine marketed tablet formulations were close to 100 with low %RSD.

Keywords: Nifedipine, Hydrotropic solubilization, Sodium Salicylate, Accuracy, Precision.

INTRODUCTION

Increasing the aqueous solubility of insoluble and slightly soluble drugs has been done by various methods to avoid the usage of organic solvents. Because of toxicity, volatility and also high cost of organic solvents, alternative method has been developed. Hydrotropic solubilization is one of the methods to enhance the aqueous solubility of less water soluble drugs[1, 2]. Hydrotropic solution may be a proper choice to preclude the use of organic solvents. Maheswari et.al[3], have developed various analytical techniques using hydrotropic solubilization for analyzing poorly water soluble drugs. So there is broad scope for hydrotropic agents in quantitative estimation of other less water soluble drugs.

Nifedipine is chemically 3, 5-pyridinedicarboxylic acid, 1, 4-dihydro-2, 6-dimethyl-4-(2-nitrophenyl)-dimethyl ester. It is a potent vasodilator agent with calcium antagonistic action. It is a useful anti-anginal agent that also lowers blood pressure. In the present work, Nifedipine in tablet formulations were analyzed spectroscopically using 40% Sodium Salicylate solution as solubilizing agent[4].

MATERIAL AND METHODS

Preliminary solubility studies of pure drug (Nifedipine)

Solubility of Nifedipine was determined at 28 ± 1°. 100 mg of drug was added to screw capped 30 ml glass vials containing different aqueous systems likes distilled water, buffer of pH 6.4, buffer of pH 8.2, 20% sodium salicylate solution, 30% sodium salicylate solution, 40% sodium salicylate solutions, 20% sodium benzoate solution. The vials were shaken for 12 hours in rotatory shaker. These solutions were allowed to equilibrate for the next 24 hours and then centrifuged for 5 minutes at 2000 rpm. The supernatant liquid of each vial was filtered through what man filter paper no.41. Then the filtrates were diluted with water to get 30 µg/ml concentrations and absorbance was measured at 350 nm. Content of drug against solvent blank present in each filtrates were calculated from the standard calibration curve.

Standard calibration curve

The standard stock solution of nifedipine (1 µg/ml) was prepared in 40% sodium salicylate solution. This standard stock solution was diluted with distilled water, to obtain various dilutions from 20 – 80 µg/ml. The solution containing 20 µm/ml of nifedipine was scanned between 200 and 400 nm. The λ-max was found at 350 nm and recorded graph was shown at Fig.1. The absorbance of the other diluted solutions was measured and standard calibration graph (Fig.2) was plotted against concentration.

Analysis of nifedipine tablet formulations by proposed method

Twenty tablets of nifedipine marketed formulation I was weighed and ground to fine Powder. An accurately weighed powder sample equivalent to 50 mg of nifedipine was transferred in to a 200 ml volumetric flask. 50 ml of 40% sodium salicylate solution was added and the flask was shaken for about 20 minutes to dissolve the drug. Then the volume was made up to the mark with distilled water. The solution was filtered through what man filter paper No.41. 20 ml of the above filtrates was pipetted out and transferred into clean 100 ml volumetric flask and made up to the mark with distilled water. The absorbance was measured at 350 nm and the drug content of the tablet formulation was then calculated. As similar procedure was used in case of nifedipine tablet formulation II and results were tabulated in Table 2.

Analysis of nifedipine tablet formulations by official method[5]

Twenty tablets of nifedipine formulation I was weighed and ground to fine Powder. An accurately weighed quantity of powder equivalent to 50 mg of nifedipine was transferred into 200 ml flask. The substance was dissolved with 50 ml of methanol and volume was made up to the mark with methanol. 20ml of the above filtrate was pipetted out and transferred in to 100 ml clean flask and made up to the mark with methanol. The absorbance was measured at 350 nm. The standard solution was analyzed by similar way using 0.005% w/v solution of nifedipine RS in methanol. A similar procedure was followed for formulation II. The content of nifedipine in formulation I and II were calculated and results were tabulated in Table 2.

Validation of proposed method[6]

Accuracy of the method was determined by the recovery studies in the tablets formulations of the nifedipine. Recovery studies were carried out by addition of known quantities of standard drug to pre-analyzed sample at three different concentrations. Also the experiment was repeated six times within a day to determine intra-day precision and on six different days to determine inter-day precision. The percentage relative standard deviation was calculated at each concentration level. The values of method validation were given in Table 3.

RESULTS AND DISCUSSION

By performing the solubility studies, it was found that the solubility of nifedipine in 40% sodium salicylate solution was more satisfied as compared to its solubility in other solvents like distilled water, buffer pH 6.4, buffer pH 8.2, 20% sodium salicylate solution, 30% sodium salicylate solution and 20% sodium benzoate solution. The λ-max for pure nifedipine in 40% sodium salicylate solution was found at 350 nm and recorded graph was shown at Fig. 1.

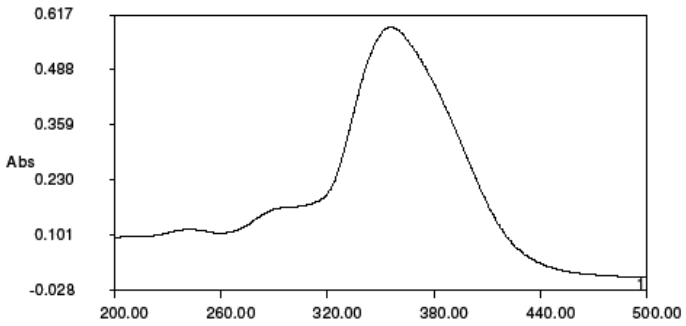

Fig 1: It shows UV spectrum of nifedipine in 40 % sodium salicylate solution

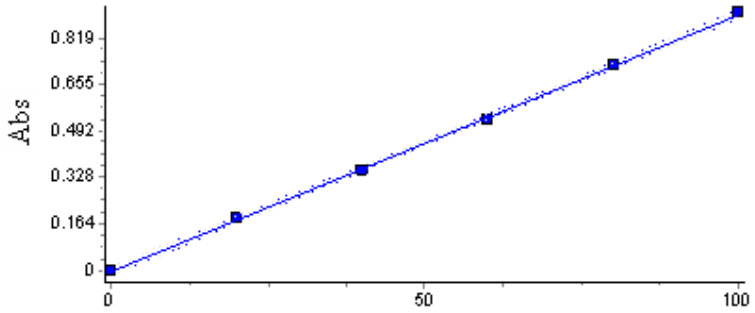

Fig 2: It shows Standard calibration graph for nifedipine pure drug

Table 1: Summary of Optical Parameters of Nifedipine

Parameters	Data
λ – Max	370 nm
Linearity	20 – 100 µg/ml
Regression equation	y = 0.009043x - 0.003476
Correlation coefficient	R^2 = 0.9995
Slope	0.009043
Intercept	0.003476
LOD	1.2833 µg/ml
LOQ	3.888 µg/ml

Beer's law is obeyed in concentration range of 20-80 µg/ml, using regression analysis the linear equation y = 0.009043x - 0.003476 with correlation coefficient of R^2= 0.9995. All the optical parameters are tabulated in table 1.

From the comparison studies of the proposed method with Pharmacopoeial method, the amount of drug (nifedipine) estimated by both the methods are very close to each other and comparable. This is indicating the accuracy of the proposed method of analysis. Percent label claim of nifedipine tablet formulations estimated by proposed and Pharmacopeial method ranged between 99.50 % - 100.80 % and values were tabulated on Table 2. Method was validated in terms of accuracy and precision. The accuracy of the method was proved by performing recovery studies in the commercially available formulations. Values greater than 99% indicate that proposed method is accurate for the analysis of drug.

Table 2: Comparison of proposed method with IP 1996 method

	λ – max (nm)		Amount found (mg)*		% drug content*	
	A	B	A	B	A	B
By proposed method	350	350	9.953	9.923	99.53	99.23
By IP 1996 method	350	350	10.065	9.963	100.65	99.63

*(n=4)

The precision of the method was checked in terms of Inter-day and Intra-day, where methods were repeated on six different day and also repeated on six different time periods in same day. The results were given in Table 3 and shows % RSD of less than 1% at each level clearly indicate that the method is precise enough for the analysis of the drug.

Table 3: Validation data for proposed method

Formulation	Label claim (mg)	Level of std (%)	% Recovery*		%RSD	
			Intra-day	Inter-day	Intra-day	Inter-day
Brand A	10	20	99.43	99.56	0.5486	0.8136
	10	40	99.13	99.72	1.2482	0.5869
	10	60	99.50	100.06	0.9853	1.4528
Brand B	10	20	100.82	99.72	0.6582	1.0426
	10	40	99.90	99.84	0.9810	0.4773
	10	60	100.03	99.76	0.6584	0.7585

*(n=6)

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