Establishing and Validating a UV Spectrophotometric Approach for Enalapril Maleate Analysis in Bulk and Formulated Products

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Abstract:
A simple, accurate, sensitive, precise and economical spectroscopic method has been developed and validated for the determination of enalapril maleate in bulk and tablet dosage form. The solvent used is double distilled water for solubilizing purpose. The drug shows the absorption maxima of 211nm. The method obeys Beer's law in the concentration range of 10-60 µg/mL and exhibited good correlation coefficient (R2=0.9983). The developed method is validated statistically as per ICH guidelines for linearity, precision and accuracy.

Keywords: Enalapril maleate, UV Spectroscopy, ICH Guidelines, ACE inhibitor and Antihypertensive.

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INTRODUCTION:

Enalapril maleate [1] (ENM) is an ACE (Angiotensin converting enzyme) inhibitor and is one of the leading antihypertensive drugs in world. It is belong to the class of organic compounds known as dibenzoxepines. ENM is the maleate salt of enalapril, the ethyl ester of long acting angiotensin converting enzyme inhibitor. ENM has a molecular weight of 492.5. ENM is chemically described as ((S)-1- (N-(1-(ethoxy carbonyl)-3-phenyl propyl)-L-alanyl)-L-proline, (Z)-2-butenediote), a derivative of two amino acids L-alanine and L-proline.

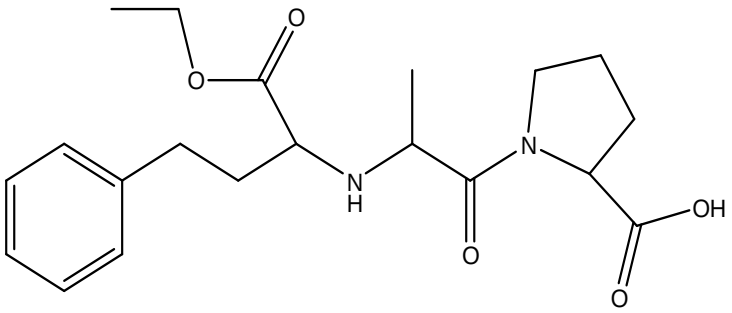

Fig. 1 Structure of Enalapril Maleate

Quantitative determination of ENM can be carried out by various methods like Spectrophotometry [2-14], HPLC [15], Polarography [16], AAS [17] and Membrane selective electrodes [18]. It is used for treatment of hypertensions and chronic heart failure. It is an ideal drug for hypertensive patients. ENM has also been estimated after derivatization with 2,4-dinitroflurobenzene at pH 9 to a colored product which absorbs maximally at 356nm. Spectrophotometric method reported for analysis of ENM in commercial dosage form suffered disadvantage of heating at higher temperatures. The present study is aimed at developing a new spectrophotometric method for the estimation of enalapril maleate and validating as per ICH guidelines [19].

MATERIALS AND METHODS:

UV visible spectrophotometer (Lab India UV-3092) with 1cm matched quartz cells were used for all absorbance measurements. Enalapril maleate used as API, Double distilled water and NaOH used as a solvent.

PREPARATION OF STANDARD STOCK SOLUTION:

The standard stock solution of ENM was prepared by transferring accurately weighed about 100 mg of ENM to 100 mL volumetric flask containing 0.1N NaOH. Then volume was made up to the mark by using double distilled water to give concentration 1000 µg/ml from this, 10 ml of solution was transferred to a 100 ml volumetric flask and volume was made up with double distilled water to give a concentration of 100µg/mL (standard stock solution) and it was further diluted with double distilled water to get concentration of 30 µg/mL.

Selection of Suitable Detection Wavelength:

The working standard solution of 30µg/mL was scanned between 400 nm to 200 nm in UV spectrophotometer against double distilled water as blank after baseline correction. Wavelength range selected was around absorption maxima of 211nm.

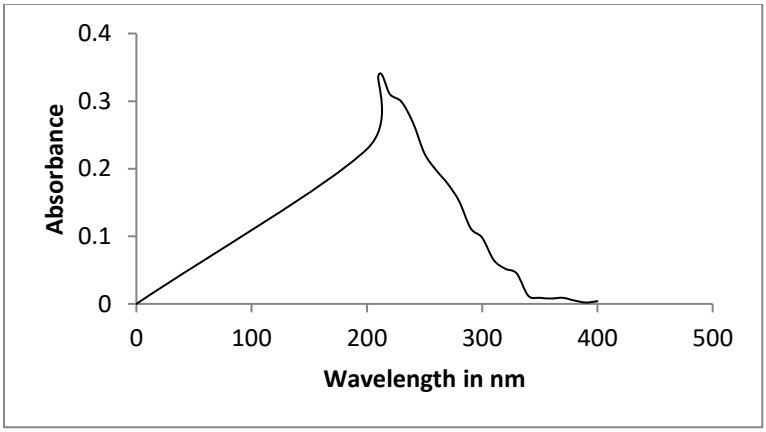

Fig. 2: UV Spectrum of Enalapril Maleate (400-200nm)

Preparation of Calibration Curve:
For the preparation of standard calibration curve, concentration of 10-60 µg/mL were prepared by pipetting out 0.1, 0.2, 0.3, 0.4,0.5, 0.6ml from the 100µg/mL solution in to a 10mL volumetric flask and made up the volume with double distilled water. The absorbance of std solution was measured at 211 nm against double distilled water as blank. Calibration curve of the ENM was then plotted by taking the absorbance obtained on y-axis and the concentration of the solution on x-axis. The curve showed linearity in the range of 10-60 µg/ml with correlation coefficient of 0.997. The data was given in Table 01 and the calibration curve was shown in Fig 03.

Table 01: Linearity Data of Enalapril Maleate

CONCENTRATION Microgram/ml	ABSORBANCE
10	0.199
20	0.338
30	0.562
40	0.718
50	0.881
60	1.051

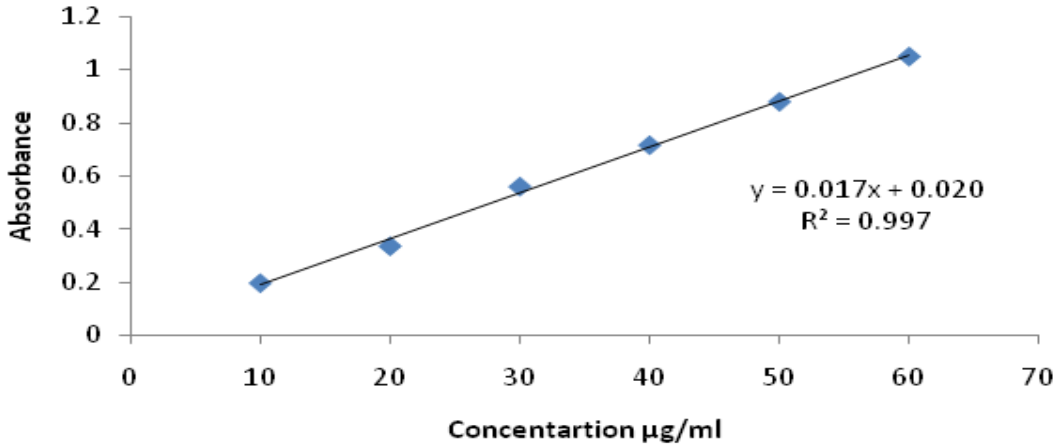

Fig. 3: Calibration curve of Enalapril Maleate

PRECISION:
It is a closeness of a series of individual analyte measurements applied repeatedly to multiple aliquots of the same sample it is calculated as a relative standard deviation the RSD is often tested in three different categories they are repeatability, intraday and inter day. The precision is checked by repeatedly measuring the absorbance of six standard solutions of ENM 30 µg/mL. Absorbance was measured at 211nm and the average, standard deviation, relative standard deviation were calculated and tabulated in Table 02. The method was found to be precised as the RSD values are less than 02.

Table02: Precision Data for Enalapril Maleate

	Intra Day	Day 1	Day2	Day3
	ABSORBANCE			
Preparation 1	0.621	0.620	0.701	0.733

Preparation 2	0.611	0.629	0.712	0.724
Preparation 3	0.641	0.638	0.711	0.734
Preparation 4	0.612	0.622	0.723	0.701
Preparation 5	0.617	0.643	0.726	0.714
Preparation 6	0.642	0.641	0.770	0.712
Average	0.6195	0.6305	0.7158	0.7224
Standard deviation	0.0116	0.0087	0.0094	0.0141
Relative standard deviation	1.87	1.38	1.33	1.96

ACCURACY:

accuracy for analytical method of ENM was determined by std addition methods at 3 levels i.e. 50%, 100% and 150%. Absorbance was measured at 211nm. Results are expressed in terms of % recovery and found to be accurate as the % recovery is within 95 to 105 %. The values are tabulated in Table 03.

Table 03: Accuracy Data for Enalapril Maleate

Accuracy Level	Amount Added (µg/mL)	Amount Recovered	% Recovery	Mean Recovery
50 % Level	15	14.98	99.87	100.36
	15	15.20	101.33	
	15	15.22	101.47	
100 % Level	30	29.98	99.93	
	30	29.97	99.90	
	30	30.02	100.07	
150 % Level	45	45.23	100.51	
	45	44.88	99.73	
	45	45.20	100.44	

DISCUSSION AND CONCLUSION:

It can be concluded from the results that the proposed method was simple, accurate, precise, most economical and consistent for the determination of enalapril maleate in bulk and tablet dosage form. Results suggest that this method can be used for routine estimation of enalapril maleate in bulk and tablet dosage forms.

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