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Research Article

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Development of sensitive spectrophotometric method for the determination of metoprolol in bulk and tablet form

M. Suman[1], C. Narasimha Rao[1], S. Gangadhara[1], K. Siva Kumar[2] and P. Venkateswarlu[1]*

[1]Dept. of Chemistry, S. V. University, Tirupati, A. P., India
[2]Dept. of Chemistry, S. V. Arts UG & PG College(T. T. D'S), Tirupati, A. P., India

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ABSTRACT

A simple procedure for the determination of metoprolol in bulk and tablet forms by spectrophotometry method was developed. The proposed method is based on the charge transfer reaction between the drug and chlorodinitrobenzene (CDNB) at room temperature in methanol. When metoprolol standard solution is allowed to react with CDNB, a yellow colour was observed which measured at λ_{max} *425nm. Linearity is maintained within in a wide concentration range of 8-16µg/ml. The limit of detection and limit of quantitation are 0.1104 and 0.3678 respectively.The assay of results is in good agreement with label claim. Hence the proposed method is precise, accurate and useful for the regular quality control.*

Keywords: UV-Visible double beam spectrophotometer, chlorodinitrobenzene (CDNB), Metoprolol, Methanol.

INTRODUCTION

Metoprolol is a white crystalline powder with chemical formula $C_{15}H_{25}NO_3$ and molecular weight 267.364g/mol. Chemically, it is (*RS*)-1-(Isopropylamino)-3-[4-(2-methoxyethyl)phenoxy]propan-2-ol [1]. This drug is used as beta blocker. Clinically, beta blockers are important drugs used in the treatment of disorders like hypertension, angina Pectoris and arrhythmia [2]. They are also used in the treatment of Congestive Heart Failure (CHF) and myocardial infraction [3-5]. Metoprolol is a competitive beta 1 adrenoceptor antagonist used extensively for more than 25 years in the treatment of such cardio vascular disorders [6, 7]. In British Pharmacopoeia, the drug is determined by Potentiometric titration method [8]. From the literature survey, it was determined by several analytical methods such as thin layer chromatography [9], Infrared Spectroscopy [10] and Gas chromatography [11].

In the present investigation a new spectrophotometric method has been developed which is simple, high speed in performance for the determination of metoprolol in bulk drug and pharmaceutical formulations .

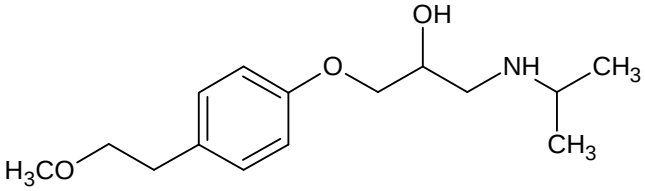

Fig.1: Structure of Metoprolol

EXPERIMENTAL SECTION

Instrumentation
Shimadzu UV-Visible double beam spectrophotometer (model 2450) with 1cm matched quartz cells was used for the spectral measurements.

Chemicals and Reagents
Methanol, Dimethyl sulphoxide(DMSO) acetone and CDNB. Metoprolol was procured from Astra Zeneca, India. All the chemicals are of analytical grade.

Preparation of sample solutions
About 50 mg of Metoprolol was accurately weighed and taken in 50ml volumetric flask and dissolved in few ml of methanol and after dissolution , the solution was made up to the mark with the same solvent and filtered , the final concentration of the solution was made to 1mg/1ml (100µg/ml)

In the case of pharmaceutical formulations two tablets of Metoprolol (Label claim: 50mg) were weighed and finely powdered , a portion of powder equivalent to 50 mg of the drug was taken into 50ml standard flask and dissolved with small portion of methanol and made up to the mark with the same solvent. The contents in the flask are filtered on Whatmann filter paper 41 and washed well with methanol for the complete recovery of the drug. The resulting concentration of the solution was found to be 1 mg/ml. This solution is considered as stock solution and the required aliquots were taken from the solution for the determination of the drug by the proposed method.

To a series of clean; dry 10ml volumetric flasks different aliquots of standard metoprolol solution ranging from 0.8 – 1.6 ml (8 – 16 µg/ml) is transferred by using micro burette. To each flask CDNB solution of concentration 9.8 x 10^{-3} M and volume 1.6 ml is added and the entire contents are heated on a water bath at a temperature range 100 ± 1°C. After heating the contents are cooled to laboratory temperature and transferred to 5 cm^3 volumetric flasks and the volume is adjusted to 4ml with DMSO by using micro burette. The formation of yellow colour was observed which measured at 425 nm against the blank and the amount of drug was computed from calibration graph.

RESULTS AND DISCUSSION

The absorption spectrum showed λ_{max} 425nm for the drug metoprolol. The calibration plot was obtained from the series of concentrations ranging from 8-16 µg/ml.The optical characteristics such as Beer's law limit, molar absorbtivity , Sandell's sensitivity and the regression analysis is made for slope ,intercept and correlation co efficient and these results are presented in table 1.

Table1 Optical characteristics of the proposed method

Parameter	Value
λ_{max} (nm)	425
Beer's law limit (µg/ml)	8.5-26.6
Molar absorbance ($L.mol^{-1}$ cm^{-1})	0.75
Sandell's sensitivity (µg.cm^{-2}/0.001 A.U)	0.001316
Correlation coefficient (r^2)	0.996185
Slope (m)	0.027155
Intercept (c)	0.042021
%RSD	0.131579
Colour	Yellow
LOD	0.110475
LOQ	0.367882

Table2 Determination of Metoprolol in dosage forms

Pharmaceutical formulation	Amount added (mg)	*Amount found (mg)	% recovery	±SD	RSD
Metolar	10	9.95	99.56	0.015	0.151
Betaloc	15	14.95	99.68	0.025	0.161

**Average of five determinations*

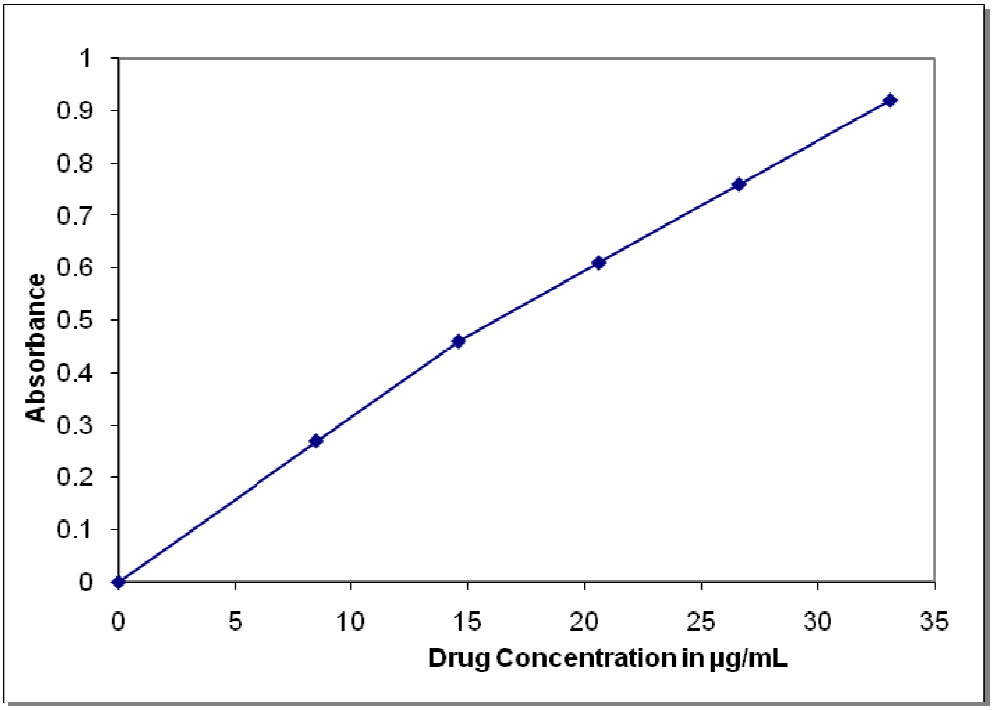

Fig. 2 Calibration curve of Metoprolol with CDNB

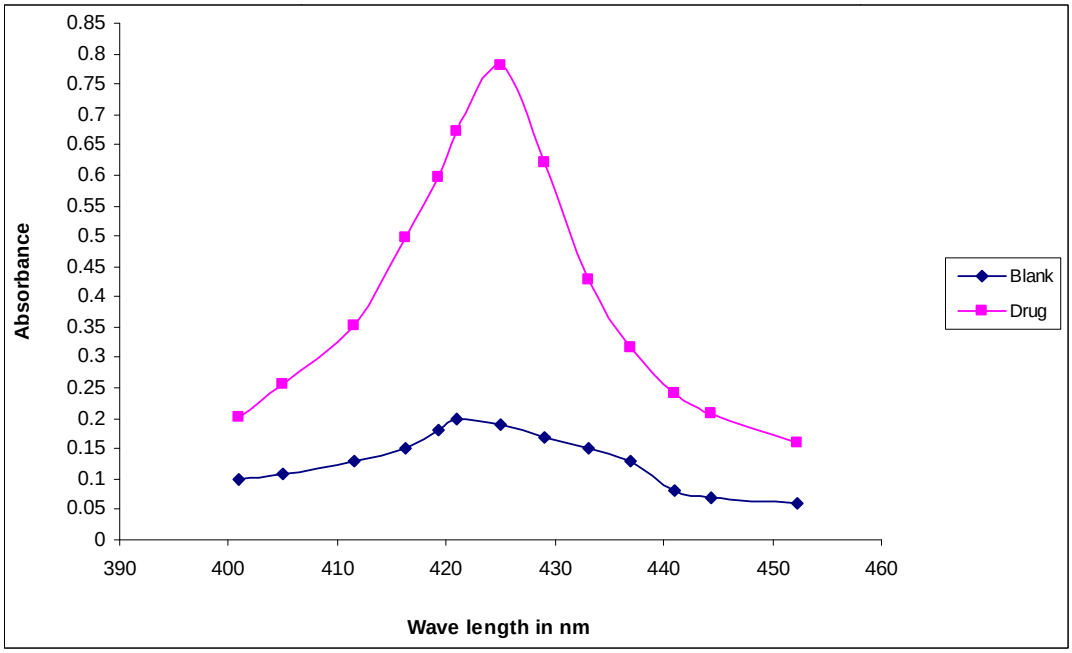

Fig. 3 Absorbtion spectrum of Metoprolol with CDNB

Table 3 Method accuracy from Recovery assay

Pharmaceutical formulation	Labeled amount(mg)	*Amount Found (mg)	% Recovery	± SD	RSD%
Metolar	50	49.94	99.89	0.020	0.041
Betaloc	50	49.95	99.90	0.021	0.046

**Average of five determinations*

CONCLUSION

The proposed method for the determination of Metoprolol is simple, accurate, linear and precise. Hence the method can be used for the regular analysis of Metoprolol in bulk and in its pharmaceutical formulations.

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