CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.2628126

Available online at: http://www.iajps.com *Research Article*

METHOD DEVELOPMENT AND VALIDATION OF PROPRANOLOL HCL BY UV SPECTROSCOPIC METHOD IN A BULK AND PHARMACEUTICAL DOSAGE FORM

Mrs. Kansa Noori*, G . Narendar, CH. Anjali, G. Srilatha, B. Vani, Santosh Illendula,K.N.V. Rao, K. Rajeswar Dutt.

Department of Pharmaceutical Analysis and Quality Assurance, Nalanda College of Pharmacy, Cherlapally, Nalgonda, Telangana-508001

Article Received: January 2019 **Accepted:** March 2019 **Published:** April 2019

Abstract:

A new simple, accurate, rapid, precise, reproducible and cost-effective spectrophotometric method for the quantitative estimation of Propranolol Hcl in bulk and pharmaceutical dosage form. The developed UV spectrophotometric method for the quantitative estimation of Propranolol Hcl is based on measurement of absorption at maximum wavelength 228 nm using Acetonitrile with buffer as a solvent. The stock solution of Propranolol Hcl was prepared, and subsequent suitable dilution was prepared in acetonitrile: buffer to obtained standard curve. The standard solution of Propranolol Hcl shows absorption maxima at 228 nm. The drug obeyed beer lambert's law in the concentration range of 5 - 25 µg/ml with regression 0.999 at 228 nm. The overall % recovery was found to be 99.03% which reflects that the method was free from the interference of the impurities and other excipients used in the bulk and marketed dosage form. The low value of % RSD was indicative of accuracy and reproducibility of the method. The % RSD for inter-day and intra-day precision was found to be 0.173 and 0.17 respectively which is <2% hence proved that method is precise. The results of analysis have been validated as per International Conference on Harmonization (ICH) guidelines. The developed method can be adopted in routine analysis of Propranolol Hcl in bulk and tablet dosage form.

Keywords: *Propranolol Hcl, UV Visible Spectrophotometry, Method development, Validation, ICH guidelines, Acetonitrile , Accuracy, Precision.*

Corresponding author:

Kansa Noori,

Department of Pharmaceutical Analysis and Quality Assurance,
Nalanda College of Pharmacy, Charlapally, Nalgonda, Telangana-508001.
E-Mail:santoshillendula@gmail.com

QR code

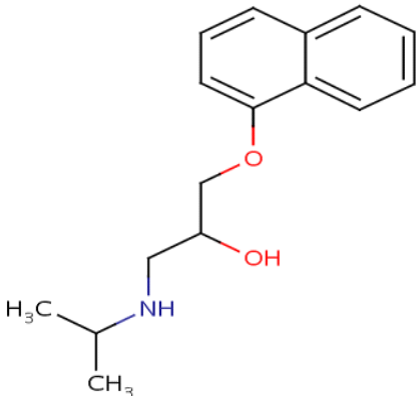
Please cite this article in press Kansa Nooriet al., ***Method Development and Validation of Propranolol Hcl By UV Spectroscopic Method In A Bulk And Pharmaceutical Dosage Form.,****Indo Am. J. P. Sci, 2019; 06(04).*

INTRODUCTION:

Propranolol HCL IUPAC Name [1-naphthalein-1-yloxy-3 (propan-2-ylamino) propan-2-ol; hydrochloride] **:** Propranolol is a white powder, odourless,bitter taste . It is Soluble in ethanol and water practically insoluble in ether benzene and ethyl acetate. Propranolol Hcl is a non-selective beta-adrenergic blocking agent. Propranolol Hcl inhibits the response to adrenergic stimuli by completely blocking beta adrenergic receptors with in the myocardium and within bronchial and vascular smooth muscles. Side effects of propranolol Hcl are**:** CNS-Fatigue, Lethargy, Hallucination

Respiratory-Brochospasm, GI-Nausea, Vomiting , CVS-Bradycardia, Heart failure , Skin- Rashes. It is used to treat high blood pressure, chest pain, prevent migraine, head ache ,tremor.

Structure of Propranolol HCL:



MATERIALS AND METHODS

Chemicals and Reagents: Methanol, Ethanol, Acetone, Acetonitrile,Water.

Instruments:

The Spectroscopic analysis was carried out using Double beam PG Instruments recording UV-Visible Spectrophotometer(SHIMADZU UV-1601**)** with 1mm path length matched quartz cells was used for analytical purpose.

Reagents and Solutions

Diluent preparation : Take 50ml of buffer in 50ml of acetonitrile.

Preparation of pH 4 Ammonium phosphate buffer: Dissolve 13.2g of dibasic ammonium phosphate in sufficient water to produce 500ml and pH is adjusted to 4 with ortho phosphoric acid.

Preparation of standard Stock Solution of Propranolol HCL

100mg of Propranolol Hcl was weighed accurately and transferred into 100ml volumetric flask. About 10 ml of diluent was added and sonicated to dissolve. The volume was made up to the mark with same solvent. The final solution contained about 100µg/ml of Propranolol Hcl. Working standard solution of Propranolol Hcl containing 10µg/ml for method. Finally add those above solutions and prepare the final solution about 10µg/ml.

Preparation of Sample Solutions.

Take 20 Tablets average weight and crush in a mortar by using pestle and weight powder 100 mg equivalent weight of Propanolol Hcl sample into a 100ml clean dry volumetric flask, dissolve and make up to volume with diluent. Further dilution was done by transferring 0.1 ml of the above solution into a 10ml volumetric flask and make up to volume with diluent.

Determination of wavelength of maximum absorbance for Propanolol HCL

The absorbance of the final solution scanned in the UV spectrum in the range of 200 to 400nm against solvent mixture as blank.

Optimization of selection of Solvent

It is well known that the solvents do exerts a profound effect on the quality and the shape of the peak. The choices of solvents for UV method development are: Methanol, Ethanol, Acetonitrile, Acetone etc. First optimize the different solvents. From that solvents Acetonitrile satisfied the all the optimized conditions.

5.4. Wavelength Selection

The standard solutions are prepared by transferring the standard drug in a selected solvent or mobile phase and finally diluting with the same solvent or diluent. That prepared solution is scanned in the visible wavelength range of 200-400nm.This has been performed to know the maxima of Propranolol Hcl. While scanning the Propranolol Hcl solution we observed the maxima at 228 nm. The visible spectrum has been recorded on (SHIMADZU UV-1601 make UV – Vis spectrophotometer model UV-1601.The scanned visible spectrum is attached in the following page.The λ_{max} of the Propranolol Hcl was found to be 228 nm in diluents as solvent system.

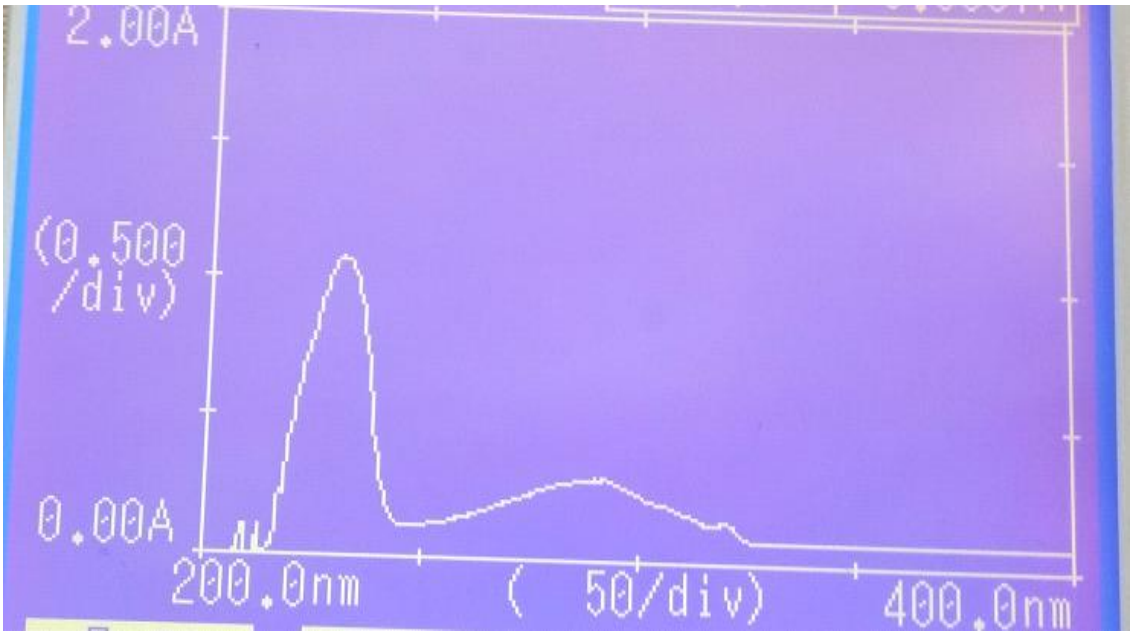


Figure.1: Shows UV Spectrum of Propranolol HCL

METHOD VALIDATION

1. Accuracy: ***Recovery study:*** The accuracy is nothing but the comparison of obtained value with the standard value. After completion of analysis of Propranolol containing 3 group 3 replicates with the bulk and pharmaceutical dosage form.

Method: The accuracy of the developed method can be studied by preparing the solutions of various concentrations i.e. 80%, 100% and 120%. In this concentrations the amount of marketed pharmaceutical dosage form was kept as constant and the quantity of pure drug (API) is varied. The prepared solutions in triplicates and here determined is percentage recovery of pure drug. The results are shown in Table-1.

2. Precision:

Repeatability

The precision of each method was ascertained separately from the peak areas & retention times obtained by actual determination of six replicates of a fixed amount of drug. Propranolol HCL the percent relative standard deviations were calculated for Propranolol HCL is presented in the Table-2.

Intermediate Precision:

Intra-assay & inter-assay:

The intra & inter day variation of the method was carried out & the high values of mean assay & low values of standard deviation & % RSD (% RSD < 2%) within a day & day to day variations for Propranolol revealed that the proposed method is precise.Table-3.

3. Linearity & Range:

The calibration curve showed good linearity in the range of 5-25µg/ml, for Propranolol HCL with correlation coefficient (r^2) of 0.999 (Fig-2). A typical calibration curve has the regression equation of y = 0.040x + 0.003 for Propranolol Hcl

Standard solutions of Propranolol Hcl in the concentration range of 5 g/ml to 25 g/ml were obtained by transferring (5,10,15 and 20,25 ml) of Propranolol Hcl stock solution (100ppm) to the series of clean & dry 10 ml volumetric flasks. The volumes in each volumetric flask were made up with the solvent system and mixed.

The absorbances of the solutions were measured at 228 nm against the solvent system as blank and calibration curve is plotted. The Lambert-Beer's Law is linear in concentration range of 5 to 25 g/ml at 228 nm for Propranolol Hcl. The results were shown in Table-4.

4. Method Robustness:

Robustness of the method was determined by carrying out the analysis under different Wavelength i.e. at 226nm,228nm and 230nm.. The respective absorbances of 10µg/ml were noted SD < 2%) the developed UV-Spectroscopic method for the analysis

of Propranolol Hcl. The results were shown in Table-5.

5. LOD & LOQ:

The limit of detection (LOD) and the limit of quantification limit (LOQ) are measured by using the following equations: **L.O.D. = 3.3 (SD/S).**

L.O.Q. = 10 (SD/S)

Where, SD = Standard deviation of the response,

S = Slope of the calibration curve

The slope S and the SD may be estimated from the calibration curve of the analyte/sample.

Result & Discussion

The LOD was found to be 0.097 g/ml and LOQ was found to be 0.29 g/ml for Propranolol Hcl respectively which represents that sensitivity of the method is high.

6. ASSAY OF PROPANOLOL HCL IN DOSAGE FORM:

PROPANOLOL HCL 20mg

Assay of marketed tablet formulation Brands :

Propranolol Hcl was procured from the local market as tablets of strength having 20mg, marketed with brand names of Inderal. These marketed formulations were manufactured by the Astrazeneca respectively.

Weighed accurately about twenty tablets and calculate the weights of individual tablets and finally calculate the average weight. They were triturated to fine powder by using a mortar and pestle. The powdered tablet equivalent to 20mg of Propranolol was dissolved in 15ml of diluent with the help of sonication process and the final volume was made upto the mark with the diluent in 25 ml volumetric flask. The resulted solution was filtered using Whatman filter paper (0.45µm). This final solution was further diluted to obtain 10µg/ml concentration of the solution by using diluents used as a solvent and observed by UV analysis. This procedure was repeated in triplicate.The data are shown in Table-6.

Amount Present

$$= \frac{\text{Sample Absorbance}}{\text{Standard Absorbance}} \times \frac{\text{Standard Dilution}}{\text{Sample Dilution}} \times \frac{\text{Potency}}{100} \times \text{Average weight}$$

.

$$\%\text{Content} = \frac{\text{Amount Present}}{\text{Label Claim}} \times 100$$

RESULTS AND DISCUSSION:

The standard solutions of Propranolol Hcl in Acetonitrile with Ammonium phosphate buffer pH 4 (50:50) subjected to a scan individually at the series of wavelengths of 200 nm to 400 nm. Absorption maximum of Propranolol Hcl was found to be at 228 nm. Therefore, 228 nm was selected as λ_{max} of Propranolol for the present study. The calibration curve of Propranolol Hcl was found to be linear in the range of 5-25 µg/ml at 228 nm. Therefore, it was clear that Propranolol Hcl can be determined without interference of any irrelevant substance in single component pharmaceutical products. The used technique was initially attempted on bulk drugs in their synthetic sample and concentrations were estimated.

The % recovery was carried out at 3 levels, 80%, 100% and 120% of Propranolol standard concentration. Three samples were prepared for each recovery level. The solutions were then analyzed, and the percentage recoveries were found to be satisfactory within the acceptable limits as per the content of the label claim for marketed tablet dosage form. The newly developed method was validated according to the ICH guidelines and the method validation parameters.

The developed method was subjected to do the various method validation parameters such as specificity, accuracy, precision, linearity and range, limit of detection and limit of quantification, robustness and ruggedness etc

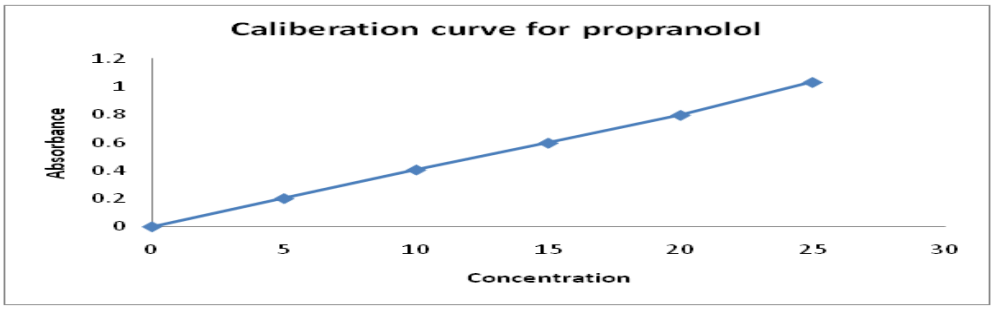


Figure-2:Calibration Curve for propranolol Hcl at 228nm

Table-1: Results of Accuracy :

Level of Recovery	Sample Conc. (µg/ml)	Absorbance	% Recovery	Mean % Recovery
80%	8	7.960	99.5	99.2
80%	8	7.984	99.8	
80%	8	7.881	98.5	
100%	10	9.718	97.18	98.4
100%	10	9.891	98.91	
100%	10	9.913	99.13	
120%	12	11.941	99.5	99.5
120%	12	11.916	99.3	
120%	12	11.973	99.7	

Acceptance criteria: correlation coefficient should not be less than 0.990.

2. Precision:

Repeatability:

Table-2: Results of Repeatability

S.No.	Conc. (µg/ml)	Wavelength (nm)	Absorbance
1	10	228	0.408
2	10	228	0.409
3	10	228	0.408
4	10	228	0.407
5	10	228	0.408
6	10	228	0.407
Mean ± S.D.			0.407
Standard Deviation			0.00118
% RSD			0.2899

Table-3: Results of intra-Day & inter-Day

Con. taken (µg/mL)	Observed Conc. Of Propranolol (µg/ml) by the proposed method			
	Intra-Day		Inter-Day	
	Absorbance	**Statistical Analysis**	Con. found (µg/mL)	**Statistical Analysis**
10	0.408	Mean = 0.408 SD = 0.00070 %RSD = 0.173	0.407	Mean = 0.407 SD = 0.0070 %RSD = 0.173
10	0.409		0.408	
10	0.408		0.407	

Table-4: Results of Linearity

Concentration (µg/ml)	Absorbance (n=6)
5	0.2020
10	0.4069
15	0.5988
20	0.7976
25	1.0332

Acceptance criteria: correlation coefficient should not be less than 0.9990

Table-5: Result of Method Robustness Test Wavelength

Concentration(µg/ml)	Wavelength	Absorbance	Statistical Analysis
10	226	0.406	Mean = 3.66 SD = 0.002345208 % RSD = 0.06393
10		0.408	
10		0.409	
10	228	0.407	
10		0.408	
10		0.410	
10	230	0.404	
10		0.405	
10		0.403	

Table-6: Assay Results of Marketed Formulations

Formulations	Actual concentration of Propranolol[Label Claim] (µg/ml)	Amount obtained of Propranolol (µg/ml)	% Propranolol
A	20	19.816	99.08

CONCLUSION:

From the experimental studies it can be concluded that simple, rapid, economic and reproducible UV-Spectroscopic method is developed for Propranolol Hcl. The developed method for the drug (Propranolol) was found to be accurate and precise.

The great features of spectrophotometric methods are their simplicity, economical and rapidity. The results of method validation showing that the developed analytical procedure is suitable for its intended purpose and meets the Guidelines given by the ICH. The developed method was successfully applied for the routine analysis of Propranolol Hcl in bulk and pharmaceutical dosage form in the future.

ACKNOWLEDGEMENT:

The authors are greatful to the management of Nalanda College of Pharmacy, Nalgonda for providing the facilities to carry out the present research work

REFERENCES:

1. A.H Becket, J. B Stenlake, Practical Pharmaceutical Chemistry, Part II, CBS Publishers, 85, 157-165.
2. Dr.P.D.Sethi, quantitative analysis of drugs in pharmaceutical formulations, third edition, CBS publishers & distributors, New Delhi, 1997, 25,34,65-68.
3. G.R.Chatwal, Instrumental methods of chemical analysis, fifth edition, Himalaya publishing house, 2.107-2.184, 2.5682.571, 2.573-2.575.
4. Dr. S. Ravi Sankar, Pharmaceutical Analysis, fourth edition, Rx publication, 1.8-2.5, 18.3-18.12.
5. Y.R. Sharma, Elementary Organic Spectroscopy, 1st Edition, S.Chand and Company Pvt.Ltd. 8-50.
6. B.K. Sharma, Instrumental methods of chemical analysis, 1st Edition, Goel Publishing House, C3-C10, C287-C316.
7. Dr.P.D.Sethi, High Performance Liquid chromatography, 1st Edition, CBS Publishers, 11-19, 161-190.
8. Skoog, Holler, crouch, Instrumental analysis, Indian edition, cengage learning India Pvt ltd, Thomson book scole, New Delhi, 836-838
9. Dr.A.V. Kasture, a textbook of Pharmaceutical analysis, instrumental methods, volume II, Nirali Prakashan, 04-09.
10. G. Devalarao, a text book of pharmaceutical analysis, volume II, Birla publications Pvt ltd, Delhi, 86-90
11. International Conference On Harmonization Of Technical Requirements For Registration Of Pharmaceuticals For Human Use, Q2(R1), Incorporated In November 2005
12. WWW.DRUGBANK of Propranolol.com and Propranolol Wikipedia.
13. Mamatha, et al.,(2018) developed a method by applying a simple technique of simultaneous equation and area under curve method by spectrophotometry.
14. Sharma, et al.,(2018) reported an easy, accurate and truthful method for the instantaneous assay of Hydrochlorothiazide, Dihydralazine and Propranolol in tablet.
15. D B Doshi, et.al., (2016) reported a simple, rapid, precise, accurate, sensitive and stability indicating high performance thin layer chromatographic method for the simultaneous estimation of Propranolol hydrochloride and

Flunarizine dihydrochloride in pharmaceutical tablet formulation.
16. VijayaJyothi, et al.(2015) reported UV spectrophotometric method development & validation for simultaneous estimation of Hydrochlorothiazide and Propranolol in dosage form by Simultaneous Equation Method.
17. Namdeo G. Shinde, et.al(2015) reported a new, simple and sensitive UV spectrophotometric method for simultaneous quantitative determination of propranolol hydrochloride and rosuvastatin calcium in bulk and pharmaceutical dosage form.
18. P. Kate *et al*.,(2015) reported a stability indicating RP-HPLC method for Etizolam and Propranolol Hydrochloride in pharmaceutical dosage form.
19. Yadav Priya, et al.,(2014-2015) developed and validated a new very rapid, sensitive, reverse phase Ultra Performance Liquid Chromatography (RP-UPLC) technique for the estimation of Propranolol Hydrochloride in dosage form.
20. Devi, et al.,(2014)developedRP-HPLC method for the quantitative estimation of Propranolol hydrochloride and Etizolam using C 18 column and a mobile phase consisting of Methanol and Water in the ratio 70:30.