

VALIDATION OF SODIUM NITROPRUSSIDE IN VISIBLE SPECTROPHOTOMETRIC DETERMINATION OF TRIPOLIDINE HYDROCHLORIDE

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ABSTRACT

Objective: A simple and sensitive extractive visible spectrophotometric method is developed for the assay of triprolidine hydrochloride using sodium nitroprusside.

Methods: Based on color development with amino groups, presence, which is basic, may be due to the formation of inner complex replacing H₂O by the tertiary amino group present in the drug.

Results: The colored products exhibit absorption λ_{\max} at 447 nm. Regression analysis of Beer-Lambert plots showed good correlation in the concentration ranges (40-240) $\mu\text{g/ml}$ and correlation coefficients are 0.994. The Sandell's sensitivities 2.6373×10^{-2} (1 mole cm^{-1}) and molar absorptivity value are 1.1938×10^4 ($\mu\text{g cm}^{-2}$). Recovery studies are found to be 99.708-99.786.

Conclusion: The method can be applied successfully for the estimation of the drug in the presence of other ingredients that are usually present in formulations.

Keywords: Tertiary amino group, Inner complex, Regression analysis.

INTRODUCTION

Tripolidine hydrochloride (TPH) is chemically 2-[(1E)-1-(4-methylphenyl)-3-(pyrrolidin-1-yl)prop-1-en-1-yl] pyridine (Fig. 1). This is an anti-allergic, histamine H1 antagonist that blocks the action of endogenous histamine, which subsequently leads to temporary relief of negative symptoms brought on by histamine. It is used for the treatment of seasonal or perennial allergic rhinitis or non-allergic rhinitis, conjunctivitis, and mild urticarial and angioedema [1]. The most common side effects are sedation, dizziness, coordination, gastrointestinal disturbances, nausea, vomiting, and diarrhea. It may also produce blurred vision, dryness of mouth, tight of the chest, and blood disorders, including agranulocytosis and hemolytic anemia [2]. A literature survey revealed that few analytical methods have been reported for the determination of TPH in plasma using thin-layer chromatography [3] simultaneous determination of TPH with other anti-histamines [4-6] other agents [7,8] reported. Few methods have been developed for the determination of triprolidine by high-pressure liquid chromatography (HPLC) [9] and spectrophotometric method [10]. Spectrophotometric and High performance liquid chromatographic method for the determination of TPH and its metabolite in biological samples using liquid chromatography [11], mass spectrometry [12], capillary Zone Electrophoresis Method for Quality Control Analysis of TPH with other drugs [13], degradation studies of TPH and stability-indicating ultra-performance liquid chromatography method [14], new plastic membrane and carbon paste ion selective electrodes for the determination of TPH [15] were reported. TPH is usually administered in combination with dextromethorphan and/or phenylpropranolamine and also with paracetamol [16].

The analytical useful functional groups in TPH have not been fully exploited for designing suitable visible spectrophotometric methods and so still offer a scope to develop more visible spectrophotometric methods with better sensitivity, precision, and accuracy. The author has made some attempts in this direction and succeeded in developing the proposed method. The method is extended to pharmaceutical formulations as well. Reported

HPLC methods have lesser output and are occasionally lacking the stress behavior studies. Hence, there is no simple, cost-effective individual method has been reported. Therefore, the author has made an attempt to develop a rapid spectrophotometric method for the estimation of TPH in bulk and tablet dosage form. Validation as per the United States Food and Drug Administration and ICH guidelines [17,18] is done along with stress degradation studies. Methods using various reagents [9,10,19-21] and sodium nitroprusside (SNP) [22-28] were also reported.

METHODS

Instruments used

A Shimadzu ultraviolet-visible spectrophotometer 1801 with 1 cm matched quartz cells was used for all spectral and absorbance measurements. A systronics digital pH meter 361 was used for pH measurements.

Preparation of standard drug solution

The stock solution (1 mg/ml) of TPH was prepared by dissolving 100 mg of it in 100 ml of Milli pore-distilled water. A portion of this stock solution was diluted stepwise with the distilled water to obtain the working standard solution of concentrations 240 $\mu\text{g/ml}$ for the method.

Procedure of assay of TPH in formulations

An accurately weighed amount of formulation (tablet) equivalent to 100 mg of drug was dissolved in 20 ml of distilled water, shaken well, and filtered. The filtrate was further diluted to 100 ml with distilled water to get 1 mg/ml solution of drug in formulations. One milliliter of this solution was further diluted to 25 ml to get 40 $\mu\text{g ml}^{-1}$ solution. The absorbance of the solution was determined λ_{\max} 223 nm (Fig. 2). The quantity of the drug was computed from Beer's law plot (Fig. 3) of the standard drug in distilled water.

Recommended procedure

After a systematic and detailed study of the various parameters involved, as described under results and discussion in this chapter, the

following procedure is recommended for the determination of TPH in bulk samples.

Into series of 10 ml calibrated tubes, aliquots of standard drug solution, 240 µg/ml concentration ranging from 0.1 to 0.6 ml were transferred into a series of calibrated tubes, and the volume in each tube was brought to 3.0 ml with distilled water. 1.0 ml of SNP and 1.0 ml of hydroxylamine solutions

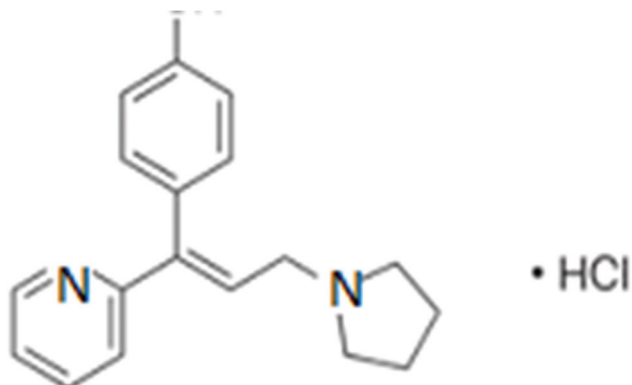


Fig. 1: Chemical structure of Triprolidine Hydro Chloride

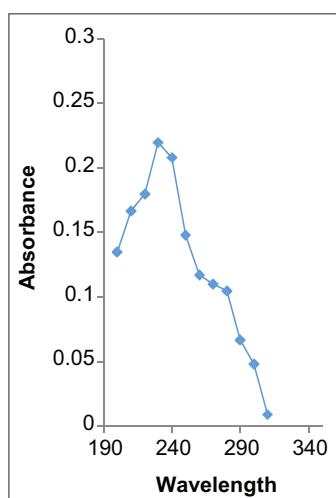


Fig. 2: Absorption spectra of triprolidine hydrochloride in methanol (ultraviolet reference method)

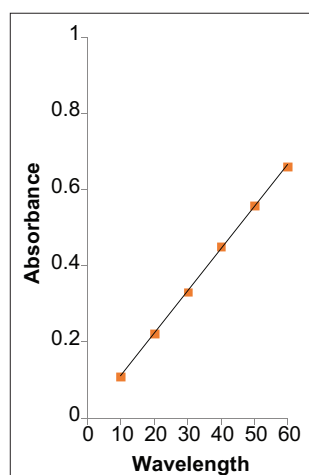


Fig. 3: Beer's law plot of triprolidine hydrochloride in methanol (ultraviolet reference method)

were successively added to each tube and shaken for 2 min. Then, 1.0 ml of sodium carbonate solution was added and shaken for 15–25 min. Then, contents were diluted to 10 ml with distilled water, and the absorbance was measured after 10 min at λ_{max} 447 nm (Fig. 4) against the reagent blank. The amount of TPH was computed from its calibration graph (Fig. 5)

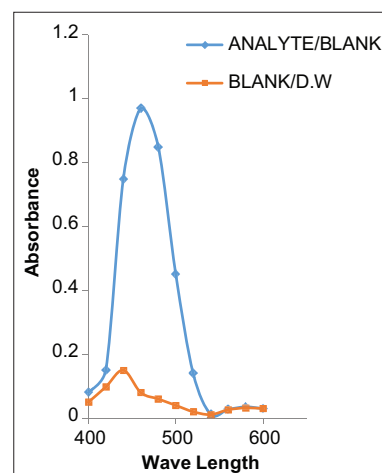


Fig. 4: Absorption spectra of triprolidine hydrochloride: Sodium nitroprusside/HA

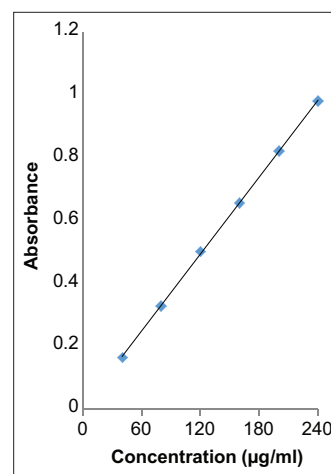


Fig. 5: Beer's plot of triprolidine hydrochloride: Sodium nitroprusside/HA

Table 1: Optical and regression characteristics, precision, and accuracy of the proposed methods for TPH

| S.no | Parameter | Values |
|------|--|-------------------------|
| 1. | Wavelength λ_{max} (nm) | 447 |
| 2. | Beer's law limits ($\mu\text{g ml}^{-1}$) | 40–240 |
| 3. | Detection limits ($\mu\text{g ml}^{-1}$) | 5.9481 |
| 4. | Molar absorptivity (1 mole cm^{-1}) | 1.1938×10^4 |
| 5. | Sandell's sensitivity ($\mu\text{g cm}^{-2}/0.001$ absorbance unit) | 2.6373×10^{-2} |
| 6. | Regression equation ($Y=a+bC$) Slope (b) | 0.0038 |
| 7. | Standard deviation of slope (S_b) | 4.8366×10^{-5} |
| 8. | Intercept (a) | 0.0082 |
| 9. | Standard deviation of intercept (S_a) | 7.5343×10^{-3} |
| 10. | Standard error of estimation (S_e) | 8.0932×10^{-3} |
| 11. | Correlation coefficient (r^2) | 0.9994 |
| 12. | Relative standard deviation (%)* | 0.3379 |
| 13. | % Range of error (confidence limits) 0.05 level* | 0.3546 |
| 14. | % Range of error (confidence limits) 0.01 level | 0.5562 |
| 15. | % Error in bulk samples** | 0.256 |

Table 2: Assay and recovery of TPH in pharmaceutical formulations

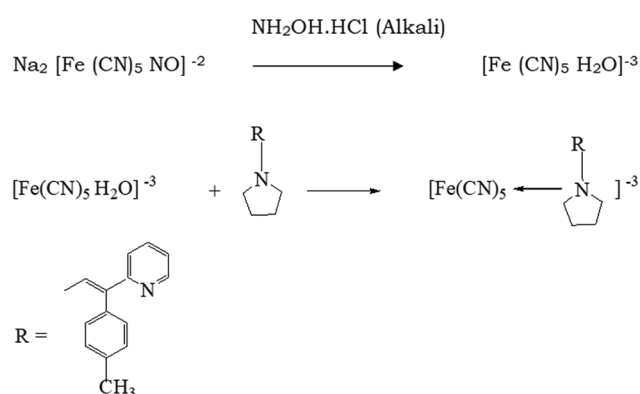
| Sample | Amount taken (mg) | Amount found by proposed method | Amount found by reference method | Percentage recovery by the proposed method |
|-----------|-------------------|----------------------------------|----------------------------------|--|
| Tablet I | 2.5 | 2.490±0.0025 F=1.44 t=0.43 | 2.495±0.003 | 99.708±0.15 |
| Tablet II | 2.5 | 2.492±0.0022 F=1.1 t=1.04 | 2.496±0.002 | 99.786±0.16 |

*: Average ± standard deviation of six determinations; the t- and F-values refer to a comparison of the proposed method with the reference method. Theoretical values at 95% confidence limit t=2.57, F=5.05. **: After adding two different amounts of the pure labeled to the pharmaceutical formulations, each value is an average of three determinations

Chemistry of the colored species in the present investigation

TPH possesses different functional moieties such as tertiary amino group and indole of varied reactivity. An attempt has been made to indicate the nature of colored species formed in each proposed method for TPH determination tentatively based on analogy.

In the presence of hydroxylamine and alkali, SNP exists as $[\text{Fe}(\text{CN})_5\text{H}_2\text{O}]^{-3}$. The color obtained with amino groups presence, which is basic, may be due to the formation of inner complex replacing H_2O by a tertiary amino group. The reactions of TPH with SNP/HA are described in scheme given below.



RESULTS AND DISCUSSION

Optimum operating conditions used in the procedure were established adopting a variation of one variable at a time method. The effect of various parameters such as the effect of volume of SNP solution on colored species, volume of NH_2OH , volume of Na_2CO_3 solution on color product, reaction time, order of addition of reagents on color development, solvent for final dilution, and stability of the colored species after final dilution was studied and the results are summarized in Table 1. Commercial formulations containing TPH were successfully analyzed by the proposed method. The values obtained by the proposed and reference method for formulations were compared statistically by the t-test and F-test and found not to differ significantly. These results are summarized in Table 2.

CONCLUSION

The proposed method for TPH determination has many advantages over other analytical methods due to its rapidity and lower cost. Unlike HPLC, LC procedures and the instrument are simple and are not costly. Economically, all the analytical reagents are inexpensive and available in any analytical laboratory. The proposed method reports a new way for the determination of TPH in pharmaceuticals

REFERENCES

1. Drug Profile, Triprolidine. Available from: <http://www.mims.com/triprolidine>.

- Reynolds JE. Promethazine and other anti-histamine In: Martindale: The Extra Pharmacopoeia. Vol. 28. London: The Pharmaceutical Press; 1982. p. 1294.
- Deangelis RL, Kearney MF, Welch RM. J Pharm Sci 1997;66:841-3.
- Gupta A, Nema RK, Sahu A. Simultaneous estimation of phenylpropanolamine hydrochloride and triprolidine hydrochloride in pharmaceutical preparations by RP-HPLC method. Pharm Res 2009;1:67-71.
- Caglar H, Buyuktuncel E. HPLC method development and validation: Simultaneous determination of active ingredients in cough and cold pharmaceuticals. Int J Pharm Pharm Sci 2014;6:421-8.
- EL-Shabrawy Y, El-Gindy A, Al-Shabraw Shoeib M, El-Gindy Y. An HPLC method for determination of 15 pharmaceutical compounds in anti-cold products. Stand Res J Pharm Pharmacol 2014;1:86-94.
- El-Gindy A, Attia KA, Nassar MW, Abu Seada HH, Al-Shabrawi Shoeib M. HPLC method for determination of paracetamol, pseudoephedrine, triprolidine, methylparaben, propylparaben, sodium benzoate and other related substances in pharmaceutical syrup. J Liquid Chromatogr Relat Technol 2013;36:1251-63.
- Saida BM, Alabjaw SA, Deabas F, Saket MM, Shareiah R, Abu Nameh ES. Liquid chromatographic Method for the determination of triprolidine, liquid chromatographic method for the determination of triprolidine. J Chem Pharm Res 2014;6:327-32.
- Hansen EB Jr., Getek TA, Korfmacher WA. Application of HPLC-thermospray ionization mass spectrometry for the analysis of triprolidine and its metabolite hydromethyltriproclidine in biological samples. J Anal Toxicol 1989;13:185-7.
- Di Berardino S, Jasionowska R. Rapid and sensitive CZE (capillary zone electrophoresis) method for quality control analysis of pharmaceuticals containing pseudoephedrine, triprolidine and paracetamol. Am J Anal Chem 2014;5:613-9.
- Moneab MK, Chandrasekh KB, Vyasa S. Degradation studies of triprolidine: Isolation, characterization of oxidative degradation products and development of a validated stability indicating method UPLC method. J Chromatogr Relat Technol 2011;34:652-69.
- Zayed SI. New plastic membrane and carbon paste ion selective electrodes for the determination of triprolidine. Anal Sci 2004;20:1043-8.
- Bye CE, Cooper J, Empey DW, Fowle AS, Hughes DT, Letley E, et al. Effects of pseudoephedrine and triprolidine, alone and in combination, on symptoms of the common cold. Br Med J 1980;281:189-90.
- Guidance for Industry. Analytical Procedure and Methods Validation: Chemistry, Manufacturing and Controls Documentation; Draft Guidance. Rockville, MD. UD Food and Drug Administration; 2000.
- International Conference on Harmonization. Q₂A: Text on Validation of Analytical Procedures. Fed Regist 1995;60:11260-2.
- Drug Bank. Available from: <http://www.drugbank.ca/drug/db01264>. [Last accessed on 2015 Jun 10].
- Aman T, Ahmad A, Aslam M, Kashmiri MA. Spectrophotometric determination of triprolidine hydro chloride by m dinitro benzene in pharmaceutical preparations. Anal Lett 2002;35:733-46.
- Abu Reid IO, Kariem EA. Spectrophotometric method for the simultaneous determination of pseudoephedrine and triprolidine in bulk

- and tablet forms. *Int J Adv Pharm Anal* 2017;13:21-3.
21. Davidson AG, Mkoji LM. The simultaneous assay of triprolidine, pseudoephedrine and dextromethorphan in combined preparations by derivative-difference spectrophotometry. *J Pharm Biomed Anal* 1988;6:449-60.
 22. Askal HF, Refaat IH, Darwish IA, Marzouq MA. A selective spectrophotometric method for determination of rosoxacin antibiotic using sodium nitroprusside as a chromogenic reagent. *Spectrochim Acta A Mol Biomol Spectrosc* 2007;69:1287-91.
 23. Moldovan Z, Aboul-Enein HY. A sensitive spectrophotometric method for the determination of diosmin using sodium nitroprusside as a chromogenic reagent. *Inst Sci Technol* 2011;39:545851.
 24. Li QM, Gao LX. A novel method for the determination of streptomycin using sodium nitroprusside as a chromogenic reagent by spectrophotometry. *Anal Lett* 2008;41:2595-207.
 25. Frank MJ, Joahson JB, Rubin SH. Spectrophotometric determination of sodium nitroprusside and its photo degradation products. *J Pharm Sci* 1976;65:44-8.
 26. Zhan Y, Zhang Y, Li Q, Du Z. Selective spectrophotometric determination of paracetamol with sodium nitroprusside in pharmaceutical and biological samples. *J Anal Chem* 2011;66:215-20.
 27. Liu B. A novel technique for the determination of propyl thio uracil with sodium nitroprusside as a chromogenic reagent by spectrophotometry. *J Anal Chem* 2015;70:328-32.
 28. Labhade SR, Labhade KR, Gaikwad VB. Simple and improved visible spectrophotometric method for determination of paracetamol using sodium nitroprusside chromogenic reagent. *Chem Sci Trans* 2015;4:377-88.

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