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Spectrophotometric estimation of tolterodine tartarate in tablet dosage form

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ABSTRACT

Validated spectrophotometric methods (Method A and B) for the estimation of Tolterodine tartarate in tablet formulations are described. Method A involved estimation by simple UV spectrophotometry and in method B the drug was treated with Folin ciocalteau reagent and estimated by visible spectrophotometry. Tolterodine tartarate is a competitive muscarinic receptor antagonist, used for treating urinary incontinence. The drug exhibited maximum absorbance at 282 nm and 742 nm for method A and B, respectively. The calibration plots were found to be linear in the concentration ranges of 50 to 250μg/ml and 10 to 60μg/ml, with regression values of 0.9998 and 0.9987 for method A and B, respectively. The methods were validated by performing recovery studies, precision and by determining limits of measurement. With the values obtained the methods were found to be accurate and precise.

KEYWORDS

Tolterodine tartarate;
Tablet;
UV and visible spectrophotometry.

INTRODUCTION

Tolterodine tartarate (TOLT) is chemically (R)-N, N-diisopropyl-3-(2-hydroxy-5-methylphenyl)-3-phenylpropanamine L-hydrogen tartarate. Tolterodine tartarate is a competitive muscarinic receptor antagonist, used for treating urinary incontinence. Literature survey reveals that Tolterodine tartarate[1-4] in tablet dosage form and in biological fluids are estimated by visible spectrophotometry (complexation with 2, 2-bipyridyl), HPLC and GC-MS methods. In the present work, a successful attempt has been made to estimate the drug by accurate, precise and less time consuming UV and visible spectrophometric methods[5-6].

MATERIALS AND METHODS

Instrument

Perkin Elmer model UV-Visible spectrophotometer (Lamba-25) with 1 cm matched quartz cell was used in the present study.

Chemicals and reagents

Tablet formulations containing 2 mg of TOLT was procured from the market. Folin ciocalteau phenol reagent AR grade (FC reagent) and sodium hydroxide were used.

Standard stock solution

Accurately 10 mg of TOLT was weighed and dissolved in distilled water. The solution was diluted to the 10 ml to give a concentration of 1 mg/ml.

Working standard solution

The standard stock solution was diluted to get a concentration of 150μg/ml and was used for method A. For method B an aliquot of standard solution was taken and treated with 1 ml of FC reagent and 3 ml of 1M sodium hydroxide solution and diluted with distilled water to give a concentration of 30μg/ml.

Sample preparartion

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Twenty tablets are weighed and crushed. The powdered tablet equivalent to 10mg of TOLT was weighed and transferred to 10 ml volumetric flask, dissolved and made up to volume with distilled water. The solution was sonicated and filtered through whatmann filter paper no. 40. This solution was diluted to a concentration of 150µg/ml and used as sample solution for method A, whereas for method B an aliquot of sample stock solution was treated with the reagents as in case of standard, diluted and used.

Determination of wavelength maximum

The standard solutions prepared separately for method A and B are scanned in the wavelength range of 200 to 800 nm. The drug was found to exhibit wavelength maximum at 282 nm and 742 nm for method A and B, respectively.

Assay

The working standard and sample solutions (n=6) were analyzed and the absorbance values were recorded. And also, the amount of drug in the samples (n=6) were calculated both for method A and B.

Assay results

From the replicate analysis (n = 6) of the drug by the proposed method, the average percentage label claims for TOLT was found to be 99.83 and 99.8 in method A and method B, respectively.

Validation[7-8]

Linearity and range

For evaluating the linearity range of TOLT, varying concentrations of standard stock solution were diluted with distilled water to give minimum of five concentrations in the range of 50 to 250µg/ml for method A and aliquots of standard stock were treated with the specified volume of reagents and diluted with distilled water for giving concentrations in the range of 10 to 60µg/ml for method B. The calibration curves were constructed for both the methods by plotting the absorbances of these solutions against the concentrations and the linearity was found in the concentration ranges mentioned. The values of correlation coefficient were 0.9998 and 0.9987 for method A and method B, respectively.

Precision

The precision of the methods were studied by analysis of multiple samplings of working standard solutions for both the methods on the same day and on different days and expressed as Co-efficient of variance (CV) which was not more than 2%.

Recovery study

To ensure the reliability and accuracy of the methods, recovery studies were carried out by mixing a known quantity of standard drug with pre-analyzed sample and the content were reanalyzed by the proposed methods.

The lower the values of relative standard deviation (RSD) indicate the method is accurate. The mean percentage recoveries of TOLT were 100.9 and 98.95 for method A and method B, respectively. Thus shows that there is no positive or negative interference of excipients in tablet.

Limits of measurement

Limits of measurement like Limit of detection (LOD) and Limit of quantitation (LOQ) were determined. The linearity concentrations were analyzed in replicate and calibration curves were constructed. LOD and LOQ were calculated statistically with the standard deviation of 'y' intercept and slope. The values for LOD and LOQ were found to be 0.56 and 1.87g/ml, respectively for method A and the values were 0.099 and 0.299 µg/ml, respectively for method B.

The values for different parameters studied for the methods are summarized in the TABLE below.

RESULTS AND DISCUSSION

The TABLE 1 give details of the findings of assay and validation parameters studied.

The works were designed to develop UV and visible spectrophotometric methods for the determination of tolterodine tartarate in pharmaceutical dosage form and to validate the developed methods.

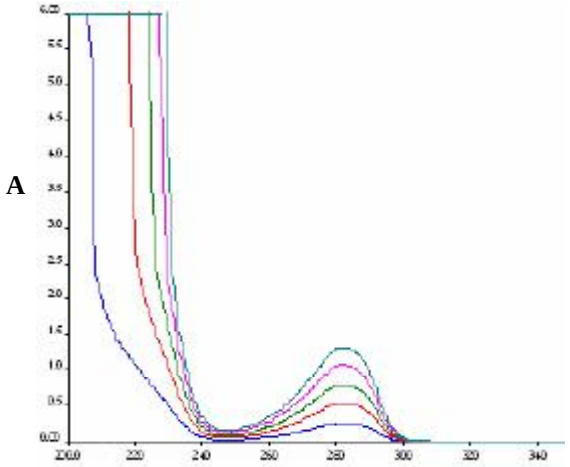
Since no UV or visible methods were reported, effort has been made to develop UV method using water as solvent in which the drug is easily soluble. The drug showed maximum absorbance at 282 nm.

The development of visible method was based on the fact that the phenolic hydroxyl group present in the drug reduces Folin ciocalteau reagent in presence of an alkali and forms blue coloured solution. This solution showed maximum absorbance at 742 nm.

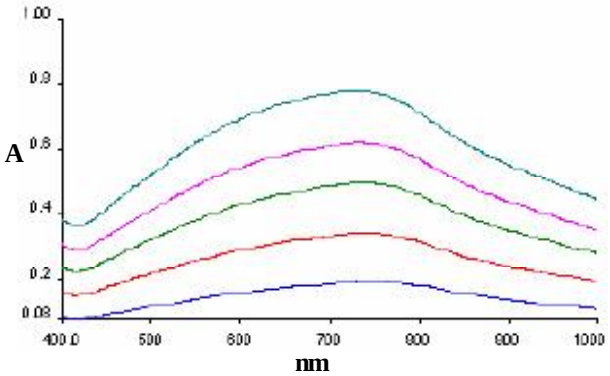
The drug showed good linearity for UV and visible

TABLE 1: Results obtained for tolterodine tartarate

Parameters	Observations	
	Method A	Method B
Wavelength maximum (λmax)	282 nm	742 nm
Linearity range (μg/ml)	50 to 250	10 to 60
Molar absortivity	2.359×10^3	8.248×10^3
Correlation coefficient	0.9998	0.9987
Label claim (mg)	2	2
% Label claim	99.83	99.8
% R.S.D (NMT 2%)	0.2892	1.042
% Recovery	100.9	98.95
% R.S.D (NMT 2%)	1.614	0.5324
Intra day Precision % R.S.D (NMT 2%)	0.0216	0.061
Inter day Precision % R.S.D (NMT 2%)	0.036	0.104
Limit of detection (μg/ml)	0.56	1.87
Limit of quantitation (μg/ml)	0.099	0.299



Graph 1: Overlain linearity spectrum of tolterodine tartarate (UV method)



Graph 2 : Overlain linearity spectrum of tolterodine tartarate (visible method)

spectrophotometric methods (method A and B) in the concentration range of 50 to 250μg/ml and 10 to 60μg/ml, with regression values of 0.9998 and 0.9987, respectively.

In quantitative estimations, the percentage label claim values were found to be in good agreement with the labeled amount. Thus the methods can be used for estimating drug in formulation.

The accuracy of the methods was good, with satisfactory values for percentage recovery.

The precision was studied by repeating the analysis on the same day (intra day) and on different days (inter day). The percentage relative standard deviation values for the responses (intra and intra day) in UV and visible methods were found to be less than 2%, thus proving good precision of the methods.

Limits of measurements like limit of detection and limit of quantitation were also satisfactory. Hence it is conveniently adopted for the routine analysis.

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