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RESEARCH ARTICLE

# DEVELOPMENT OF NEW VISIBLE SPECTROPHOTOMETRIC METHODS FOR THE DETERMINATION OF QUETIAPINE IN PHARMACEUTICAL DOSAGE FORMS

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**Three simple and sensitive spectrophotometric methods have been developed for the determination of quetiapine in pure and pharmaceutical dosage forms. Method A was based on the formation of Ion-association complex of the drug with solochrome Black T ($\lambda_{max}$: 520 nm). Method B was based on oxidative coupling of the drug with 3-methyl-2-benzothiazolinone hydrazone ($\lambda_{max}$: 620 nm). Method C was based on oxidation followed by complex formation with 1,10-phenanthroline (PTL) in the presence of ferric chloride to form a colored chromogen ($\lambda_{max}$: 510 nm). These methods were statistically evaluated and found to be precise and accurate.**

**Key words:** Quetiapine, Spectrophotometry, Chromogen, Pharmaceutical dosage form.

## INTRODUCTION

Quetiapine (QTP) is chemically 2-(2-(4-dibenzo [*b,f*][1,4]thiazepine-11-yl-1-piperazinyl) ethoxy) ethanol with selective clinical activity against schizophrenia as well as for the treatment of acute manic episodes associated with bipolar I disorder (Ramington, 2000; O'Neil *et al* 2001). The literature survey revealed that there are reports regarding analytical method developments including spectrophotometric (Pucci *et al* 2003; Hiraman *et al* 2009; Bagade *et al* 2009; Patil *et al* 2011; Shukla *et al* 2011; Shah *et al* 2011) and HPLC (Saracino *et al* 2006; Prasanthi *et al* 2011) methods for the estimation of different drugs in bulk and pharmaceutical formulations, but only a few methods are available for QTP. In the present investigation, three simple and sensitive spectrophotometric methods have been developed for the determination of QTP. Method A is based the formation of Ion-association complex of the drug with solochrome Black T (SBT). Method B is based on oxidative coupling of the drug with 3-methyl-2-benzothiazolinone hydrazone (MBTH). Method C is based on oxidation followed by complex formation with 1, 10-phenanthroline (PTL) (Collins *et al* 1959; Tsen, 1961) in the presence of ferric chloride to form a colored chromogen. Beer's law was obeyed and results of analysis for the three methods were validated statistically and by recovery studies.

## MATERIALS AND METHODS

### *Materials*

A UV-Vis spectrophotometer (Systronics, Model 2201) was used for all the measurements. All the chemicals used were of analytical grade. solochrome Black T (0.5%), HCl (5 N), MBTH (0.2% *w/v*), 1,10-phenanthroline (0.198% *w/v*), and ceric ammonium sulphate (1% *w/v*) were prepared.

### *Methods*

*Preparation of standard drug solution*

The stock solution (1 mg/ml) of quetiapine was prepared by dissolving 100 mg of drug in 100 ml of distilled water. A portion of stock solution was diluted to get the working standard solution.

*Preparation of sample solution*

Twenty tablets of QTP were weighed and powdered. A quantity of powder equivalent to 100 mg was dissolved in 100 ml of distilled water. The solution was sonicated for 15 min to get the working standard solution.

*Assay procedures*

*Method A:*

Aliquots of the drug solution representing 100-500 *µ*g of QTP was transferred into a series of 125 ml separating funnels and equalized with water. To these flasks, 0.5 ml of 0.1 N HCl and 1 ml of SBT solution (0.5% *w/v*) were added and the solution was saturated with aqueous phase up to 10 ml. The mixture was shaken for 10 min and the drug-dye complex was then extracted with 10 ml chloroform. The absorbance of the separated yellow colored chloroform layer was measured after 5 min at 520 nm against reagent blank. The amount of QTP was computed from its calibration graph.

*Method B:*

Aliquots of standard drug solutions of QTP ranging from 1-5 ml (200 *µ*g/ml) were taken in to a series of 10 ml volumetric flasks. To each flask, 2.0 ml of ceric ammonium sulphate solution (1%) and 1.5 ml of MBTH were added, mixed well and the solution was allowed to react at room temperature for about 15 min. The solution was made up to the mark with distilled water and the absorbance of the bluish-green colored chromogen thus formed was measured at 620 nm against reagent blank. The amount of QTP was computed from the Beer-Lambert's plot.

*Method C:*

Aliquots of working standard solution containing 250-1250 *µ*g were transferred into a series of 10 ml volumetric flasks. To these flasks, 1.5 ml of ferric chloride and then 2 ml of 1, 10-phenanthroline was added. The volume was equalized with water and kept for boiling for 15 min. The flasks were cooled to room temperature and 2 ml of *o*-phosphoric acid was added to each flask, finally the volume was brought to 10 ml with distilled water. The absorbance was measured at 510 nm against reagent blank. The amount of QTP present in the sample solution was computed from its calibration curve.

**RESULTS AND DISCUSSION**

The optical characteristics such as Beer's law limits, Sandell's sensitivity, molar extinction coefficient, percent relative standard deviation and percent range of error (0.05 and 0.01 confidence limits) were calculated for all the three methods. The precision and accuracy were performed by analyzing six replicate samples containing known amount of drug and the results were summarized in the **Table 1**. The values obtained for the determination of QTP in pharmaceutical formulations (tablets) by the proposed methods were presented in the **Table 2**. Studies revealed that the common excipients and other additives usually present in the tablets did not interfere in the proposed methods.

**Table 1.** Optical characteristics, precision and accuracy of the proposed methods

| Parameter | Method A | Method B | Method C |
|---|---|---|---|
| $\lambda_{max}$ (nm) | 520 | 620 | 510 |
| Beer's law limit(*µ*g/ml) | 10-50 | 20-100 | 25-125 |
| Sandell's sensitivity (*µ*g/cm$^2$/0.001 abs. unit) | 0.0255 | 0.0354 | 0.00521 |
| Molar absorptivity (litre.mole$^{-1}$.cm$^{-1}$) | 1.108 x10$^4$ | 0.797 x 10$^4$ | 5.659x 10$^4$ |
| Regression equation (Y*) | | | |
| Slope (b) | 0.0138 | 0.0088 | 0.0064 |
| Intercept (a) | 0.0028 | 0.0031 | 0.0050 |
| Correlation coefficient (r) | 0.9993 | 0.9994 | 0.9990 |
| % Relative standard deviation** | 1.085 | 0.998 | 0.953 |
| % Range of error | | | |
| 0.05 significance level | 0.827 | 0.593 | 0.488 |
| 0.01 significance level | 1.221 | 0.878 | 0.765 |

**Y = a + bX, where Y is the absorbance and X is the concentration, **For six replicates*

**Table 2.** Estimation of quetiapine in pharmaceutical dosage forms

| Formulation | Labeled Amount (mg/tablet) | Amount found* by proposed methods (mg) | | | % Recovery** by proposed methods | | |
|---|---|---|---|---|---|---|---|
| | | Method A | Method B | Method C | Method A | Method B | Method C |
| Tablet 1 | 300 | 298.67 | 301.24 | 301.87 | 98.94 | 99.58 | 100.26 |
| Tablet 2 | 300 | 299.43 | 299.56 | 299.12 | 99.49 | 101.74 | 99.72 |

**Average of six determinations, **Recovery of amount added to the pharmaceutical formulation (Average of three determinations)*

## CONCLUSION

The proposed methods are applicable for the assay of QTP and have an advantage of wider range under Beer's law limits. The proposed methods are simple, selective and reproducible and can be used in the routine determination of QTP in pure form and formulations.


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