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Development and validation of an UV spectrophotometric method for determination of gatifloxacin in tablets

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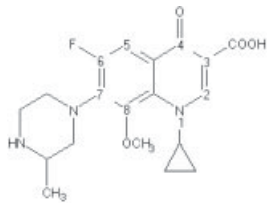
A simple, sensitive and accurate spectrophotometric method was developed for the assay of gatifloxacin in raw material and tablets. Validation of the method yielded good results concerning range, linearity, precision and accuracy. The absorbance was measured at 287 nm for gatifloxacin tablet solutions. The linearity range was found to be 4.0–14.0 μg/mL for gatifloxacin. It was also found that the excipients in the commercial tablets did not interfere with the method.

1. Introduction

In recent years, there has been growing interest in the use of fluoroquinolones as therapeutic drugs. Gatifloxacin (CAS number 160738-57-8) is a methoxy fluoroquinolone with an expanded spectrum against gram-positive and gram-negative aerobes, anaerobes, including mycobacteria and antibiotic-resistant *S. pneumoniae* (Bauernfeind 1997; Jones et al. 1999; Sindelar et al. 2000). This fluoroquinolone has high oral bioavailability (96%), and, therefore, oral and intravenous formulations are bioequivalent and interchangeable (Grasela 2000).

Chemically gatifloxacin is a (±)-1-cyclopropyl-6-fluoro-1,4-dihydro-8-methoxy-7-(3-methyl-1-piperazinyl)-4-oxo-3-quinolinecarboxylic acid sesquihydrated and is not yet official in any pharmacopeia. A survey of literature has not revealed any UV spectrophotometric method for the determination of gatifloxacin, whereas methods are reported for sparfloxacin (Marona and Schapoval 1999a). HPLC assays have been reported for sparfloxacin (Marona and Schapoval, 1999b) and gatifloxacin in body fluids (Borner et al. 2000; Liang et al. 2002).



Gatifloxacin (CAS number 160738-57-8)

In the present study, a simple, economical, precise and accurate analytical method for estimation of gatifloxacin in pure form and in solid dosage forms was developed. The results of the analysis were validated by statistical methods and recovery studies.

2. Investigations, results and discussion

Gatifloxacin was analyzed by a UV spectrophotometric method both as a raw material and as a pharmaceutical tablet formulation The linear regression equation for gatifloxacin was calculated to be $y = 0.077x + 0.0092$ where x and y are concentration and absorbance, respectively.

A standard calibration curve of gatifloxacin was constructed by plotting absorbance versus concentration. The UV absorption spectrum of gatifloxacin was monitored at 287 nm. Agreement with Beer's law was evident in the concentration range of the final dilution of 4.0–14.0 μg/mL. The correlation coefficient obtained for the line was 0.9998, indicating excellent linearity. The experimental results obtained for the determination of gatifloxacin tablets

Table 1: Analysis of gatifloxacin tablets (400 mg)

	A*	Average ± S. D.	C. V. (%)
1	0.436		
2	0.431		
3	0.442		
4	0.438	0.437 ± 0.004	0.84
5	0.438		
6	0.439		

* Absorbance – average of three determinations
CV, coefficient of variation; S.D., standard deviation

Table 2: Recovery test of gatifloxacin tablets

Spiked amount SR (μg/mL)	Recovery amount of SR (μg)	Recovery (%)
2.0	1.96	98.0
4.0	3.97	99.25
6.0	5.91	98.5

are shown in Table 1. The method had excellent reproducibility for the standard solution of 100 μg/mL. The average purity (%) reached was 98.33%.
The detailed accuracy is shown in Table 2. In this test the observed concentrations of gatifloxacin reference substance in the powdered tablets were not significantly different from the stated concentrations by Student's t test, $P = 0.05\%$ (98.6%, $n = 3$).
No interfering intensity was found in the UV spectra due to the tablet excipients. Gatifloxacin was shown to be stable during all the procedure.

3. Experimental

3.1. Chemicals

Gatifloxacin reference substance (assigned purity 99.99%) and gatifloxacin tablets were kind gifts from Bristol-Myers Squibb (Brazil). Each gatifloxacin tablet contained 400 mg of the active drug. The gatifloxacin powder and tablets were stored protected from light and temperature (8 °C).

3.2. Equipment

A Shimadzu UV-160 recording double beam UV-Visible spectrophotometer with data processing system was used. UV spectra of reference and sample solutions were recorded in 10 mm quartz cells.

3.3. Standard solution

The gatifloxacin standard solution was prepared by accurately weighing 10 mg of gatifloxacin and was diluted in 100 mL volumetric flasks with distilled water to give a range of solutions with final concentrations of 4–14.0 μg/mL. The absorbance value of each solution was determined at 287 nm.

3.4. Sample preparation

To analyze the concentration of gatifloxacin tablets, twenty tablets were weighed to obtain the average tablet weight. The tablets were ground up and 1810 mg (representing three times the average weight of each tablet) were transferred to a 1000 mL volumetric flask; 500 mL water were added and the flask was shaken for 20 min by a mechanical shaker followed by addition of distilled water to volume.
Aliquots of 5 mL of this solution were transferred to a 100 mL volumetric flask and distilled water was added to volume to give an estimated concentration of 60 μg/mL. Afterwards the solution was diluted 1 : 10 to give a final estimated concentration of 6.0 μg/mL. This solution was prepared six times and the absorbance of each solution was determined at 287 nm. All determinations were conducted in triplicate.
The data were analyzed by linear simple regression by the least-squares method using Excel 5.0.
The recoveries were determined by adding known amounts of gatifloxacin reference substance (2.0, 4.0 and 6.0 μg/mL) to the samples at beginning of the process. A recovery exercise was then performed.
The precision and accuracy of the assay, as well as the linearity of the calibration curve were determined for intra- and inter-day on three different days. The precision was expressed as the percent coefficient of variation of each curve. The statistical data were calculated by ANOVA (Table 3).

Table 3: Analysis of variance of gatifloxacin tablets

Source of variation	DF	SS	MS	F	P
Main effects	5	1.2471	0.24942	786.81*	3.11
Two-way interactions	1	1.2469	1.2469	3933.33*	4.75
Three-way interactions	4	0.000234	0.0000585	0.18	3.26
Residual error	12	0.003804	0.000317		
Total	17				

* $P < 0.05$

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