Validated UV-Spectrophotometric Methods for Determination of Gemifloxacin Mesylate in Pharmaceutical Tablet Dosage Forms

R ROTE AMBADAS* and P. PINGLE SUNITA

Department of Pharmaceutical Chemistry, M. G. V.'s Pharmacy College, Panchavati
Mumbai - Agra Road, Nashik- 422003, Maharashtra, India.

roteambadas@gmail.com

Received 19 February 2010; Accepted 1 May 2010

Abstract: Two simple, economic and accurate UV spectrophotometric methods have been developed for determination of gemifloxacin mesylate in pharmaceutical tablet formulation. The first UV-spectrophotometric method depends upon the measurement of absorption at the wavelength 263.8 nm. In second area under curve method the wavelength range for detection was selected from 268.5-258.5 nm. Beer's law was obeyed in the range of 2 to 12 $\mu\text{g mL}^{-1}$ for both the methods. The proposed methods was validated statistically and applied successfully to determination of gemifloxacin mesylate in pharmaceutical formulation.

Keyword: Gemifloxacin mesylate, UV-Spectrophotometry, AUC,

Introduction

Gemifloxacin (R, S)-7(3-aminomethyl-4-syn-methoxyimino-1-pyrrolidinyl)-1-cyclopropyl-6-fluoro-1, 4 dihydro-4-oxo-1, 2 naphthyridine-3-carboxylic acid is a new fluoroquinolone antibacterial compound with enhanced affinity for bacterial topoisomerase IV and has been developed for the treatment of respiratory and urinary tract infection. The compound has a broad spectrum of activity against gram-positive and gram-negative bacteria. Literature survey revealed that few analytical method have been reported for the estimation of gemifloxacin mesylate including utility of σ and π -acceptors for the spectrophotometer determination of gemifloxacin mesylate in pharmaceutical formulation¹, rapid determination in human plasma by HPLC-MS-MS^{2,3}, rapid and sensitive LC method for analysis of gemifloxacin in human plasma⁴, spectrophotometric determination of gemifloxacin mesylate in pharmaceutical formulation through ion-pair complexation⁵ and validated stability indicating assay of gemifloxacin and lomefloxacin in tablet formulation by capillary electrophoresis⁶. Gemifloxacin mesylate is not official in any pharmacopoeia. These developed proposed methods are simple, rapid and sensitive.

Experimental

Pharmaceutical grade gemifloxacin mesylate was supplied by Matrix. Pharma Ltd., Sinner, Maharashtra, India and hydrochlorothiazide was supplied by Ajanta. Pharma, Paithan, Maharashtra, India. The methanol was purchased from Qualligens Fine Chemicals, Mumbai, India. Commercially available tablets Gem one (equivalent to 320 mg of gemifloxacin mesylate) of Dr. Reddy was purchased from market for analysis.

Instrumentation

Shimadzu UV-2450 double beam spectrophotometer with 1 cm path length supported by Shimadzu UV-Probe software, version 2.21 was used for all spectrophotometric estimations. Shimadzu balance (AUW-120D) was used for all weighing.

Preparation of standard solution of gemifloxacin mesylate

Standard stock solution of gemifloxacin mesylate was prepared by dissolving 25 mg of gemifloxacin mesylate in 25 mL of methanol to get concentration of 1.0 mg mL^{-1} in volumetric flask. Ten mL of stock solution was further diluted to 100 mL with methanol to get a working standard solution of concentration $100 \mu\text{g mL}^{-1}$. This solution used as standard working solution.

Tablet sample preparation

Ten tablets were weighed accurately and powdered. Powder equivalent to 10 mg of gemifloxacin mesylate was weighed and transferred to 100 mL volumetric flask. Then it was dissolved in 25 mL of methanol by shaking the flask for 15 minutes and volume was made up to the mark with distilled water. The solution was filtered through Whatmann filter paper no. 41. A 1 mL aliquot of sample stock solution was transferred to 10 mL standard volumetric flask and volume was made up to mark with distilled water. Procedure was repeated five times for analysis of sample solution.

Results and Discussion

Measurement of UV spectra

From the working stock solutions appropriate dilutions of gemifloxacin mesylate were made with distilled water. Solutions were scanned in the wavelength range of 400 - 200 nm and recorded the UV- Spectrum of gemifloxacin mesylate using distilled water in the reference cell. The recorded UV- Spectrum of gemifloxacin mesylate, showed λ_{max} at 263.8 nm (Figure 1).

Figure 1. Zero order UV spectrum of gemifloxacin mesylate, $4 \mu\text{mL}^{-1}$.

Method validation*Linearity*

The wavelengths selected should be such that at one the wavelength having same $\lambda_{\max}$ at different concentration of one of the drug, hence from the spectra of gemifloxacin mesylate 263.8 nm were selected as wavelength of detection for proposed method shown in Figure 1. The concentration range over which the drugs obeyed Beer's law was 2 to 12 $\mu\text{g mL}^{-1}$ for gemifloxacin mesylate. The equation for calibration curve of gemifloxacin mesylate is $y = 0.0604x + 0.0256$ and correlation coefficients is 0.9991 (Table 1).

Table 1. Linearity of gemifloxacin mesylate.

Parameter	UV-Spectrophotometric method	AUC method
Beers law range, $\mu\text{g mL}^{-1}$	2-12	2-12
Intercept	0.0256	0.0275
Slope	0.0604	0.00134
Correlation coefficient	0.9991	0.9983
Limit of detection (LOD), $\mu\text{g mL}^{-1}$	0.12	0.12
Limit of quantitation (LOQ), $\mu\text{g mL}^{-1}$	0.37	0.37

Precision and accuracy

The proposed method was used for the determination of drug in tablets and results indicating satisfactory recoveries and high precision (Table 2).

Table 2. Result of analysis of commercially available tablet of gemifloxacin mesylate by UV-spectrometric and AUC method.

Parameter	UV-spectrophotometric method	AUC method
Labelled claim mg tablet ⁻¹	320	320
% mean (n=5)	101.20	101.80
Standard deviation	1.20	1.12
Standard Error	0.539	0.504

Precision of the method was evaluated with five replicates of standard solution of 10 $\mu\text{g mL}^{-1}$ of gemifloxacin mesylate. The relative standard deviation value for gemifloxacin mesylate was found to be 0.63 and 1.83 for intra-day and inter-day precision. Inter-day precision and accuracy of the method was tested for 3 days at the same concentration levels. Percentage recoveries for gemifloxacin mesylate are shown in Table 3.

Table 3. Accuracy and precision of gemifloxacin mesylate by UV-spectrophotometric and AUC- method.

Accuracy/precision	UV-spectrophotometric method		AUC- method	
	% Recovery	% RSD	% Recovery	% RSD
0%	101.24	0.77	100.60	1.24
100%	100.23	1.70	101.91	0.19
150%	99.86	1.17	98.43	1.17
Intra-day precision	99.57	0.552	100.19	0.65
Inter-day precision	100.23	0.828	99.87	1.80

AUC method

Measurement of UV spectra

UV spectra for the solutions of gemifloxacin mesylate were recorded in a 10 mm cell over the range of 200-400 nm using distilled water in the reference cell. From the working stock solutions appropriate dilutions of gemifloxacin mesylate were made with distilled water. For the estimation of gemifloxacin mesylate by AUC method the wavelength ranges were selected from 268.8-258.8 nm (263.8 ± 5 nm) for gemifloxacin mesylate (Figure 2).

Figure 2. UV-spectrum for area under curve (AUC) of gemifloxacin mesylate, 4 $\mu\text{L/mL}$ from 258.8-268.8 nm.

Method validation

Linearity

The AUC of each drug was measured in the range of 258.8-268.8 nm. The concentration range over which the drugs obeyed Beer's law was chosen 2 to 12 $\mu\text{g mL}^{-1}$ for gemifloxacin mesylate. The equation for calibration curve of gemifloxacin mesylate was $y = 0.0275x + 0.00134$ and correlation coefficients is 0.9983. The LOD and LOQ values 0.123 $\mu\text{g mL}^{-1}$ and 0.374 $\mu\text{g/mL}$ for montelukast sodium and levocetirizine dihydrochloride showed good precision of gemifloxacin mesylate for the proposed method (Table 1).

Precision and accuracy

The proposed method was used for the determination of drug in tablets and results indicating satisfactory recoveries and high precision (Table 2). Precision of the method was evaluated with five replicates of standard solutions of 10 $\mu\text{g mL}^{-1}$ of gemifloxacin mesylate. The percent relative standard deviation (%RSD) values for gemifloxacin mesylate was found to be 0.552 and 0.828 for intra-day and inter-day precision. Inter-day precision and accuracy of the method was tested for 3 days at the same concentration levels. Percentage recoveries for gemifloxacin mesylate are shown in Table 3.

Conclusion

UV spectrophotometric and AUC methods were developed and validated for the determination of gemifloxacin mesylate in pharmaceutical dosage forms. The selected methods were found to be sensitive, reproducible and accurate for the analysis of gemifloxacin mesylate in tablets. In general, both methods were found to be suitable for routine quality control of the drugs in a tablet dosage form.

Acknowledgment

Ajanta Pharma Ltd., Paithan, Maharashtra, India for providing hydrochlorothiazide and gemifloxacin mesylate by matrix Pharma, Sinner, Maharashtra, India as a gift sample for the research work. The authors are also thankful to Management and Principal of M.G.V's. Pharmacy College, Panchavati, Nashik, for providing necessary facilities.

References

1. Krishna M V and Dannana G S, *E- J Chem.*, 2007, **5(3)**, 493.
2. Doyle E, Fowles S E, McDonnell D F and McCarthy R, *J Chromatogr B*, 2000, **746**, 191-198.
3. Lee W and Yong C H, *J Chromatogr A*, 2000, **879**, 113.
4. Pal K, Chakrabarty U S, Das A, Bhaumik U, Chatterjee B and Ghosh A, *Chromatographia*, 2009, **69(9/10)**, 853.
5. Krishna M V and Dannana G S, *E-J Chem.*, 2007, **5(3)**, 515.
6. Elbashir A A and Saad B, *J Liquid Chromatogr Relat Technol.*, 2008, **31**, 1465.