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Research Article

DEVELOPMENT AND VALIDATION OF FIRST ORDER DERIVATIVE SPECTROPHOTOMETRIC METHOD FOR ESTIMATION OF LACOSAMIDE IN BULK AND TABLET DOSAGE FORM

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ABSTRACT

To develop a simple, precise, accurate and reproducible spectrophotometry method for estimation of Lacosamide by employing first order derivative method and validate it as per ICH guidelines. The method is based on first order UV derivative spectrophotometry. Distilled water was selected as a solvent for estimation of Lacosamide with the absorption at 250 nm for quantification of Lacosamide**.** The linearity was established over the concentration range of 5-50 µg/ml for Lacosamide. The correlation coefficient (r^2) for Lacosamide was 0.9980. The mean % recovery was found to be in range of 99.24% - 99.72% for Lacosamide. The results of analysis have been validated statistically and recovery studies confirmed the accuracy of the proposed method. The method was validated as per the International Conference on Harmonization (ICH) guidelines. The proposed method is recommended for routine analysis since it is rapid, simple, accurate, sensitive and specific.

Keywords: Lacosamide, Spectrophotometry, First order derivative, Validation.

INTRODUCTION

Lacosamide is chemically (2R)-N-benzyl-2-acetamido-3-methoxypropanamide (Figure 1). Lacosamide is a functionalized amino acid that has activity in the maximal electroshock seizure test, and is indicated for the adjunctive treatment of partial-onset seizures and diabetic neuropathic pain. Recent studies indicate that Lacosamide only affects those neurons which are depolarized or active for long periods of time, typical of neurons at the focus of an epileptic seizure, as opposed to other antiepileptic drugs such as carbamazepine or lamotrigine which slow the recovery from inactivation and reduce the ability of neurons to fire action potentials [1].

The literature survey indicates that various analytical methods involving HPLC-UV, stability indicating HPLC, HPTLC, RP-UPLC , Bio analytical have been reported for Lacosamide[2,3,4,5,6].However, no first order derivative method had been reported till the date, for determination of this drug by proposed methods. This method uses Distilled water as a solvent which makes method very cost effective as no costly solvent is used. The literature review prompted to develop an accurate, precise and simple method for the estimation of Lacosamide in bulk form. The work was extending to tablet formulation.

MATERIALS AND METHODS

Reagents and Chemicals

Analytically pure Lacosamide were used. Lacosamide was procured from Astron Research Centre, Ahmedabad, (Gujarat, India). Distilled water was collected from distillation assembly.

Instrument

A shimadzu UV/Vis 1800 double beam spectrophotometer is used with wavelength accuracy (± 0.3 nm), 1 cm matched quartz cells and UV probe 2.35 software was used for all the spectral measurements. Calibrated analytical Balance Denver SI234, Germany, was used for weighing purpose.

Preparation of standard stock solutions

Accurately weighed 10 mg of Lacosamide was transferred into 100 ml volumetric flask and dilute upto the mark with distilled water to get stock solutions containing 100µg/ml Lacosamide.

Selection of Analytical Wavelength

A solution of Lacosamide was prepared in distilled water by appropriate dilution and spectrum was recorded between 200 – 400 nm. All zero order spectrums (D^0) were converted to first derivative spectrum (D^1) using delta lambda 10 and scaling factor 1.0. The UV spectrum of Lacosamide in Distilled water has shown maximum absorbance at 250 nm.

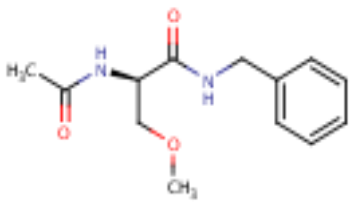

Fig. 1: Chemical Structure of Lacosamide

Method validation

The proposed method was validated according to the ICH Guideline Q2 (R1)[7]. The method has been validated in terms of Linearity, Precision, Accuracy, Limit of detection (LOD) and Limit of quantification (LOQ).

Calibration curve (Linearity)

Appropriate volume of aliquot from Lacosamide standard stock solution was transferred to volumetric flask of 10 ml capacity. The volume was adjusted to the mark with Distilled water to give a solution containing 5 – 50 µg/ml Lacosamide. All D1 spectrums were recorded using above spectrophotometric condition. D1 absorbances at 250 nm were recorded for Lacosamide. Calibration curve were constructed by plotting average absorbance versus concentration for both drugs. (Figure 3)

Accuracy

Accuracy was assessed by determination of the recovery of the method by addition of standard drug to the known amount of marketed formulation at 3 different concentration levels 80, 100, and 120% taking into consideration percentage purity of added bulk drug samples. Each concentration was analysed 3 times and average

recoveries were measured.

Precision

The intraday and interday precision study of Lacosamide was carried out by estimating different concentrations of (36, 40, 44 µg/ml) Lacosamide, three times on the same day and on three different days and the results are reported in terms of % RSD.

Detection limit and Quantitation limit

ICH guideline describes several approaches to determine the detection and quantitation limits. These include visual evaluation, signal-to-noise ratio and the use of standard deviation of the response and the slope of the calibration curve. In the present study, the LOD and LOQ were based on the third approach and were calculated according to the 3.3 σ/S and 10 σ/S criterions, respectively;

Where; σ is the standard deviation of y-intercepts of regression lines

S is the slope of the calibration curve

Robustness

The sample solution was prepared and then analysed with change in typical analytical conditions like stability of analytical solution.

Analysis of Tablet formulation

Content of Ten Tablets were weighed accurately. A powder quantity equivalent to 50 mg LACOSAMIDE was accurately weighed and transferred to volumetric flask of 50 ml capacity. 25 ml of Distilled water was transferred to this volumetric flask and sonicated for 5 min. The flask was shaken and volume was made up to the mark with Distilled water. The above solution was filtered through whatman filter paper (0.45µ). From this solution (1000 µg/ml) 0.2 ml was transferred into 10ml volumetric flask and make upto mark with Distilled water to give a solution containing 20 µg/ml of Lacosamide. The resulting solution was analysed by proposed method. The quantitation was carried out by keeping these values to the straight line equation of calibration curve.

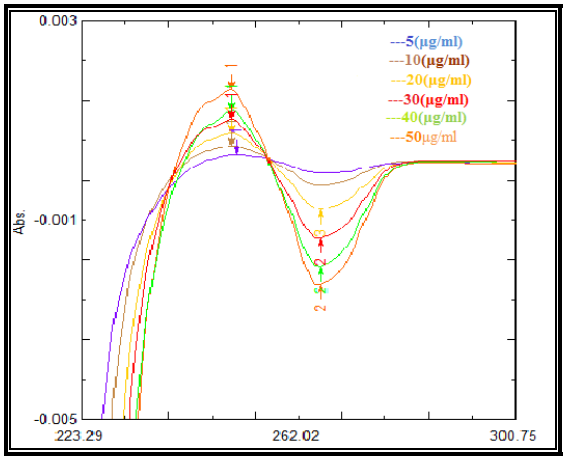

Fig. 2: D1 spectrum of LAC (5-50ppm) in Distilled water

RESULT AND DISCUSSION

A simple, economic, precise, accurate method for estimation of Lacosamide was developed. This developed method was validated according to ICH guidelines.

For this method, 250 nm of Lacosamide for first order derivative spectra was selected for the analysis which shown in figure 2.

The linearity range of 5-50 µg/ml Lacosamide was taken. Straight line equations were obtained from mean of five sets and the calibration curves was shown in figure 3. The Correlation Coefficients (r^2) for Lacosamide was found to be 0.9980.

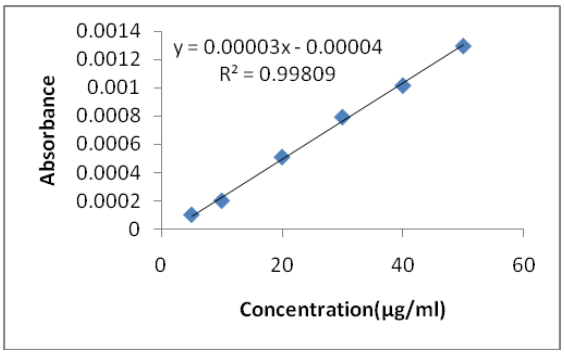

Fig. 3: Calibration curve of Lacosamide

The accuracy of Lacosamide was carried out as percent recovery shown in Table 1 and average recovery was found in the range of 99.24% - 99.72 % for Lacosamide.

Table 1: Results of recovery studies of Tablet formulation

CONC. LEVEL	Amt. of LAC taken in µg/ml	Amt. of STD LAC added in µg/ml	% Recovery	% RSD
80%	20	16	99.67	1.50
100%	20	20	99.72	1.73
120%	20	24	99.24	0.76

The intraday precision and interday precision were expressed in terms of relative standard deviation (RSD). For intraday & interday precision, % RSD for Lacosamide was found to be satisfactory shown in Table 2 and 3.

Table 2: Intraday Precision Data *(n=3)

Sr. no.	Concentration (µg/ml)	Mean absorbance* ± S.D	RSD
`1	5	0.000101±0.000001	0.9900
2	20	0.000524±0.000006	1.0517
3	50	0.00131 ± 0.00001	0.7633

Table 3: Interday Precision Data *(n=3)

Sr. no.	Concentration (µg/ml)	Mean absorbance*±S.D	RSD
1	5	0.000102±0.000002	1.4878
2	20	0.00052±0.000007	1.2610
3	50	0.00131± 0.000020	1.5267

The proposed method was evaluated statistically. The LOD was found to be 0.7366 µg/ml and 2.2321µg/ml for Lacosamide. The summary of validation parameter was shown in Table 4. The method was successfully applied to tablet formulation. The results are shown in Table 5.

Table 4: Summary of validation parameters

Parameter	Lacosamide
Linearity (µg/ml)	5 – 50 µg/ml
Co-relation coefficient(r^2)	0.9980
Slope	0.00004
Intercept	0.00003
LOD (µg/ml)	0.7366
LOQ (µg/ml)	2.2321
Precision	
Intraday (n=3) RSD	0.9350
Interday (n=3) RSD	1.4252

Table 5: Results of analysis of tablet formulation *(n=3)

Drugs	Label claim(mg)	Amount of drug estimated (mg)	% label claim* ± S.D.	% Recovery
LAC	50	49.16		99.54

The proposed First order derivative spectrophotometry method provides simple, specific, precise, accurate and reproducible quantitative analysis for determination of Lacosamide. The method was validated as per ICH guidelines in terms of specificity, linearity, accuracy, precision, limits of detection (LOD) and quantification (LOQ), robustness and reproducibility. The proposed method can be used for routine analysis and quality control assay of Lacosamide in bulk and tablet formulation.

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REFERENCES

1. http://www.drugbank.ca/drugs/DB06218. Update on March 26-2013.
2. Kestelyn C, Lastelle M, Higuet N, Dell'Aiera S, Staelens L, Boulanger P, Boekens H, Smith S. A simple HPLC-UV method for the determination of lacosamide in human plasma. Bioanalysis 2011; 22: 2515-22.
3. Chhalotiya UK, Bhatt KK, Shah DA, Baldania SL, Patel JR. Stability-indicating liquid chromatographic method for quantification of new anti-epileptic drug lacosamide in bulk and pharmaceutical formulation. Chemical Industry and Chemical Engineering Quarterly 2012; 18: 35-42
4. Kamdar SA, Vaghela VM, Desai PA. Development and Validation of HPTLC Method for Estimation of Lacosamide in Bulk Drug and in Tablet Dosage Form. International Journal of Chem Tech Research 2012; 4: 1193-1197.
5. Molleti S, Rao V, Jayaveera KN. Stability indicating reverse phase UPLC method for determination of lacosamide in bulk and pharmaceuticals dosage form. Ber-pharma chemical 2013; 5: 81-89.
6. Kondawar MS, Shinde SR. Development and validation of bioanalytical method for lacosamide from rat brain tissue. International journal of pharm Tech research 2012; 4: 1417-1421.
7. ICH Harmonized Tripartite Guidelines, Validation of Analytical Procedures: Text and Methodology, Q2 (R1), Geneva, Nov 2005.
8. Rathod DR, Dole MN and Sawant SD. Spectrophotometric determination of Glipizide in bulk and tablet dosage form by absorption maxima, first order derivative spectroscopy and area under the curve. Asian J Pharm Clin Res 2012; 5(Suppl 3): 102-104.
9. Sengar MR, Gandhi SV, Patil UP and Rajmane VS. Simultaneous determination of Diclofenac Sodium and Thiocolchicoside in fixed dose combination by spectrophotometry. Asians J Pharm Clin Res 2010; 3 (Issue 2): 89-91.