Biomedical & Pharmacology Journal Vol. **3**(2), 417-420 (2010)

Novel spectrophotometric methods for the determination of lornoxicam in pharmaceutical dosage forms

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(Received: August 19, 2010; Accepted: September 21, 2010)

ABSTRACT

Three simple and sensitive visible spectrophotometric methods (A, B & C) for the determination of Lornoxicam (LOC) in bulk and pharmaceutical dosage forms are described. They are based on the formation of colored species by Redox reaction with Folin-Ciocalteau (FC) phenol's reagent under alkaline conditions (method A; λ_{max} 700 nm) or oxidation followed by complex formationwith 1,10-Phenanthroline (PTL) in presence of Ferric Chloride (method B; λ_{max} 510 nm) or oxidative coupling of the drug with 3-methyl-2-Benzothiazoline Hydrazone HCl (MBTH) in the presence of Sodium meta periodate (method C; λ_{max} 620 nm). These methods were extended to the analysis of pharmaceutical formulations and results compared with the reference method.

Key words: Spectrophotometry, Lornoxicam, Pharmaceutical formulations.

INTRODUCTION

Lornoxicam (LOC)[1-4] which is chemically 6-Chloro-4-hydroxy-2-methyl-N-2-pyridinyl-2H-thieno [2, 3-e]-1, 2-thiazine-3-carboximide 1, 1-dioxide is a non steroidal anti-inflammatory drug with analgesic properties and belongs to the class of oxicams. A number of methods such as HPLC[6-8], UV Spectrophotometric methods were reported for the estimation of Lornoxicam. Literature survey reveals that visible spectrophotometric methods have not been reported for its quantitative determination in its bulk form and pharmaceutical formulations. In the present have been developed for the determination of Lornoxicam. The developed methods have been developed for the determination of Lornoxicam. The developed methods involve the formation of colored complexes based on secondary aromatic amino group present in the drug. In method A, FC reagent reacts with Lornoxicam under alkaline conditions to form as blue colored species. Method B is based on the oxidation followed by complex formation with 1, 10-Phenanthroline in presence of Ferric Chloride to form a colored species. Huning and Fritsch described oxidative coupling of MBTH[5] with amines in presence of an oxidant. Method C utilizes this reaction for the estimation of Lornoxicam to form a colored chromogen. Beer's law is obeyed and the results of analysis for the three methods have been validated statistically and by recovery studies.

MATERIAL AND METHODS

Instrument

A Systronics Model 2201 UV-VIS spectrophotometer was used for the measurements.

Reagents

All the chemicals used were of analytical grade. The commercially available FC reagent (2N) was taken and diluted suitably with distilled water. Aqueous solutions of 1, 10-Phenanthraline (0.198% 2/v in 0.1 N Hcl), Ferric Chloride (0.003M), MBTH (0.2% w/v), Sodium hydroxide (4% w/v) and Sodium Meta periodate (0.2%% w/v) were prepared.

Standard drug solution

The stock solution (1mg/ml of free base) of Lornoxicam was prepared by dissolving 51.67 mg of the drug in 100 ml of water. The stock solution was further diluted to get 100 µg/ml required working standard solution.

Procedures

Method A

Aliquots of standard drug solution (1.0-5.0ml, 100 µg/ml) were transferred into a series of 10 ml volumetric flasks. To this added 1 ml of FC reagent and 1 ml of Sodium Hydroxide solution, volume was adjusted to 10ml with distilled water. The blue colored chromogen thus formed was measured at 700 nm against reagent blank. The amount of LOC was computed from its calibration plot.

Method B

Aliquots of standard drug solution (0.1-0.6ml, 100 µg/ml) were transferred into a series of 10 ml volumetric flasks A 1.0 ml portion of Ferric Chloride (0.003M) solution was added to each flask and then 1.0 ml of 1,10-Phenanthroline was added. The flask were cooled to room temperature and 2.0 ml of O-phosphoric acid was added to each flask, finally the volume was brought to 10ml distilled water. The absorbances were measured at 510 nm against a reagent blank. The amount of LOC was computed from its calibration graph.

Method C

Aliquots of working standard solution of LOC (0.01-0.05 ml, 10µg/ml) were transferred into a series of 10 ml volumetric flask. To this 1 ml of acetic acid and 1 ml of $NaIO_4$ solution were added, final volume was equalized in all flasks using acetonitrile. The contents were boiled for 30 minutes, cooled and 1 ml of MBTH reagent was added. The solution was kept aside for 25 minutes. The total volume was made up to 10 ml with acetonitrile. The absorbance of the colored chromogen was measured at 620 nm against reagent blank. The amount of drug present in the sample solution was computed from its calibration curve.

Table 1: Optical characteristics, regression data, precision and accuracy of the proposed methods of LOC

Parameter	Method A	Method B	Method C
λ_{max} (nm)	700	510	620
Beer's law limit (µg/ml)	14-28	5-40	0.008-0.04
Molar absorptivity (L mol^{-1} cm^{-1})	5.578×10^{3}	4.1887×10^{4}	1.398×10^{4}
Detection limits (µg/ml)	0.2710	0.0258	0.0930
Sandell's Sensitivity (µg/cm^2/0.001 abs.unit)	0.07018	0.00905	0.0282
Optimum Photometric range (µg/ml)	10.5-49	1.5-5.5	5-19
Regression equation (Y=a+bc)	0.0142	0.1061	0.0355
Slope (b)			
Standard Deviation of Slope (S_b)	3.858×10^{-5}	2.301×10^{-3}	8.278×10^{-5}
Intercept (a)	0.00109	0.00025	0.00019
Standard error of estimation (S_e)	1.168×10^{-5}	1.21×10^{-4}	1.003×10^{-3}
Correlation coefficient (r)	0.9998	0.9996	0.9997
% Relative standard deviation*	0.570	0.345	0.851
% Range or Erro (Confidence limits)			
0.05 level	0.589	0.363	0.601
0.01 level	0.938	0.569	0.942
% Error in bulk samples**	-0.12	0.56	0.61

* Average of six determinations

** Average of three determinations

Analysis of pharmaceutical formulations

Twenty tablets of LOC were weighed and powdered. A quantity of tablet powder equivalent to 51.67 mg of LOC was accurately weighed and transferred into a 100 ml volumetric flask containing 100 ml of distilled water. The solution was sonicated for 15 minutes, filtered through cotton wool and the filtrate was made upto volume with water. This solution was further diluted to obtain 100 µg/ml solution and analysed as per above procedures.

Recovery Studies

To study the accuracy, reproducibility and precision of the proposed methods, recovery studies were carried out. Recovery of the added standard was studied at three different levels.

RESULTS AND DISCUSSION

The optimum conditions for each method were established by varying one parameter at a time and keeping the others fixed and observing the effect of the product on the absorbance of the colored species and incorporated in the procedure. The optical characteristics and figures of merit are given in table 1, together with the regression equations obtained by linear least square treatment for the calibration plots. The precision and accuracy

Table 2: Assay and Recovery of LOC in dosage forms

Methods	Pharmaceutical Formulation	Labelled Amount (mg/ tablet)	Proposed Method			Found by Reference Method[6]± S.D	% Recovery by proposed Methods** ± S.D
			Amount found* (mg) ± S.D.	t (value)	F (value)		
	Brand - 1	4	4.01+0.015	0.617	1.874	3.99+0.014	100.2+0.54
		8	8.03+0.010	0.821	2.206	7.94+0.012	99.81+1.01
A (FC)	Brand - 2	4	3.91+0.008	0.401	2.638	3.98+0.012	99.92+1.04
		8	7.97+0.011	0.527	1.526	8.02+0.013	100.3+0.69
	Brand - 1	4	3.93+0.012	0.369	2.540	4.01+0.015	99.82+0.75
		8	8.04+0.017	0.262	2.175	8.03+0.010	99.97+1.01
B (PTL)	Brand - 2	4	4.01+0.095	1.178	2.169	4.98+0.007	100.8+0.50
		8	7.98+0.011	0.614	2.389	7.97+0.018	100.9+0.61
	Brand - 1	5	4.95+0.01	0.165	2.534	5.02+0.013	99.8+0.50
		10	9.91+0.009	0.138	2.474	9.94+0.018	100.3+0.42
C (MBTH)	Brand - 2	5	5.01+0.016	1.075	1.104	4.97+0.072	99.92+1.03
		10	10.02+0.0120	0.048	2.189	9.98+0.019	100.1+0.46

* Average ± Standard deviation of six determinations, the t and F-values after to comparison of the proposed with reference method.

Theoretical values at 95% confidence limits t = 2.571 and F = 5.05

** Average of five determinations

were formed by analyzing six replicate samples and containing known amount of drug and their results were summarized in table 1, table 2 shows that values of percentage recovery are between 98%-102% and value of coefficient variation are sufficiently low indicating that the proposed methods are free of interferences from any excipients like starch, talc etc, and the results are reproducible. The systematic study revealed that the proposed methods for the determination of LOC are simple, selective and sensitive with reasonable precision and accuracy. They can be used as

alternative methods to reported ones for the routine determination of LOC in pure and in pharmaceutical formulations.

ACKNOLWEDGEMENTS

The authors are grateful to M/s. Veeda CR, Ahmedabad and Siddhartha Academy, Vijayawada, for providing the necessary facilities.

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