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New Spectrophotometric Methods for the Determination of Meloxicam

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Accepted 20 February 2001
Revised 29 January 2001
Received 16 May 2000

Two Simple and sensitive spectrophotometric methods, A and B have been developed for the determination of meloxicam and its dosage forms. Meloxicam forms stable green coloued chromogen with ferric chloride and potassium fericyanide exhibiting maximum absorption at 770 nm (method A) that shows linearity in concentration of 0.25-2.5 µg/ml. In method B, meloxicam forms blue coloured complex on treatment with Folin Ciocalteu reagent, showing maximum absorption at 740 nm. The chromogen obeys Beer's law in the concentration range of 5-15 µg/ml.

Meloxicam is 4-Hydroxy-2-methyl-N-(5-methyl-2-thiazolyl)-2H-1,2-benzo-thiazine-3-carboxamide-1,1-dioxide and is used as a non-steroidal antiinflammatory agent[1]. It acts by inhiniting cycloxygenase-2[2]. Literature survey revealed different analytical methods for the estimation of meloxicam including UV[3,4,6], HPLC[4,5] and TLC densitometry[6]. In the present investigation, meloxicam was found to form a stable green chromogen with ferric chloride and potassium ferricyanide that shows maximum absorption at 770 nm in the first method (method A). In the second method (method B), meloxicam formed a stable blue chromogen on treatment with Folin Ciocalteu reagent (FC reagent) in presence of 1 N NaOH and shows maximum absorption at 740 nm.

All reagents used were of analytical grade. Solutions of ferric chloride (0.1 M), potassium fericyanide (0.1% w/v), sodium hydroxide (1 N) and FC reagent (I N) (Loba Chemie, Mumbai) were prepared in distilled water. Spectral and absorbance measurements were made on a Systronics UV/Vis spectrophotometer model 117. The stock solution of meloxicam (1 mg/ml) (pure drug or formulation) was prepared in 1N NaOH and further suitable dilutions were made with distilled water to get working standard solution of 10 ug/ml for method A and 50 µg/ml for method B.

In the method A, samples of meloxicam ranging from 0.25 to 2.5 ml (1 ml=10 µg) were taken in a series of 10 ml volumetric flasks, 2 ml of feric chloride (0.1 M) and 2 ml of potassium ferricyanide (0.1%) were successively added and shaken well. An appropriate volume of distilled water was addded to each flask to bring the total volume to 10 ml. The absorbance of green coloured species formed was measured at 770 nm against reagent blank and the amount of meloxicam present in the sample solution was computed from its calibration curve.

Volumes of standard meloxicam solution ranging from 0.25 ml to 3 ml (1 ml = 50 µg) were transferred into a series of graduated test tubes in the method B. One and

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TABLE 1: OPTICAL CHARACTERISTICS AND PRECISION

Parameters	Method A	Method B
Beer's law limit (μg/ml) (C)	0.25-2.5	1.25-15
Sandell's sensitivity (μg/cm²/0.001 Absorbance unit)	0.00294	0.01996
Molar extinction coefficient (1 mole^{-1} cm^{-1})	1.194×10^5	1.760×10^4
Correlation coefficient	0.9999	0.9999
Regression equation (b + aC)		
Slope (a)	3.39×10^{-2}	5×10^{-2}
Intercept (b)	0.0035	-0.000225
Percent relative standard deviation (% RSD)	0.6754	0.7826
Percent range of error		
Confidence limit with 0.05 level	± 0.5648	± 0.6543
Confidence limit with 0.01 level	± 0.8356	± 0.9681

half milliliter of sodium hydroxide (1 N) was added to each test tube and the contents were mixed well. Then 1 ml of FC reagent (1 N) was added and finally the volume was made upto 10 ml with distilled water. The absorbance of each solution was measured at 740 nm against a reagent blank. The amount of meloxicam present was computed from its calibration curve.

The optical characteristics such as Beer's law limits, molar extinction coefficient, Sandell's sensitivity, stability of coloured species, percent relative standard deviation (calculated from eight separate samples containing 3/4th of the amount of the upper Beer's law limits of meloxicam in each method), percent range of error (0.05 and 0.01 confidence limits), correlation coefficient, slope and intercept of regression analysis using least square methods were calculated and summarized in Table 1.

The values obtained for the determination of meloxicam in several pharmaceutical formulations (Tablets) by the proposed and reported methods are compared in Table 2. To evaluate the validity and reproducibility of the methods, known amounts of pure drug was added to the previously analyzed pharmaceutical formulations and the mixture were analyzed by the proposed methods and the recoveries (average of six determinations) are given in Table 2. Interference studies revealed that the common excipients and other additives usually present in the dosage forms did not interfere in the proposed methods.

TABLE 2: ESTIMATION OF MELOXICAM IN PHARMACEUTICAL PREPARATIONS

Sample (Tablets)	Labelled amount (mg)	Amount obtained (mg)			Percent recovery of the proposed method	
		Reported method[2]	Proposed method A	B	A	B
MEL - OD	7.5	7.48	7.55	7.52	100.60	100.26
M - CAM	7.5	7.45	7.59	7.53	101.20	100.40
MUVERA	7.5	7.55	7.52	7.49	100.26	99.86
RAFREE	7.5	7.54	7.51	7.52	100.13	100.26

MEL - OD

In method A, the formation of the green coloured complex is due to the partial oxidation of 4-hydroxy group of meloxicam which ferric chloride. Ferrous ions thus produced form complexes with the reagents for divalent iron i.e., potassium ferricyanide. In method B, the reduction of FC reagent in the presence of 1 N NaOH gives a blue coloured chromogen, which may be molybdenum blue or tungsten blue. The results indicated that the proposed methods are simple, sensitive, reproducible and accurate and can be used for the routine determination of meloxicam in bulk and dosage forms.

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Comparative Evaluation of *In vitro* Performance of Commercial and Fabricated Sustained Release Diclofenac Sodium Tablets

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Accepted 5 March 2001
Revised 2 February 2001
Received 5 September 2000

Ten commercial sustained release (SR) tablets of diclofenac sodium (DS) were evaluated for *in vitro* release characteristics in pH 7.4 medium. The rate and extent of drug release were highly variable for these tablets. Five batches of sustained and controlled release matrix tablet of DS were fabricated using polymers, like carboxymethyl cellulose (CMC) or carbopol 974P (Carbopol) alone or in combinations using different ratios, and were evaluated for physical characteristics and drug release performance. The results clearly indicated that batches prepared with admixed polymers exhibited more sustained and controlled release of DS in comparison to most of the commercial tablets. The treatment of data for zero-order, first-order and Higuchi's square root of time equations showed that all the fabricated tablets provided zero-order drug release profiles.

DS is a well-known NSAID, administered orally in the treatment of rheumatic diseases. Because of its short biological half-life and the hazards of adverse GI reactions, the development of oral sustained release formulations of this drug is highly desirable[1], so as to achieve improved therapeutic effect with negligible side effects and improved patient compliance. The use of controlled release technology in the formulation of pharmaceutical products has become increasingly important in the last few years[2] and many efforts have been made towards achieving sustained release formulations of DS[3-7]. Since many SR tablets of DS are available in the Indian market, we first evaluated the *in vitro* drug release characteristics of ten commercially available SR tablets of DS and found a large variation in their rate and extent of drug release. This prompted us to fabricate some optimized SR matrix tablets of DS using one or more polymers

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