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Spectrophotometric methods for estiamation of metoclopramide hydrochloride in pharmaceutical formulation

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ABSTRACT

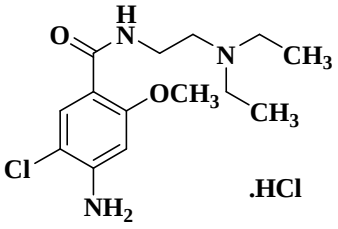
Simple sensitive and accurate spectrophotometric methods have been developed for the estimation of metoclopramide hydrochloride in pharmaceutical dosage form. Methods I, II are based on reactions of para amino phenol and catechol with metoclopramide hydrochloride in presence of sodium carbonate with maximum absorbance at 450 and 480 nm respectively. Method III is based on the reaction of drug with salicylaldehyde. It gives Schiff base. It shows maximum absorbance at 405 nm. The proposed methods were validated statistically. Recovery of methods were Carried out by standard addition method. The linearity was found to be 10-50 μg/ml, 5-50 μg/ml and 5-50 μg/ml for methods I, II, III respectively. The low values of standard deviation and percentage RSD indicate high precision of the methods. Hence they are useful for the routine estimation of metoclopramide hydrochloride in tablets.

KEYWORDS

Metoclopramide hydrochloride;
Para amino phenol;
Catechol;
Salicylaldehyde.

INTRODUCTION

Metoclopramide hydrochloride is chemically 4-amino 5-chloro-N-2 (diethyl amino) ethyl 2 methoxy benzamide hydrochloride. It is indicated for antiemetic action. The drug is officially reported in BP[1],IP[2] and USP[3]. BP[1] describes liquid chromatographic method in presence of sodium octane sulphonate and sodium acetate, adjusting pH at 3.8 with glacial acetic acid. IP[2] describes extractive spectrophotometric technique .USP[3] describes liquid chromatographic method. Some spectrophotometric methods[5-17] were reported for assay metoclopramide hydrochloride from its pharmaceutical dosage. HPLC[18-25], Fluorimetric[26], potentiometric[27-29] and amperometric[30] methods were reported for assay of drug from pharmaceutical preparation. HPLC[19] method was also reported for determination of drug.



Structure

MATERIAL AND METHODS

A SHIMADZU UV-160 A double beam UV –VISIBLE recording spectrophotometer with pair of 10 mm matched quartz cells was used to measure absorbance of the solution. A SHIMADZU analytical balance was used.

A Sartorious analytical balance with 0.01 mg was used.

TABLE 1: Optical and regression values of drug in different methods

Parameter	methods		
	I	II	III
λ max (nm)	450	480	405
Beer Law limits (μg/ml)	10-50	5-50	5-50
Molar Absorptivity (l/mol. cm)	1.488×10^3	1.4172×10^3	5.7042×10^3
Sandell's sensitivity (mcg/cm^2/0.001A.U)	0.365	0.094231	0.365
Correlation coefficient (r^2)Regression equation (y=b+ac)	0.9999	0.9979	0.9998
Slope (a)	0.0042	0.004	0.0161
Intercept	0.0013	-0.0021	-0.0013

Para amino phenol, catechol, salicylaldehyde and sodium carbonate of A.R. grade were used in the study.

Preparation of standard solution and reagents

Metoclopramide hydrochloride stock solution (μg/ml) was prepared in double distilled water. From this stock solution, working standard solution for method I (100-500μg/ml), method II (50-500 μg/ml) and method III (50-500 μg/ml) were prepared by appropriate dilutions .A 0.05 % (W/V) solution of para amino phenol, 0.04 % (W/V) solution of catechol, 6 % (W/V) of sodium carbonate were prepared in distilled water. 8 % (V/V) solution of salicylaldehyde was prepared in absolute alcohol.

EXPERIMENTAL

Method I (with para amino phenol)

Aliquots of the working standard solution of metoclopramide hydrochloride (100-500 μg/ml) were transferred in a series of 10 ml volumetric flask. Then 1 ml of para amino phenol and 1 ml of sodium carbonate solution were added. Solutions were allowed to stand for 15 minutes and volume was adjusted with double distilled water .Absorbance of resulting solutions were measured at 450 nm.

Method II (with catechol)

Aliquots of the working standard solution of metoclopramide hydrochloride (50-500 μg/ml) were transferred in a series of 10 ml volumetric flask. Then 2 ml of catechol and 1.5 ml of sodium carbonate solution were added. Solutions were allowed to stand for 45 minutes and volume was adjusted with double distilled water .Absorbance of resulting solutions were measured at 480 nm.

Method III (with salicylaldehyde)

Aliquots of the working standard solution of metoclopramide hydrochloride (50-500 μg/ml) were transferred in a series of 10 ml volumetric flask. Then 2 ml of salicylaldehyde added. Solutions were allowed to stand for 10 minutes and volume was adjusted with absolute alcohol. Absorbance of resulting solutions were measured at 405 nm.

Estimation from tablets

Twenty tablets of labelled claim 10 mg of metoclopramide hydrochloride were weighed accurately, average weight of each tablet was determined. Tablets were crushed into fine powder. An accurately weighed quantity of powder equivalent to 10 mg of metoclopramide hydrochloride was transferred into a beaker and it was shaken with 50 ml of double distilled water and filtered. The filtrate and the washing were collected in a 100. ml volumetric flask. This filtrate and the washing were diluted up to the mark with double distilled water to obtain final concentration 100 μg/ml. This solution was used for method I, II, III respectively.

Appropriate aliquots of drug solution were taken and the individual assay procedures were followed for the estimation of drug contents in tablets. The concentration of the drug in the tablets was calculated using calibration curve. The recovery experiment was carried out by standard addition method. Results of analysis are given in TABLE 1.

RESULT AND DISCUSION

In the method suggested above para-amino phenol and catechol reacts with primary amine group of metoclopramide hydrochloride in basic medium to give chromogen while salicylaldehyde reacts with the drug to give schiff base. The absorbance of the resulting solution was measured at respective wavelength of maximum absorbance. The various parameters involved for maximum colour development for these methods were optimized.

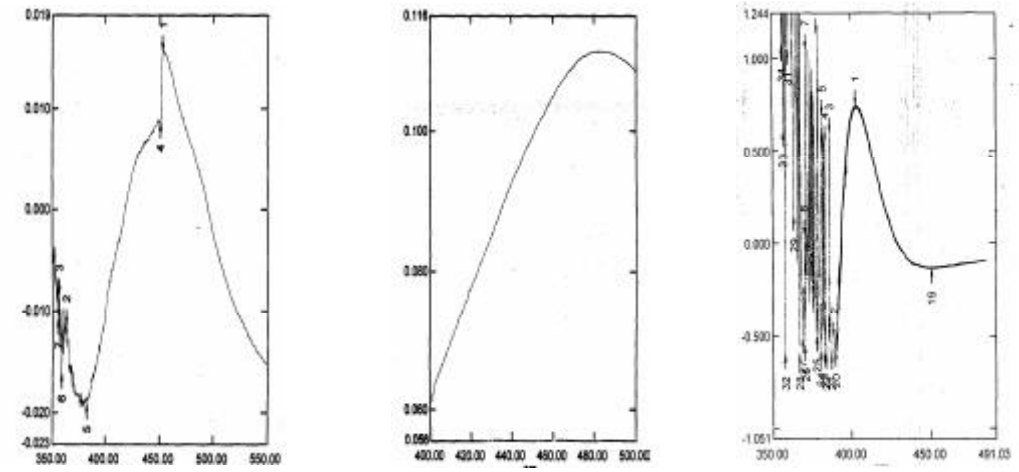
Full Paper

TABLE 2 : Results of recovery of drug with different reagents

Reagent	Amount label claim (µg/ml)	Amount of standard added (µg/ml)	Total amount recovered	Percent recovery(%)	Standard deviation	Percentageof relative standard deviation (C.O.V.)
Para Amino phenol	10	0	9.994	99.94	0.13017	1.30169
	10	10	19.894	99.47	0.1222	0.61442
	10	20	29.999	99.99	0.1840	0.6135
	10	30	39.93	99.825	0.1102	0.27605
Catechol	10	0	9.999	99.99	0.140806	1.840
	10	10	19.999	99.995	0.1480	1.840
	10	20	29.391	97.97	0.2611	0.8119
	10	30	40.183	100.457	0.2852	0.7096
Salicyl Aldehyde	10	0	9.994	99.94	0.0474	0.4742
	10	10	20.0178	100.089	0.03047	0.15233
	10	20	30.0089	100.029	0.02362	0.0787
	10	30	39.866	100.336	0.237	0.1338

Spectral properties of metoclopramide hydrochloride

With para-amino phenol **With catechol** **With salicylaldehyde**



Some of the previous methods reported were extractive spectrophotometric methods and diazotization of primary amine group of substrate which was further coupled with suitable reagent to form chromogen e.g. I.P[2] reports extractive spectrophotometric method. B.P[1] and U.S.P[3] report liquid chromatographic method for determination of metoclopramide hydrochloride. Methods reported by Shingbal D.M[4,7,9,12,13] and co-workers, Kamalapurkar O.S. and co-workers[10,11], Zarapkar S.S and co-workers[14,15], Ramappa P.G. and co-workers[16] etc suggested diazotization reaction which involves critical parameters. The method suggested by S.Grokowsky and coworkers[8] involves precipitation of drug in acidic medium and its further extraction in chloroform where as method suggested by Amin A.S[17]. involves oxidation of metoclopramide in presence of Fe-phenonthroline complex and other method involves addition of excess of Ce^{4+} ions to Fe-phenonthroline complex. These methods suggested was found to be time consuming, tedious and costlier hence are not convenient for routine analysis.

The proposed methods are simple, sensitive, accurate, precise and reproducible. These methods can be directly applied to the drug to form chromogen. The coloured complex formed were found to be stable for more than 30 min. Since critical reaction conditions are avoided the method stated is very simple. Colour forming reagents are easily available and also work out to be very economical range.

The result of recovery experiments also denoted that the results of analysis by the present method are in excellent agreement with those obtained by official methods. The values of percentage recovery are between 99.81-100.547 % of the label amount, clearly indicating that the method dose not involve any interference from starch, talc etc. The molar absorptivity values of

coloured complexes with three different reagent range from 1.4172×10^3 to 5.7042×10^3 Lit/ mole.cm indicating that method is quite sensitive. The values of standard deviation, relative mean deviation, coefficient of variation given in TABLE 2 are sufficiently low indicating the proposed methods are quite sensitive and accurate. Methods can also be applied for determination of stability of drug in formulation such as tablets. Hence these methods can be successfully applied for routine estimation of metoclopramide hydrochloride in bulk and pharmaceutical dosage form even at low concentration.

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