Research Article

Development of UV-Visible Spectrophotometric Method for Determination of Metformin Hydrochloride

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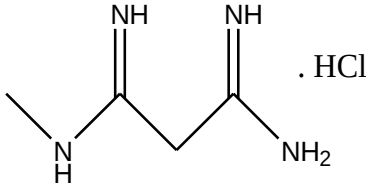
ABSTRACT

A simple, economical, accurate and precise UV-Visible spectrophotometric method for the routine estimation of Metformin HCl. has been developed. The method is based on formation of bluish green colored complex by Metformin HCl in presence of (A) 3-methyl 2-benzothiozoline hydrazoneMBTH and (B) Patent blue. The developed colored complex showed λmax at 630 nm and 639 nm respectively. Beer`s law in the concentration range of 2 to 12 µg/ ml and 5 to 30 µg/ ml. The regression line equation was Y= 0.0089x-0.0081 and Y= 0.0136x+0.0429 with a regression coefficient of 0.972 and 0.981 respectively. The precision was satisfactory; the value of relative standard deviation (RSD) had not exceeded 2%.

Keywords: Colorimetric Assay, Beer`s Law, Metformin HCl and Patent blue.

INTRODUCTION



Metformin hydrochloride chemically 1,1-dimethylbiguanide hydrochloride is white crystalline powder, hygroscopic and freely soluble in water, used as a hypoglycemic drug. **Metformin**, marketed under the trade name **Glucophage** among others, is an antidiabetic medication which is taken by mouth. It is the first-line drug of choice for the treatment of type 2 diabetes, in particular, in overweight and obese people and those with normal kidney function. Its use in gestational diabetes has been limited by safety concerns. It is also used in the treatment of polycystic ovary syndrome, and has been investigated for other diseases where insulin resistance may be an important factor such as nonalcoholic fatty liver disease. Metformin works by suppressing glucose production by the liver. Literature survey reveals that methods like HPLC and Spectrophotometric have been reported for estimation of Metformin hydrochloride in pharmaceutical formulation. The present works describe the development and validation of a new Spectrophotometric method for estimation of Metformin hydrochloride.

EXPERIMENTAL

REAGENT AND CHEMICALS

The reference standard of Metformin hydrochloride, 3-methyl 2-benzothiozoline hydrazone, and Patent blue was procured as gift sample from Vijay Trading Shrirampur, Ahmednagar.

INSTRUMENT

A systronics UV-Vis double beam spectrophotometer (JASCO 650) with 1cm matched quartz cell was used for all spectral measurement.

Standard preparation

Standard stock solution of Metformin HCl. was prepared by dissolving 10 mg of Metformin HCl in 10 ml ofethanol, shake well till it dissolve and make up the volume to 100ml as a final concentration 100 µg/ml.

Sample solutions

The marketed tablets form of Metformin HCl 500mg and manufactured by MSD

Pharmaceuticals Limited, Pavia, Italy. About 10 tablets were taken and their average weight was calculated. The tablets were crushed to a fine powder and powder equivalent to 500 mg Metformin HCl was dissolved in quantity sufficient 100 ml ethanol.

Preparation of color reagent

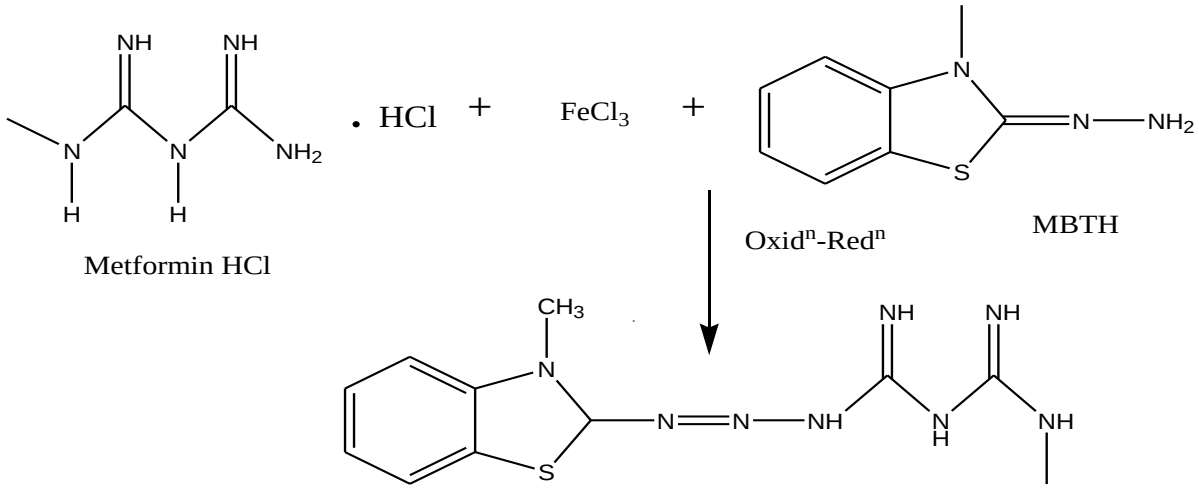
Solution of 0.5 w/v of Ethanolic $FeCl_3$, 0.2% w/v MBTH, 0.1 N HCl, 0.5% w/v Patent blue prepared separately,

Stability of color

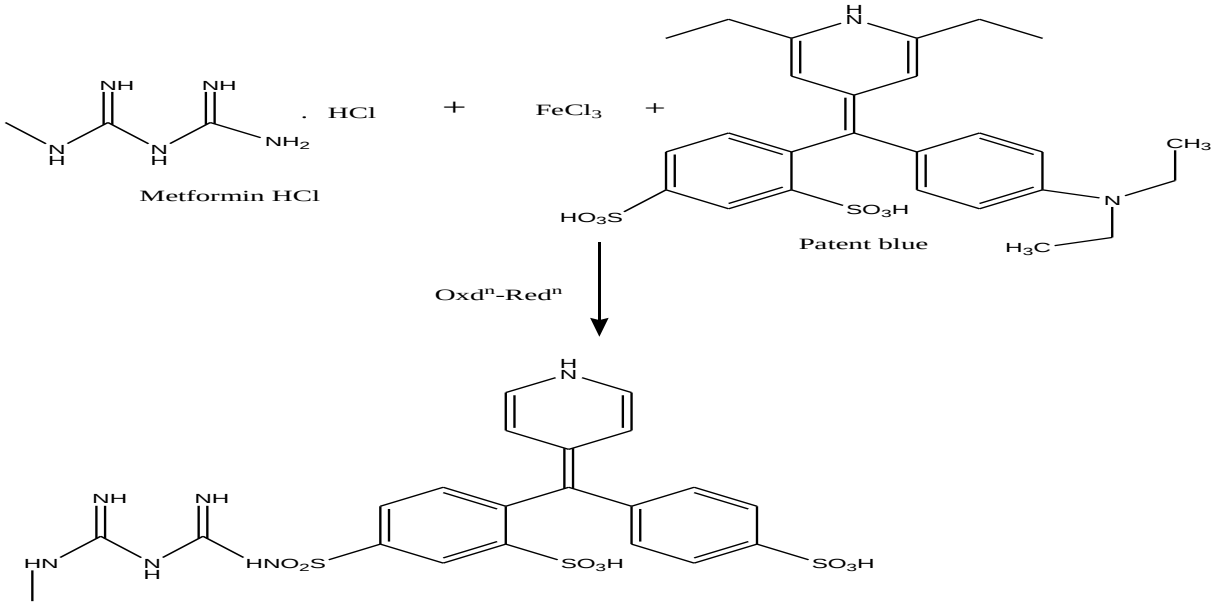
The stability of developed color complex was assessed under two different temperature condition, i.e., at room temperature and at 40^0C. For color stability, aliquots of concentration with standard drug solution, for reagent (A) 2 to 12 µg/ml and sample (B) 5 to 30 µg/ml respectively were prepared and complex was formed. The sample were kept in transparent and amber colored glass vials under room temp and elevated (40 ± 2 ^{0}C) temp condition, in controlled oven for varying period of time.

Reaction between MBTH and Metformin HCl

In general MBTH undergoes oxidative coupling reaction catalyzed by iron .Under reaction Conditions MBTH loses 2 electrons and one proton forming an electrophilic intermediate, which is the active coupling species .This intermediate, undergoes electrophilic substitution to form a color complex.



2.8 Reaction between Patent blue and Metformin HCl



Preparation of calibration curve of Metformin HCl and MBTH

Suitable aliquots of standard drug solutions (0.2 to 1.2ml) were taken in a 10 ml volumetric flask. To each flask one ml of 0.5 w/v of ethanolic $FeCl_3$, after 5 min one ml of 0.2 w/v of MBTH solution was added. The volume was made up to 10 ml with ethanol to make a final concentration 2 to 12 µg/ml. The absorbance of yellowish green colorwas measured at 630 nm and the calibration curve was plotted.

Preparation of calibration curve of Metformin HCl and Patent blue

Suitable aliquots of standard drug solution (0.5 to 3 ml) were taken in each10 ml volumetric flask. To each flask one ml of 0.1N HCl, after 5 min 0.5% w/v Patent blue was added. The volume was made up to 10 ml with water to make a final concentration 5 to 30 µg/ml. The absorbance of green color was measured at 639 nm and the calibration curve was plotted.

Table 1: Absorbance value for Reagent (A) and (B)

S. No.	Conc. (µg/ml) (A)	Conc. (µg/ml) (B)	Absorbance	
			(A)	(B)
1	2	5	0.0144	0.1168
2	4	10	0.0229	0.1563
3	6	15	0.0385	0.2512
4	8	20	0.0712	0.3263
5	10	25	0.0802	0.4021
6	12	30	0.0982	0.4290

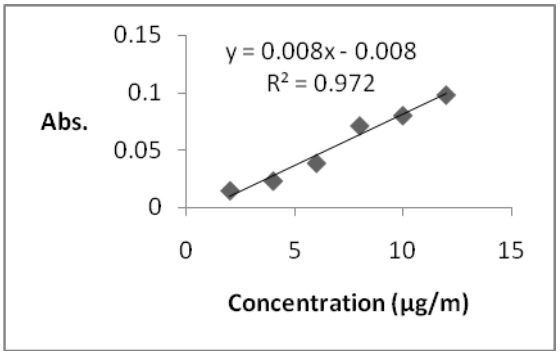


Fig. 1: Calibration curve for reagent (A)

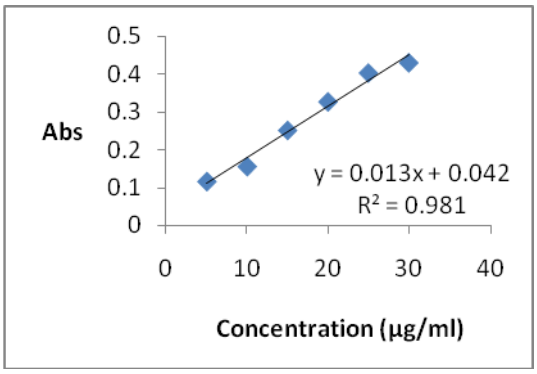


Fig. 2: Calibration curve for reagent (B)

Precision for Reagent (A) and (B)

Six samples of the same concentration of both Reagent (A) and (B) were prepared and calculated as per test procedure

Table 2: Precision for Reagent (A) and (B)

S. No.	Concentration (µg/ml)		Absorbance	
	(A)	(B)	(A)	(B)
1	2	2	0.351	0.376
2	2	2	0.353	0.374
3	2	2	0.356	0.374
4	2	2	0.356	0.378
5	2	2	0.353	0.378
6	2	2	0.354	0.375
Mean			0.354	0.375
S.D			2.071	2.062
%RSD			1.07	1.06

Table 3: Recovery study of reagent (A) and (B)

Drug	Level of addition %	Amount added µg/ml Reagent (A) and (B)	Amount Recovered µg/ml		% Recovery	
			(A)	(B)	(A)	(B)
	80	8	7.9	6.5	98.75	94.15
Met. HCl	100	10	100.6	102.9	100.6	99.53
	120	12	108.5	110.4	108.5	107.82

RESULTS AND DISCUSSION

A UV-Visible method was proposed for the suitable determination of drug. Metformin HCl is oxidized and reduced which form a green and yellowish green color complex with MBTH and Patent blue respectively with maximum absorbance at a wavelength of 630 nm and 639 nm respectively. The linearity was assessed by plotting against the concentration, shown in **Table 1**, and found that linearity existed for reagent (A) and (B) in the range of 2 to 12 µg /mLand 5 to 30 µg /mL with a correlation coefficient 0.972 and 981 respectively. The average % recovery was found to be 102.61 % and 100.5% respectively.

CONCLISION

The proposed methods were rapid, accurate and sensitive. The reagent, chemicals were used in this method is very less which makes it inexpensive. This method does not suffer any interference due to common excipients present in pharmaceutical preparation and can be conveniently adopted for quality control analysis.

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