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A simple visible spectrophotometric determination of Sumatriptan Succinate from pharmaceutical formulations

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ABSTRACT

A simple, sensitive and cost effective visible spectrophotometric method was developed for the estimation of sumatriptan succinate in bulk and dosage forms. The method is based on the formation of purple red colored species with sodium nitroprusside –acetaldehyde reagent exhibiting maximum absorption at 552 nm. Beer's law obeyed in the concentration range of 4 - 20 µg/ml. commercially available tablets were analysed, the results obtained by the proposed method were in good agreement with the labeled amounts. These methods are reproducible with an accuracy of ±1 %.

KEY words: Sumatriptan, Sodium nitroprusside, Acetaldehyde, visible Spectrophotometry, Tablets.

INTRODUCTION

The Sumatriptan succinate (SUM) (figure-1) is the most frequently prescribed anti- migraine drug of triptan class. It is chemically known as 3-[2-(Dimethylamino) ethyl] –N-methyl-1H indole -5- methane sulphonamide succinate (1:1) base [1]. SUM is a specific and selective 5-hydroxyl tryptamine receptor (5-HT_{1D}) agonist with no effect on the other 5HT receptor ($5HT_2$-5 HT_7) sub types. It is used widely for prophylaxis and acute relief of migraine attack with or without aura. SUM undergoes an extensive biotransformation mainly through Mono amino oxidase-A. The drug is official in EP [2] and USP [3] and suggests chromatographic methods for determination of SUM in bulk and tablet formulations. Several analytical techniques like HPLC [4-9], HPLC-MS-MS [10-13], HPLC- ECD [14-15], HPLC-coulometry [16], capillary LC-MS-MS [17], HPTLC [18], spectrophotometric with HPTLC [19], RP-HPLC with colorimetric [20], UV [21] and voltametry [22], capillary electrophoresis[23], densitometry and spectrophotometric detection[24] have been reported in the literature. The main purpose of the present study was to establish a relatively simple, sensitive, validated and inexpensive visible spectrophotometric method for the determination of SUM in pure form and in pharmaceutical dosage forms, since most of the previous methods involve

sophisticated equipments which are costly and pose problems of maintance. So the authors have made some attempts in this direction and succeeded in developing a method based on the reaction between the drug and sodium nitroprusside- acetaldehyde reagent [25]. The method is successfully extended to dosage forms containing sumatriptan succinate.

MATERIALS AND METHODS

Systronics UV/Visible spectrophotometer model -2203 with10mm matched quartz cells was used for all spectral measurements .Systronics model-362 pH meter was used for all the pH measurements. All the chemicals used were of analytical grade. Aqueous solutions of sodium nitroprusside (SNP, E.Merck, 1.0%, $3.35x10^{-2}$M), acetaldehyde (10%), phosphate buffer of pH 8.0(prepared by mixing 30ml of 0.067M potassium hydrogen phosphate and 970ml of 0.067Mdisodium hydrogen phosphate and pH adjusted to 8.0) were prepared.

Standard drug solution:
The standard stock solution (1mg/ml) of SUM was prepared by dissolving 100mg of SUM in 10ml 0.1M sodium hydroxide and the volume was brought to 100ml with distilled water. This solution was further diluted stepwise with the same solvent to obtain working standard solution concentration of 200µg/ml.

Sample solution preparation:
About 20 tablets were pulverized and the powder equivalent to 100mg of SUM was weighed, dispersed in 25ml of isopropyl alcohol (IPA), sonicated for 30minutes and filtered through whatman filter paper no.41. The filtrate was evaporated and the residue was used for the preparation of working sample solution in the same way as under working standard solution.

Assay
Aliquots of standard SUM drug solution [0.5-2.5ml, 200µg/ml] were delivered into a series of 25ml calibrated tubes containing 15ml of buffer pH 8.0. Then 1.0ml each of SNP solution and acetaldehyde were added successively and shaken for 2 minutes and kept aside for 5 minutes at room temperature and made up to the mark with distilled water. The purple colored species was obtained and it was stable for 1 hour. The absorbance of the coloured species was measured at 552nm against the reagent blank (Fig.2 showing absorption spectra). The amount of SUM was computed from its calibration curve (Fig.3 showing Beer's law plot).

RESULTS AND DISCUSSION

In developing this method, a systematic study of the effects of various parameters were undertaken by varying one parameter at a time and controlling all others fixed. The effect of various parameters such as time, volume and strength of sodium nitroprusside, acetaldehyde and pH buffer solution and solvent for final dilution of the colored species were studied and the optimum conditions were established. The optical characteristics such as Beer's law limit, Sandell's sensitivity, molar absorptivity, percent relative standard deviation, (calculated from the six measurements containing $3/4^{th}$ of the amount of the upper Beer's law limits) were calculated and the results are summarized in table-1.Regression characteristics like standard deviation of slope (Sb), standard deviation of intercept (Sa), standard error of estimation (Se) and % range of error (0.05 and 0.01 confidence limits) were calculated and are shown in Table-1.

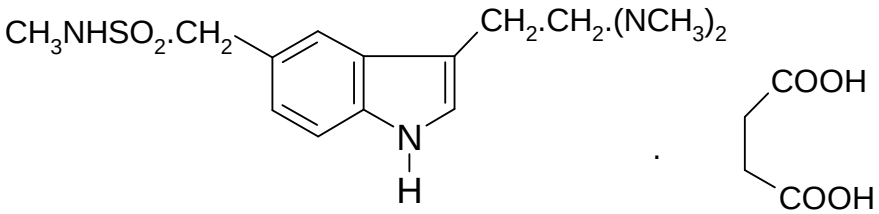

Figure- 1 Showing Chemical Structure of SUM

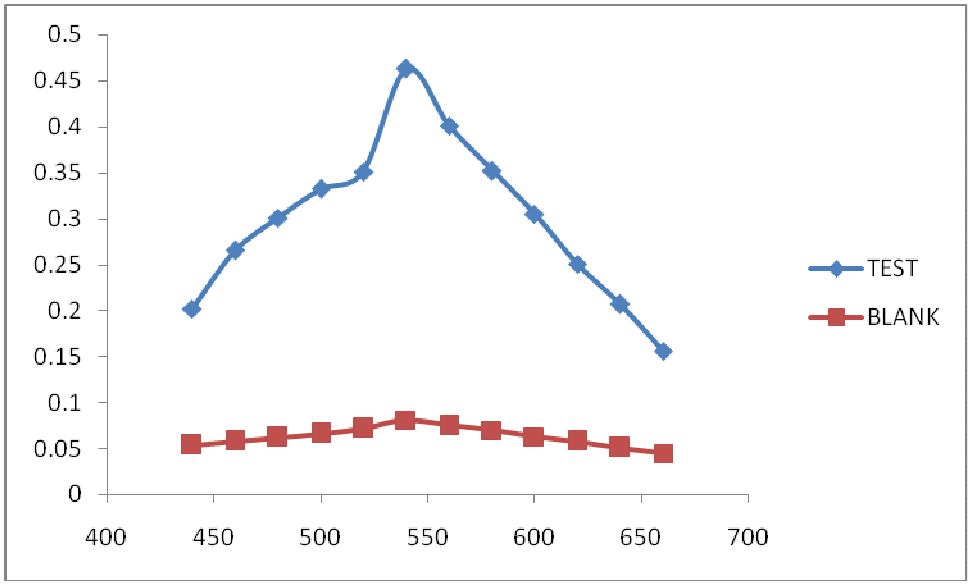

Fig.2. Showing Absorption Spectra of Sumatriptan with SNP- ACD Reagent

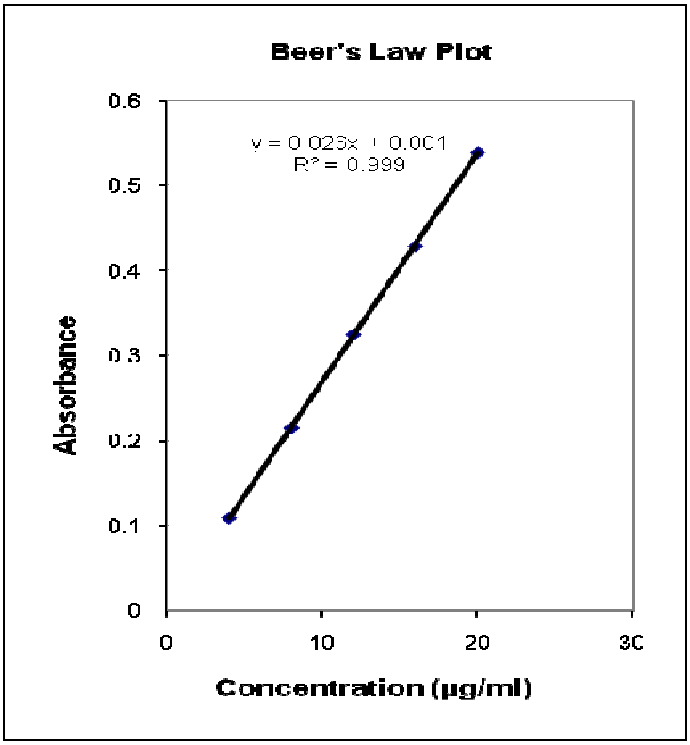

Fig.3. Showing Calibration Graph

Commercial formulations containing SUM were successfully analyzed by the proposed method. The values obtained by the proposed and reference methods for formulations were compared statistically by the t-and f-test and found not to differ significantly. As an

additional demonstration of accuracy, recovery experiments were performed by adding a fixed amount of the drug to the preanalyzed formulations at three different concentration levels (50%, 75% and 100%). These results are summarized in Table-2. The ingredients usually present in formulations of SUM did not interfere with the proposed analytical method.

Chemistry of colored species:

Cullies and Waddington [26] found that many secondary but not primary or tertiary amines react with sodium nitroprusside and acetaldehyde under mild alkaline conditions. Wolfe and Swine hart [27] have reported the formation of $[Fe(CN)_5H_2O]^{3-}$ in aqueous solution of sodium nitroprusside. The proposed method exploit structural features cyclic imino group in indole which behaves like secondary amine of the SUM molecule. The nature of colored species formation with sodium nitroprusside-acetaldehyde reagent is initial N-alkyl vinyl amine formation with acetaldehyde then followed by formation of colored inner molecular complex with sodium nitroprusside has been assumed in the scheme (Fig.4).

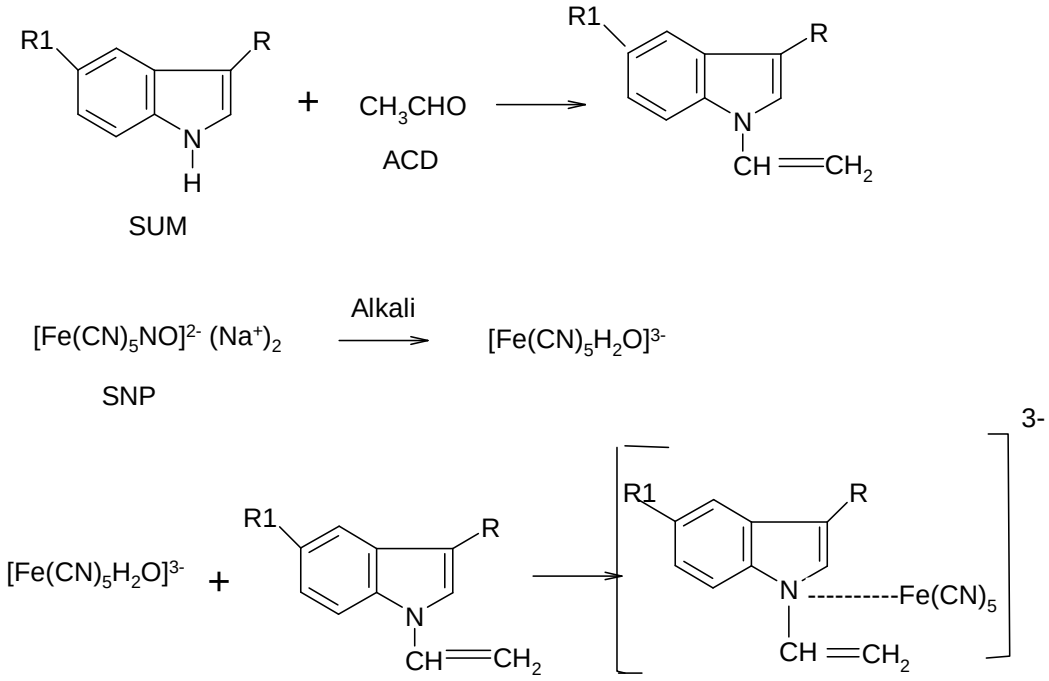

Fig.4. Showing the Scheme

Table 1: optical characteristics, precision and accuracy of proposed method

Parameter	**Values**
λ_{max} (nm)	552 nm
Beer's law limit(µg/ml)	4 - 20
Sandell's sensitivity (µg/cm^2/0.001 abs. unit	0.037296037
Molar absorptivity (Litre/mole/cm)	
Regression equation (Y)*	11086.96875
Intercept (a)	0.001
Slope(b)	0.026
%RSD	0.80272
% Range of errors(95% Confidence limits)	
0.05 significance level	0.843
0.01significance level	1.321

**Y = a+bx, where Y is the absorbance and x is the concentration of sumatriptan in µg/ml*

Table-2 analysis of sumatriptan succinate by proposed and reference methods

Method	*Formulations	Labeled Amount (mg)	Found by Proposed Methods			Found by Reference Method ± SD	#% Recovery by Proposed Method ± SD
			**Amount found ± SD	t	f		
SNP-ACD	Tablet-1	50	49.652 ± 0.097	0.144	1.661	49.647 ±0.125	99.304 ± 0.194
	Tablet-2	50	49.734 ± 0.168	0.912	1.011	49.702± 0.169	99.468 ± 0.335

** Different batches from two different companies (Sun Pharmaceuticals, Dabur Pharmaceuticals)*
***Average ± Standard deviation of six determinations, the t- and f-values refer to comparison of the proposed method with reference method. (UV). Theoretical values at 95% confidence limits t =2.57 and f = 5.05.*
 # Recovery of 10mg added to the pre analyzed sample (average of three determinations).
Reference method (reported UV method) using distilled water (λ_{max}=220nm).

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CONCLUSION

The reagents utilized in the proposed method are cheap, readily available and the procedure does not involve any critical reaction conditions or tedious sample preparation. The proposed visible spectrometric method is validated as per ICH guide lines and possess reasonable precision, accuracy, simple, sensitive and can be used as alternative methods to the reported ones for the routine determination of SUM depending on the need and situation.

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