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SIMULTANEOUS SPECTROPHOTOMETRIC ESTIMATION OF IBUPROFEN AND CHLORZOXAZONE IN TABLET DOSAGE FORM

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ABSTRACT

Two simple and precise spectrophotometric methods are developed for the simultaneous estimation of ibuprofen (IBU) and chlorzoxazone (CHZ) by using simulataneous equation method. IBU and CHZ show their absorption maxima (λ_{max}) at 221 nm and 283 nm, respectively. Beer's law is obeyed in the concentration range of 2-10 μg/mL for both the drugs at their absorption maxima. The methods are validated statistically by preparing lab made samples of different concentrations of both the drugs. The results of analysis show that the methods are rapid, precise and accurate for the simultaneous estimation of both the drugs in combined dosage form.

Key words: Ibuprofen, Chlorzoxazone, Spectrophotometric, Simulataneous

INTRODUCTION

lbuprofen is official in IP, USP and BP. Chemically, it is 2-(4-isobutyl phenyl)-propionic acid. I.P and B.P suggest a spectrophotometric method for its estimation. Gas chromatographic and HPLC methods have been reported for estimation of IBU especially in biological fluids. Chlorzoxazone is a skeletal muscle relaxant. It is pharmacologically similar to mephenesin; has a longer duration of action and is better tolerated orally. Chemically, it is 5-chloro-2 (3H) – benzoxazolone. It is official in IP, USP, which describe a HPLC method for estimation of bulk drugs and formulations.

Both drugs are available in market in different dosage form and different combination with other drugs. The different methods for estimation of IBU and CHZ are

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published time to time; it may be combination of one or two techniques like reverse phase HPLC, HPLC and ion selective electrode methods are also reported for simultaneous estimation of both the drugs.

EXPERIMENTAL

Procedure

Stock solution of ibuprofen and chlorzoxazone with 100 µg /mL in methanol was prepared. Further dilutions in methanol were done to get concentrations of 8, 16, 24, 32 and 64 µg /mL of IBU and 5,10,15,20 and 25 µg /mL of CHZ, respectively. Ibuprofen shows λ_{max} values at 221 nm, while as chlorzoxazone has λ_{max} values of 283 nm. (Fig. 1). Both drugs obeys Beer's law in these concentration ranges as shown in the Table 1.

Table 1: Linearity data

Ibuprofen		Chlorzoxazone	
Conc. (%)	**Absorbance***	**Conc. (%)**	**Absorbance***
0.0008	0.227	0.0005	0.124
0.0016	0.453	0.001	0.239
0.0024	0.686	0.0015	0.352
0.0032	0.918	0.002	0.476
0.0064	1.148	0.0025	0.594

* Mean of six replicates.

Table 2: Absorptivity values for ibuprofen and chlorzoxazone

Absorptivity at 221 nm		Absorptivity at 283 nm	
Ibuprofen	**Chlorzoxazone**	**Ibuprofen**	**Chlorzoxazone**
452	335.5	19.5	305
458	338.5	20.5	308
456	340	18.5	309
453	335.5	18	311
449	343	18.5	310
450	342	17.5	360

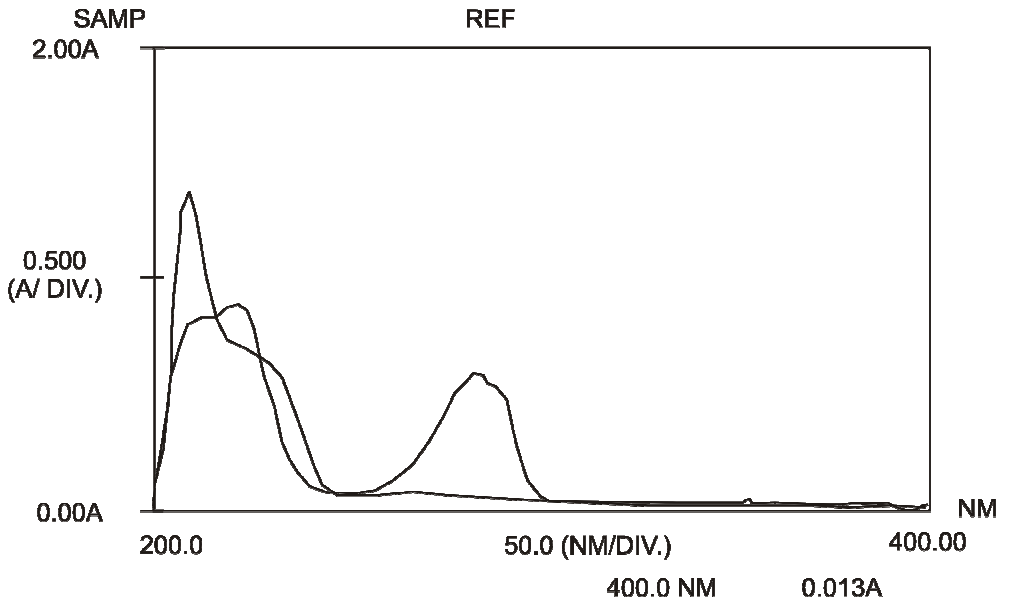

Fig. 1: Spectra of ibuprofen and chlorzoxazone

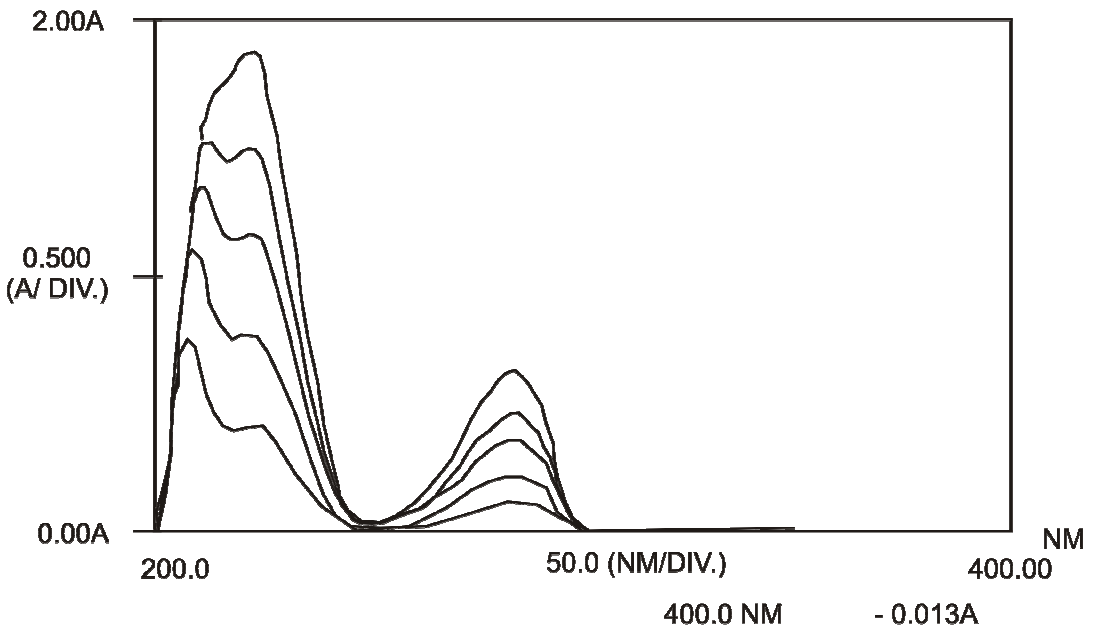

Fig. 2: Overlain spectra of five mixed standards of IBU and CHZ

The absorptivity coefficient of each of these two drugs was determined at 221 nm and 283 nm. A set of simultaneous equations framed using there values are given below:

$$A_1 \text{ at } 221 \text{ nm} = 453\ C_1 + 340\ C_2 \quad \ldots(1)$$

$$A_2 \text{ at } 283 \text{ nm} = 308\ C_1 + 19\ C_2 \quad \ldots(2)$$

Where,

C_1 and C_2 are concentrations of ibuprofen and chlorzoxazone in sample.

453 and 340 are absorptivities of ibuprofen and chlorzoxazone at 221 nm, respectively.

308 and 19 are absorptivities of of ibuprofen and chlorzoxazone at 283 nm, respectively. The absorptivity reported is mean of six independent determinations. (Table 2). Values of C1 and C2 can be calculated as

$$C_1 = \frac{308\ A_1 - 19\ A_2}{133672} \quad \ldots(3)$$

$$C_2 = \frac{453\ A_1 - 308\ A_2}{133672} \quad \ldots(4)$$

Twenty tablets of combination A were weighed and ground to a fine powder. An accurately weighed quantity of fine powder equivalent to 20 mg of ibuprofen and 50 mg of chlorzoxazone was weighed and dispersed in methanol and then shaken for 15 minutes. Volumes was made up to 100 mL, filtered through Whatmann filter paper and appropriate dilutions were made. Similar procedure was carried out for combination B using accurately weighed quantities of 20 mg of ibuprofen and 50 mg of chlorzoxazone. The absorbance of the solutions were found to be additive at 221 nm and 283 nm. Having calculated the absorptivity of two drugs at 221 nm and 283 nm, the concentration of the individual components in tablet formulation was obtained by employing simultaneous equation -

$$Cl = \frac{E_{2\ 2}\ .\ A_{\lambda 1} \ - \ E_{2\lambda 1}\ .\ A_{\lambda 2}}{E_{1\gamma 1}.\ E_{2\lambda 2} - E_{2\lambda 1}\ .\ A_{\lambda 2}} \quad \ldots(5)$$

Where,

C_1 = Concentration of ibuprofen in g/mL.

C_2 = Concentration of chlorzoxazone in g/mL.

$E_{1\lambda1} = E^{1\%}_{1cm}$ of ibuprofen at 221 nm.

$E_{1\lambda2} = E^{1\%}_{1cm}$ of ibuprofen at 283 nm.

$E_{2\lambda1} = E^{1\%}_{1cm}$ of chlorzoxazone at 221 nm.

$E_{2\lambda2} = E^{1\%}_{1cm}$ of chlorzoxazone at 283 nm.

The analysis procedure was reported six times with tablet formulations of two different manufacturers. The results of analysis of tablet formulations are show in Table 3.

Table 3: Tablet formulation analysis data

Sample	Label claim (mg/tab)	Amount found (% Label claim)*	Std. deviation
T – 1	Ibuprofen 400 mg	100.34	± 0.42
	Chlorzoxazone 250 mg	100.52	± 0.43
T – 2	Ibuprofen 400 mg	100.1	± 0.41
	Chlorzoxazone 250 mg	101.37	± 0.76

* Mean of six estimates.

Recovery studies

To study the accuracy, reproducibility and precision of the above methods, recovery studies were carried out. The recovery studies were carried out by the addition of different amounts of pure drug to preanalyzed solution of sample. 5 mL of each preanalyzed of samples were taken in five different 10 mL volumetric flasks. Then to the volumetric flasks, 0.5, 1.0, 1.5, 2.0 and 2.5 mL of mixed standard solution containing 80 µg /mL of ibuprofen and 50 µg /mL of chlorzoxazone were added. The volume of each flask was made up to mark with methanol. These solutions were then scanned over the range 200 nm- 400 nm at sampling wavelengths. The absorbances of the sample at two sampling wavelengths were calculated to obtain recovery of ibuprofen and chlorzoxazone

respectively. The results of analysis are mentioned in Table 4. Results and recovery studies were found to be satisfactory.

Table 4. Recovery study data

Sample	Concentration of drug added (mcg/mL)		% Recovery	
	Ibuprofen	**Chlorzoxazone**	**Ibuprofen**	**Chlorzoxazone**
T – 1	4	2.5	100.75	100.40
T – 1	8	5.0	100.50	100.26
T - 2	4	2.5	99.31	100.02
T - 2	8	5.0	100.35	99.47

RESULTS AND DISCUSION

The proposed methods for estimation of ibuprofen and chlorzoxazone in combined dosage form are found to be simple, accurate and rapid. The method requires measurement of absorbance at only two wavelengths to determine the concentration of two drugs. The recovery studies carried out gave satisfactory result in the range of 97-100% (Table 4). Also a satisfactory low value of standard deviation for IBU and for CHZ was indicative of the reproducibility of the method.

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