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Research Article

SIMULTANEOUS UV-SPECTROPHOTOMETRIC ESTIMATION OF DICLOFENAC AND TOLPERISONE HYDROCHLORIDE IN TABLET DOSAGE FORM

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ABSTRACT

Diclofenac sodium is a non-steroidal anti-inflammatory drug (NSAID) taken to reduce inflammation and as an analgesic reducing pain in certain conditions. Tolperisone hydrochloride is a piperidine derivative, is a centrally-acting muscle relaxant. Two simple, accurate and economic methods; Q analysis and first order derivative method have been described for the simultaneous spectrophotometric estimation of Diclofenac sodium and Tolperisone hydrochloride in tablet dosage form. Absorption maxima of Diclofenac sodium and Tolperisone hydrochloride in distilled water were found to be 275.0 nm and 260.0 nm respectively. Beer's law was obeyed in the concentration range 5-50 µg/ml for Diclofenac and 5-60 µg/ml for Tolperisone hydrochloride. In Q analysis method, absorbances were measured at the selected wavelengths, 237.0 nm (isoabsorptive point) and 260.0 nm (λmax of Tolperisone). In first order derivative method, zero crossing point of Diclofenac sodium and Tolperisone hydrochloride were selected at 275.0 nm and 260.0 nm respectively. The analysis of binary pharmaceutical formulation was carried by both methods. Results of two methods were validated statistically by recovery studies and were found to be satisfactory.
Keywords: Diclofenac sodium (DIC), Tolperisone hydrochloride (TOL), Ultraviolet spectrophotometry, Q - Analysis method and First order method.

INTRODUCTION

Diclofenac sodium (DIC) is a non-steroidal anti-inflammatory drug (NSAID) taken to reduce inflammation and as an analgesic reducing pain in certain conditions. Chemically it is 2-(2-(2,6-dichlorophenylamino)phenyl) acetic acid[1,2]. Tolperisone hydrochloride (TOL) is a piperidine derivative, is a centrally-acting muscle relaxant used in the treatment of acute muscle spasms in back pain and spasticity in neurological diseases[1,2]. Chemically it is 2-methyl-1-(4-methylphenyl)-3-(1-piperidyl) propan-1-one[1,2]. Diclofenac sodium (DIC) and Tolperisone hydrochloride (TOL) and are available in tablet dosage form in the ratio 1:3. Diclofenac sodium is official in Martindale, The Extra Pharmacopoeia[1], The Merck Index[2], I. P.[3], B. P.[4] and U. S. P.[5] whereas Tolperisone hydrochloride is official in Martindale, The Extra Pharmacopoeia[1] and The Merck Index[2]. Literature survey reveals that many analytical methods such as spectrophotometric[6] and RP-HPLC[7-9] methods are reported for determination of Diclofenac sodium individually from pharmaceutical dosage form and UV spectrophotometric[10], HPLC[11-14] methods are reported for determination of DIC with other drugs in combined dosage form. Some UV spectrophotometric[15-18], HPLC methods[19-22] and HPTLC[23,24] methods are reported for determination of Tolperisone hydrochloride individually from pharmaceutical dosage form and UV spectrophotometric[25], HPLC[26] methods are reported for determination of TOL with other drugs in combined dosage form. This paper represents two simple, rapid, accurate, precise, reproducible and economic UV spectro -

photometric methods for simultaneous estimation of Diclofenac sodium and Tolperisone hydrochloride in bulk and tablet dosage form.

MATERIALS AND METHODS

Instrument

A UV/ VIS double beam spectrophotometer, model 1700, with matched quartz cells corresponding to 1 cm path-length and spectral bandwidth of 2 nm was used in the study.

Materials

Standard gift samples of Diclofenac sodium (DIC) and Tolperisone hydrochloride (TOL) were procured from EMCURE Pharmaceuticals Ltd, Pune. Combined Diclofenac sodium and Tolperisone hydrochloride tablets were purchased from local market.

Solvent used

Methanol AR grade and distilled water were used as solvents in the study.

Stock solutions

The stock solution (100µg/ml) of DIC and TOL were prepared separately by dissolving accurately about 10 mg of each drug in 25 ml methanol AR grade in 100 ml volumetric flask. The volume was adjusted up to the mark with distilled water.

Preparation of calibration curves

Working standard solutions of DIC and TOL were prepared separately from standard stock solution. These solutions were scanned in the spectrum mode from 400.0 nm to 200.0 nm. The maximum absorbance of DIC and TOL was found to be 275.0 nm and 260.0 nm, respectively. The linearity of DIC and TOL was found to be in the concentration ranges of 5-50 µg/ml and 5-60 µg/ml, respectively, at their respective maximas. The coefficients of correlation were found to be 0.9993 for DIC and 0.9990 for TOL, respectively.

Method I: Q - Analysis method

In the quantitative assay of two components by Q analysis method, absorbances were measured at two wavelengths, one being the isoabsorptive point and other being the wavelength of maximum absorption of one of the two components. Solutions of 10 µg/ml of DIC and TOL were prepared separately. Both the solutions were scanned in the spectrum mode from 400.0 nm to 200.0 nm. From overlain spectra of DIC and TOL, absorbances were measured at the selected wavelengths i.e. 237.0 nm (isoabsorptive point) and 260.0 nm (λmax of TOL) (Fig. 1). The mixed standards having concentrations 10, 15 and 20 µg/ml of DIC and 30, 45 and 60 µg/ml of TOL respectively were prepared and scanned in the spectrum mode from 400 nm to 200 nm. The absorbances of mixed standards were measured at selected wavelength. The concentration of each component can be calculated by mathematical treatment of the following mentioned equation.

For Diclofenac sodium,

$$C_x = \frac{Q_m - Q_y}{Q_x - Q_y} \times \frac{A_1}{a_1}$$

For Tolperisone hydrochloride,

$$C_y = \frac{Q_m - Q_x}{Q_y - Q_x} \times \frac{A_1}{a_2}$$

Where, C_x = concentration of DIC

C_y = concentration of TOL

A_1 = Absorbance of sample at isoabsorptive wavelength 237.0 nm.

a_1 and a_2 = Absorptivity of DIC and TOL at isoabsorptive wavelength 237.0 nm respectively.

$$Q_x = \frac{\text{Absorptivity of DIC at 260.0 nm}}{\text{Absorptivity of DIC at 237.0 nm}}$$

$$Q_y = \frac{\text{Absorptivity of TOL at 260.0 nm}}{\text{Absorptivity of TOL at 237.0 nm}}$$

$$Q_m = \frac{\text{Absorptivity of sample solution at 260.0 nm}}{\text{Absorptivity of sample solution at 237.0 nm}}$$

Analysis of tablet formulation

Each tablet contains 50 mg of DIC and 150 mg of TOL. Twenty tablets were weighed and average weight of tablet was determined and crushed to fine powder. The powder sample equivalent to 10 mg of DIC and 30 mg of TOL was weighed and transferred to 100 ml volumetric flask. The powder mixture was dissolved in 25 ml of methanol AR grade and was kept in ultrasonicator for 45 min. Finally, the volume was made up to the mark with distilled water. The solution was filtered through Whatmann filter paper No. 41. The filtrate was further diluted to obtain mixed sample solutions in Beer's-Lambert's range for each drug in the ratio of 1:3 having concentrations 10, 15 and 20 µg/ml of DIC and 30, 45 and 60 µg/ml of TOL, respectively. The absorbances of mixed sample solutions were measured at 237.0 nm and 260.0 nm. These values were equated in the above mentioned equations and the concentration of each drug was calculated (Table I). Recovery studies were carried out at 80 %, 100 % and 120 % level of label claim.[27,28] (Table II).

Method II: First order derivative method

Solutions of 10 µg/ml of DIC and TOL were prepared separately. Both the solutions were scanned in the spectrum mode from 400.0 nm to 200.0 nm. The absorption spectra thus obtained were derivatized from first to fourth order. First order derivative (n=1) was selected for analysis of both the drugs. The zero crossing wavelengths, 275.0 nm and 260.0 nm were selected for DIC and TOL, respectively.

Preparation of calibration curves:

The standard dilutions of 5, 10, 15, 20, 25, 30, 35, and 40 µg/ml of DIC and 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55 and 60 µg/ml TOL were prepared separately from stock solution and scanned in the spectrum mode from 400.0 nm to 200.0 nm. The absorption spectra obtained were derivatized to obtain first order derivative spectra. The absorbances of standard solutions of DIC and TOL were measured at zero crossing point of TOL (260.0 nm) and zero crossing point of DIC (275.0 nm) respectively. The working calibration curves of both the drugs were plotted separately. The mixed standard solutions in Beer's-Lambert's range from 10, 15 and 20 µg/ml of DIC and 30, 45 and 60 µg/ml of TOL, respectively were prepared. The concentration of individual drug present in the mixture was determined against calibration curve of each drug in quantitation mode.

Analysis of tablet formulation

Tablet solution was prepared in methanol AR grade as described earlier and was further diluted with distilled water to obtain mixed sample solutions in Beer – Lambert's range for each drug in the ratio of 1:3 from 10, 15 and 20 µg/ml of DIC and 30, 45 and 60 µg/ml of TOL, respectively were prepared. The absorbances of mixed sample solutions were measured at 275.0 nm and 260.0 nm. The concentrations of DIC and TOL present in the sample solution were determined against calibration curve in quantitation mode. The tablet analysis obtained by proposed method was validated by statistical evaluation (Table I). Recovery studies were carried

Table I: Analysis of Tablet Formulation

Method	Tablet sample	Label claim (mg/tablet)	Amount found* mg/tablet	% Label claim found*	% RSD
I	DIC	50	49.91	99.82	0.18
	TOL	150	149.60	99.73	0.12
II	DIC	50	49.95	99.90	0.15
	TOL	150	149.76	99.84	0.10

**Mean of six estimations*
DIC and TOL denote Diclofenac sodium and Tolperisone hydrochloride respectively.

Table II: Statistical validation of recovery studies

Method	Level of % Recovery	% Recovery found *		± Standard Deviation		Standard Error	
		DIC	TOL	DIC	TOL	DIC	TOL
I	80	99.78	99.82	0.10	0.14	0.08	0.10
	100	99.90	99.77	0.12	0.18	0.07	0.11
	120	99.94	99.83	0.13	0.20	0.11	0.16
II	80	99.85	99.91	0.18	0.24	0.14	0.20
	100	99.89	99.81	0.23	0.30	0.18	0.25
	120	99.92	99.78	0.28	0.33	0.20	0.27

***Mean of six estimations*

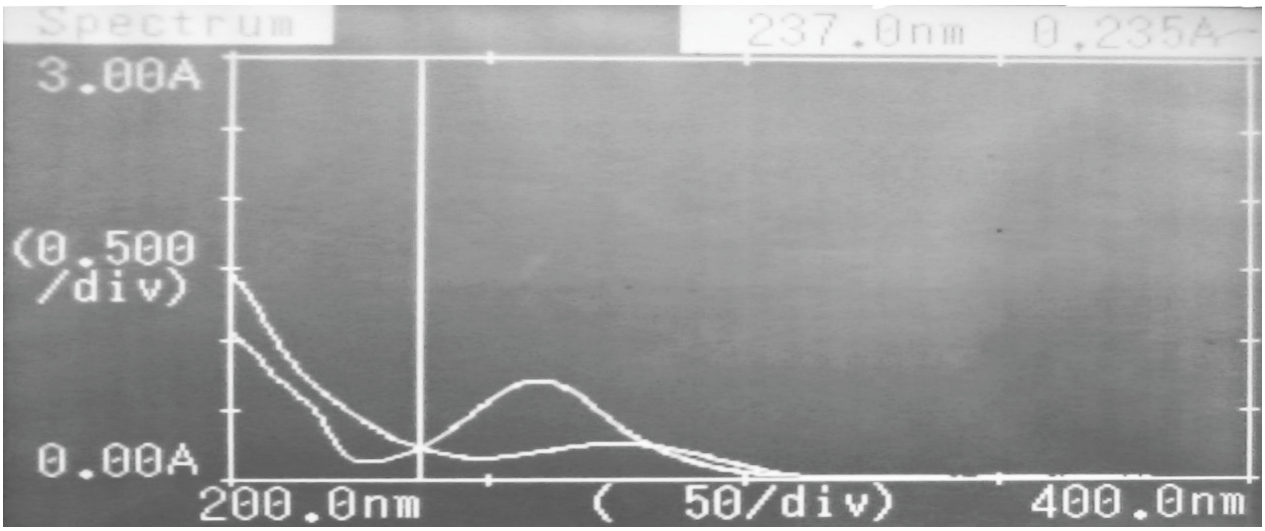

Fig. 1: Overlain UV spectra of Diclofenac sodium and Tolperisone hydrochloride

out at 80 %, 100 % and 120 % level of label claim. (Table II).

RESULTS AND DISCUSSION

In Q analysis method, from overlain spectra of DIC and TOL two wavelengths were selected at 237.0 nm (isoabsorptive point) and 260.0 nm (λmax of TOL). DIC and TOL follow linearity in the concentration range 5-50 µg/ml and 5-60 µg/ml respectively. This method is also a simple and easy method.

The first derivative spectrophotometric method requires spectral data processing and hence can be applied only on recor ding spectrophotometers with such facilities. This method was employed totally to eliminate the spectral interference from one of two drugs while eliminating the other drug.

This was achieved by selecting the zero crossing point on the derivative spectra of one drug as the wavelength for estimation of other drug. First derivative method is simple, less time consuming, no manual calculation is required and gives better results.

All the developed methods were found to be simple, rapid, accurate, precise, reproducible and economic for simultaneous estimation of DIC and TOL in bulk and tablet dosage form. The value of standard deviation was satisfactorily low and the recovery was close to 100 % indicating the reproducibility and accuracy of the methods.

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REFERENCES

1. Sweetmann S. C. Eds., Martindale, The extra pharmacopoeia, The complete drug reference. 36th Ed., The Pharmaceutical Press, London, 2009, 44, 1899.
2. Budhwari S., The Merck Index, 13thEd., Merck Research Laboratories, Whitehouse Station, New Jersey, 2001, 542, 9596..
3. Indian Pharmacopoeia, Vol. I., The Controller of Publication, New Delhi, 2007, 1020.
4. British Pharmacopoeia, 4th Ed., Vol. I, Her Majesty's Stationary Office, London, 2004, 627.
5. The United State Pharmacopoeia, Asian Ed., Vol. II, United States Pharmacopoeial Convention Inc. Washington DC, 2008, 1943.
6. Khaskheli A. R., Abro K., Sherazi S. T., Afridi H. I., Mahesar S. A. and Saeed M. Simple and faster spectrophotometric determination of Diclofenac sodium in tablet, serum and urine samples. Pak J. Anal. Environ. Chem. 2009, 10, 53-58.
7. Emami J., Ghassami N.and Talari R. A rapid and sensitive modified HPLC method for determination of Diclofenac in human plasma and its application in pharmacokinetic studies, DARU, 2007, 15(3), 132-138.
8. El-sayed Y. M., Abdel-hameed M. E., Suleiman M. S. and Najib N. M., A rapid and sensitive HPLC method for the determination of Diclofenac sodium in serum. J. Pharm. Pra., 2011, 40, 757-729.
9. Mayee R., Rawat S., Thosar A., Atre K. and Mane P. Development and validation of HPLC method for determination of Diclofenac sodium by tape stripping method. Asian J Pharm Bio. Res., 2011, 1, 317-322.
10. Sengar M. R., Gandhi S. V., Patil U.P. and Rajmane V. S. Simultaneous determination of Diclofenac sodium and Thiocolchicoside in fixed dose combination by spectrophotometry, Asian J. Pharmaceutical and clinical research, 2010, 3(2), 89-91.
11. Dhaneshwar S.R. and Bhusari V. K., Validated HPLC Method for Simultaneous Quantitation of Diclofenac Sodium and Misoprostol in Bulk Drug and Formulation, Der Chemica Sinica, 2010, 1 (2): 110-118.
12. Gowramma B., Rajan S., Muralidharan S., Meyyanathan S. N., Suresh B., Validated HPLC method for simultaneous estimation of Paracetamol and Diclofenac in pharmaceutical formulation., Int. J. Chem. Tech. Res., 2010, 2, 676-80.
13. Mulgund S. V., Phoujdar M. S., Londhe S., Mallade P. S., Kulkarni T. S., and Deshpande A. S., Stability indicating HPLC method for simultaneous determination of Mephenesin and Diclofenac diethyl amine., Indian J Pharm Sci., 2009, 71, 35-40.
14. Shinde V. M. and Desai B. S. Simultaneous estimation of Paracetamol, Diclofenac and Chlorzoxazone from tablet by HPLC. Indian J. Pharm. Sci., 2008, 57, 35-37.
15. Koladia B. B. and Vagela V. M. UV spectrophotometric Method: A Quantitative Estimation of Tolperisone hydrochloride in bulk and pharmaceutical dosage form., International J. Pharm. Tech Research, 2012, 4(3), 1317-1322.
16. Praveen P., Jagathi V. and Rao G., Spectrophotometric determination of Tolperisone using 2, 4-dinitrophenylhydrazine reagent, Inter. J. Res. Pharm. Sci., 2010, 1(3), 317-320.
17. Jagathi V, Shaiba M, Raghavi K, Sindhura M. and Prashanthi R., Assay of tolperisone by extractive spectrophotometry. Res. J. Pharm. Biol. Chem. Sci. 2010; 3: 654–657.
18. Nimila I. C., Balan P., Chiranjeevi N., Maheswari V. U. and Rajasekhar S., Method development and statistical validation of UV spectrophotometric method for tolperisone hydrochloride in bulk and tablet dosage form., J Pharm. Res., 2011, 4: 1356–1357.
19. Murali M. and Satyanarayana P. V., Simple validated isocratic RP –HPLC method for estimation of Tolperisone in bulk and pharmaceutical dosage form, Der Pharma Chemica, 2011, 3: 13–19.
20. Bae J. W., Park Y. S. and Sohn U. D., HPLC determination of Tolperisone in human plasma., Arch Pharm Res., 2006, 29, 339–342.
21. Murakami T., Konno H., Fukutsu N., Onodera M., Kawasaki T. and Kusu F., Identification of a degradation product in stressed tablets of Tolperisone hydrochloride by the complementary use of HPLC hyphenated techniques, J. Pharm. Biomed. Anal. 2008, 47(3), 553-559.
22. Thummala Veera R. R., Raja Kumar S., Srinivas A., Tharlapu S. S., Jagan M., Ivaturi M. R., and Someswara Rao N., Development and validation of a precise, single HPLC method for the determination of Tolperisone impurities in API and pharmaceutical dosage forms, Sci. Pharma. 2013, 81, 123–138.
23. Liwruangrath S., HPTLC determination of Tolperisone hydrochloride, J. Pharm. Biomed. Anal., 1999, 20, 401-404.
24. Chhalotiya U. K., Bhatt K. K., Shah D. A., Nagda D. C. and Chauhan G. R., Estimation of centrally acting muscle relaxant drug Tolperisone hydrochloride using HPTLC method, World J. Analytical Chemistry, 2013, 1(1), 1-7.
25. Sharma K. K., First derivative spectroscopic method for simultaneous estimation of Paracetamol and Tolperisone in their combined dosage form, J. Pharm. Sci. Bio. Res., 2012, 2, 92-96.

26. Liawruangrath S., Liawruangrath B. and Piboola P., Simultaneous determination of Tolperisone and Lidocaine by high performance liquid chromatography, J. Pharm. Biomed. Anal., 2001, 26(5), 865-872.
27. Chan C. C., Analytical Method Validation and Instrument Performance Verification, Wiley Interscience, 2004, 16-22.
28. Validation of analytical procedure: methodology Q2B, ICH Harmonized Tripartite Guidelines, 1996, 1-8.

