# Simultaneous Determination of Drotaverine Hydrochloride and Aceclofenac in Tablet Dosage Form by Spectrophotometry

**Vivek S. Rajmane, Santosh V. Gandhi[1], Upasana P. Patil, Mahima R. Sengar**

Department of Pharmaceutical Analysis, A.I.S.S.M.S. College of Pharmacy, Kennedy Road, Near R.T.O., Pune - 411 001.

## Abstract

Three accurate, precise, sensitive and economical procedures for simultaneous estimation of Drotaverine hydrochloride and Aceclofenac in tablet dosage form have been developed. The methods employed were Absorbance Ratio Method (I), Simultaneous equation method (Vierodt's method) (II) and First Order Derivative Spectroscopic Method (III). The first method employs 230 nm as $\lambda_1$ (Isobestic point) and 242 nm as $\lambda_2$ ($\lambda$max of Drotaverine hydrochloride) for formation of equations. The second method employs estimation of a drug concentration by selecting $\lambda$max where the absorbance of these drugs is maximum. So $\lambda$max for Drotaverine hydrochloride and Aceclofenac is 242 nm and 273 nm respectively. The third method is based on first order derivative spectroscopy. Wavelengths 250 nm and 226 nm were selected for the estimation of the Drotaverine hydrochloride and Aceclofenac respectively. Both the drugs obey Beer's law in the concentration range 10-50 μg mL$^{-1}$. The results of analysis have been validated statistically and by recovery studies.

## 1. Introduction

Drotaverine hydrochloride (DRO) Chemically 1-[(3,4-[diethoxyphenyl) methylene]-6,7-Diethoxy-1, 2,3,4-tetrahydroisoquinolene is an papaver analogue mainly used as an antispasmodic and smooth-muscle relaxant in pain associated with gastrointestinal colic, biliary colic, and postsurgical spasms [1]. Aceclofenac, (ACE) chemically, 2-[(2',6-dichlorophenyl) amino] phenylacetoxyacectic acid, is a phenylacetic acid derivative with potent analgesic and anti-inflammatory properties. It is official in *Indian Pharmacopoeia* [2].

Literature survey revealed RP-HPLC determination of DRO as a single drug in biological samples like plasma and urine [3-5]. Also RP-HPLC simultaneous determination of DRO in presence Nifuroxazide [6] as well as Omeprazole [7] in pharmaceutical samples has been reported. Spectrophotometric [6, 8, 9] and HPTLC [6, 10, 11] methods have been reported for the estimation of DRO in combination with other drugs. Voltametric [12] and spectrofluorometric [13] measurement of DRO have been also reported.

HPLC method has been reported for estimation of ACE in formulations in combination with other drugs [14]. Also bioanalyical HPLC methods are reported for determination of ACE in human plasma as a single drug [15, 16] or in presence of its

metabolites [17]. Few spectrophotometric [18, 19], HPTLC [20, 21] and voltametric [22] methods are also reported.

Extensive literature survey reveals that no method is reported for simultaneous determination of Drotaverine hydrochloride and Aceclofenac in tablet dosage form. Aim of present work was to develop simple, precise, accurate and economical spectrophotometric methods for simultaneous determination of binary drug formulation.

## 2. Experimental

### 2.1. Instrumentation

The instrument used in the present study was JASCO double beam UV/Visible spectrophotometer (Model UV-550) with slit width fixed at 2 nm. All weighing was done on electronic balance (Model Shimadzu AY -120).

### 2.2. Reagents and chemicals

Analytically pure sample of DRO and ACE was kindly supplied by Akums Drugs & Pharmaceuticals Ltd. (Haridwar, India) and used as such without further purification. The pharmaceutical dosage form used in this study was a Canefo-D tablets manufactured by Medopharm (Chennai, India) labeled to contain 80 mg of Drotaverine hydrochloride and 100 mg of Aceclofenac B.P.

### 2.3. Theory

#### 2.3.1. Absorbance Ratio Method (Method I)

In this method, the isoabsorptive points for both the drugs were determined from the spectra of standard drug solutions, which were found to be 230 nm, 255 nm and 291 nm. The wavelengths selected were 230 nm as $\lambda_1$ (Isoabsoptive point) and 242 nm ($\lambda$max for DRO) as $\lambda_2$ for formation of equations as shown in Fig.1. The Q- values for both the drugs were calculated and were found to be 0.5669 for ACE and 1.2162 for DRO. Absorptivity (a) for both the drugs at isoabsorptive point was found to be 31.95. The equations obtained for the estimation of concentration are

$$C_{DRO} = \frac{Q_0 - 0.5669}{1.2162 - 0.5669} x \frac{A}{31.95} \tag{1}$$

$$C_{ACE} = \frac{Q_0 - 1.2162}{0.5669 - 1.2162} x \frac{A}{31.95} \tag{2}$$

Where, A is the absorbance of sample at isoabsorptive point ($\lambda_1$).

#### 2.3.2. Simultaneous Equation Method (Method II)

In this method, for the estimation of a drug, the wavelengths selected were $\lambda$max of respective drug, which were found to be 242 nm ($\lambda_1$) and 273 nm ($\lambda_2$) for DRO and ACE respectively as shown in figure 1. Absorbances were recorded at $\lambda$max of respective drugs. Absorptivity at $\lambda_1$ and $\lambda_2$ was found to be 38.86 and 8.3 for DRO and 17.86 and 25.4 for ACE, respectively. The equations obtained for the estimation of concentration were,

$$C_{DRO} = \frac{(A_2).(17.86) - (A_1).(25.4)}{(8.3).(17.86) - (38.86).(25.4)} \tag{3}$$

$$C_{ACE} = \frac{(A_1).(8.3) - (A_2).(38.86)}{(8.3).(17.86) - (38.86).(25.4)} \tag{4}$$

Where $A_1$ and $A_2$ is the absorbance of sample at $\lambda_1$ and $\lambda_2$ respectively.
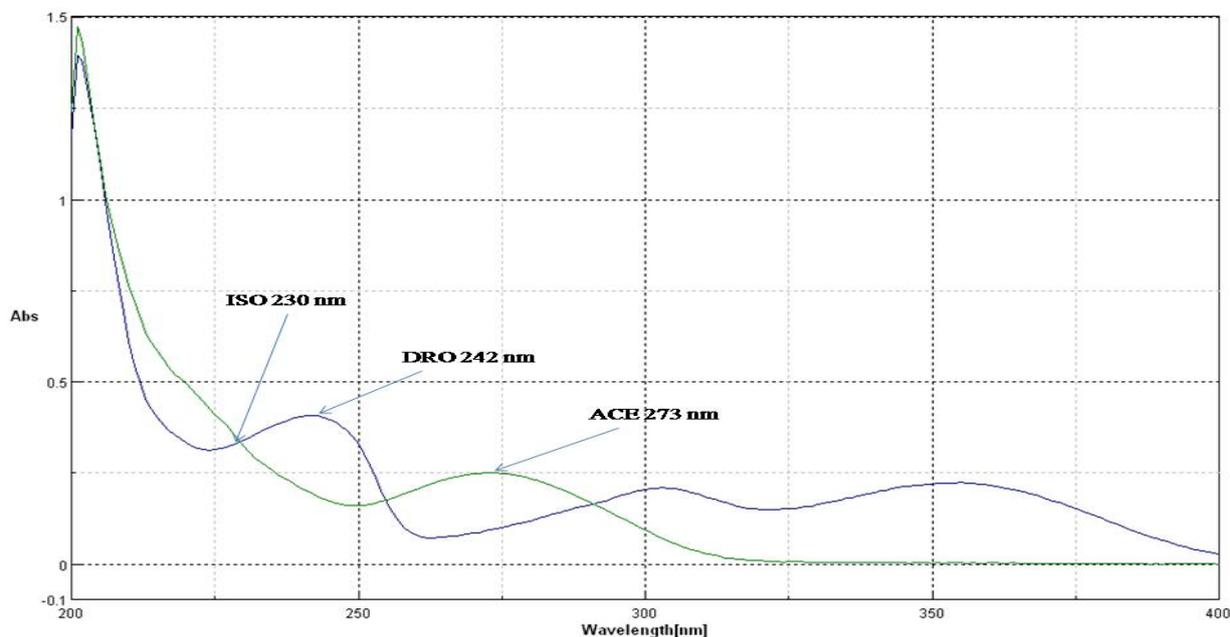


**Fig.1.** Zero order overlain spectra of DRO (10 μg mL$^{-1}$ ) and ACE (10 μg mL$^{-1}$ ) ISO - Isoabsorptive point

### 2.3.3. First Order Derivative Spectroscopic Method (Method III)

The third method is based on first order derivative spectroscopy to overcome spectral interference from other drug. First order derivative spectra of both the drugs were recorded (Figure 2). It was observed that DRO showed dA/dλ zero at 226 nm in contrast to ACE that has considerable dA/dλ at this wavelength. Further, ACE has zero dA/dλ at 250 nm while at this wavelength DRO has significant dA/dλ. Therefore these two wavelengths were employed for the estimation of DRO and ACE without any interference. The calibration curves were plotted at these two wavelengths of concentrations against dA/dλ within the above mentioned range. The equations of line obtained to determine concentrations of DRO and ACE are as follows:

$$C_{DRO} = dA/d\lambda_{250} - 0.0015 / 0.0016 \tag{5}$$

$$C_{ACE} = dA/d\lambda_{226} - 0.0012 / 0.0017 \tag{6}$$

### 2.4. Preparation of Standard Stock Solutions

Standard stock solutions were prepared by dissolving separately 10 mg of each drug in 100 mL of methanol to get concentration of 0.1 mg mL$^{-1}$. 1 mL of the stock solution was further diluted to 10 mL with 0.1 N HCl to get a working standard solution of concentration 10 μg mL$^{-1}$ of both DRO and ACE and scanned in the wavelength range of 200-400 nm.

### 2.5. Preparation of Sample Stock Solution

Contents of twenty tablets were weighed accurately and powdered. Powder equivalent to 100 mg of ACE and 80 mg of DRO was weighed and dissolved in 50 mL of methanol with

the aid of ultrasonication for 5 min. The solution was filtered through Whatman filter paper no. 41 to a 100 mL volumetric flask. Filter paper was washed with methanol, adding washings to the volumetric flask and volume was made up to the mark with methanol to get sample stock solution which was further diluted with 0.1 N HCl to get final concentration of solution (DRO 16 μg mL$^{-1}$ and ACE 20 μg mL$^{-1}$) in the linearity range.
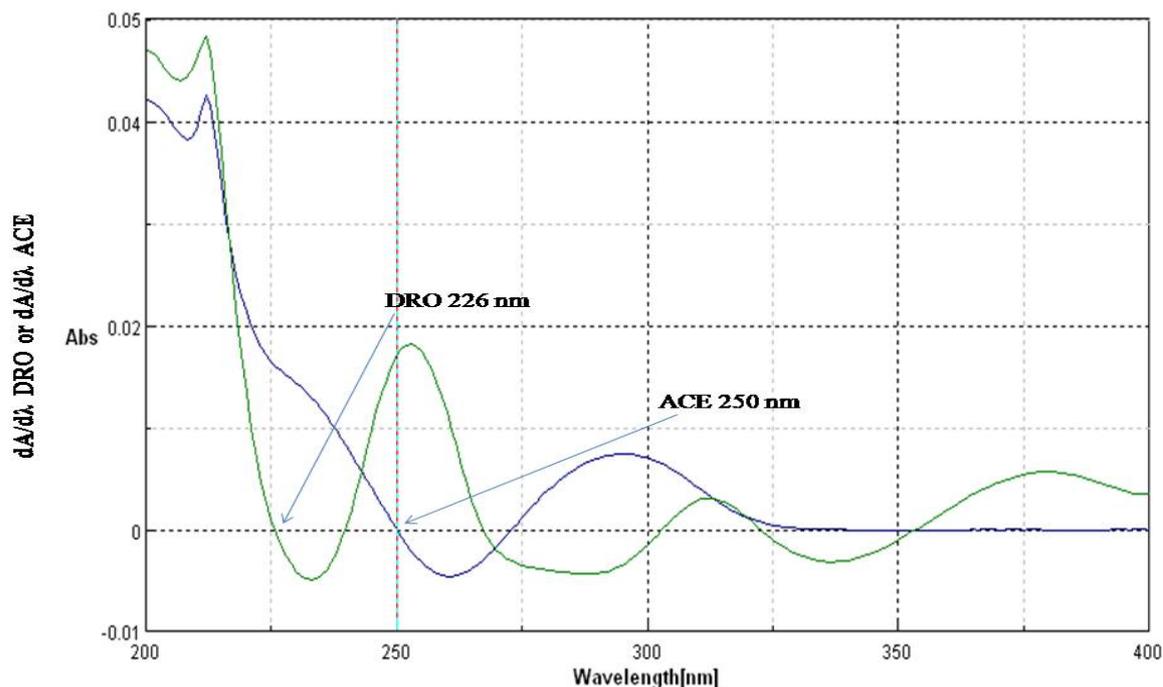


**Fig.2.** First order derivative overlain spectra of DRO (10 μg mL$^{-1}$) and ACE (10 μg mL$^{-1}$)

## 2.6. Recovery studies

The accuracy of the proposed methods was checked by recovery studies, by addition of standard drug solution to preanalysed sample solution at three different concentration levels within the range of linearity for both the drugs.

## 3. Results and Discussion

Under experimental conditions described, calibration curve, assay of tablets and recovery studies were performed. The proposed methods was evaluated by the assay (n = 6) of commercially available tablets containing DRO and ACE. The results of assay are presented in Table 1. Results of recovery studies are shown in Table 2. The accuracy and reproducibility is evident from the data as results are close to 100 % and low standard deviation. The proposed methods are simple, economical, rapid, precise and accurate. Hence these can be used for routine analysis of DRO and ACE in tablet formulation.

**Table 1.** Results of commercial formulation analysis

| Method | Label Claim (mg/TAB) | % Label Claim estimated* (Mean ± S.D) | % R. S. D. |
|--------|----------------------|---------------------------------------|------------|
| I | DRO-80 | 99.52 ± 0.484 | 0.488 |
| | ACE-100 | 98.41± 0.398 | 0.406 |
| II | DRO-80 | 97.89 ± 0.496 | 0.507 |
| | ACE-100 | 98.56 ±0.334 | 0.339 |
| III | DRO-80 | 98.82 ± 0.852 | 0.862 |
| | ACE-100 | 101.51 ± 0.410 | 0.403 |

* Mean of six determinations, R.S.D. is relative standard deviation

**Table 2.** Recovery studies of DRO and ACE

| Drug | Conc. of drug added | | % Recovery * (Mean ± S.D) | | |
|------|---------------------|---------|--------------|--------------|--------------|
| | $\mu g\ mL^{-1}$ | % Level | Method I | Method II | Method III |
| DRO | 8 | 50 | 98.94 ± 0.596 | 99.31 ±0.632 | 99.85 ±0.575 |
| | 16 | 100 | 98.68 ±0.106 | 101.05 ±0.077 | 100.62 ±0.069 |
| | 24 | 150 | 98.94 ±0.074 | 100.06 ±0.096 | 100.28 ±0.381 |
| ACE | 10 | 50 | 101.37 ±0.698 | 99.49 ±0.440 | 98.43 ±0.291 |
| | 20 | 100 | 100.94 ±0.970 | 98.95 ±0.350 | 98.30 ±0.281 |
| | 30 | 150 | 101.40 ±0.170 | 98.36 ±0.183 | 98.61 ±0.345 |

*Mean of three determinations*

## 4. Conclusion

The validated spectrophotometric methods employed here proved to be simple, economical, rapid, precise and accurate. Thus these can be used for routine simultaneous determination of DRO and ACE in tablet dosage form instead of processing and analyzing each drug separately.

## Acknowledgement

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