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Research Article

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Novel first derivative UV spectrophotometric method for the determination of celecoxib in solid dosage forms

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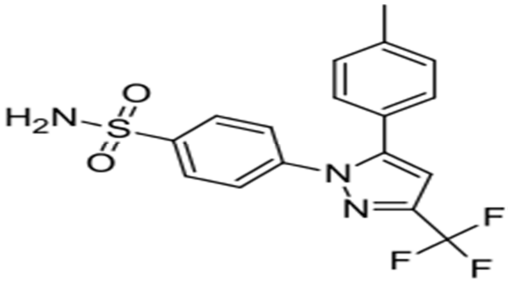
ABSTRACT

A simple, precise, rapid and economical procedure has been developed for estimation of Celecoxib in bulk drug and pharmaceutical solid dosage form. In this study UV- spectrophotometer Shimadzu model UV 1800 was used. The first order derivative spectrophotometric method was employed for estimation of Celecoxib using analytical grade methanol as solvent. Celecoxib has absorbance at λmax 252nm. Celecoxib obeys Beer's law in concentration range 5-30µg/ml and the recovery studies verified accuracy of the purposed method; result validated as per ICH guideline and results were found satisfactory and reproducible. The method was successfully performed for the estimation of Celecoxib in capsule dosage form without the interference of common excipients.

Keywords: Celecoxib, First derivative method, Spectrophotometric determination.

INTRODUCTION



Celecoxib
4-[5-(4-Methylphenyl)-3-(trifluoro methyl) pyrazol-1-yl] benzene sulfonamide prescribed in osteoarthritis, rheumatoid arthritis, acute pain, musculoskeletal pain, ankylosing spondylitis, painful menstruation and to reduce the number of colon and rectal polyps in people with familial adenomatous polyposis. Tentative evidence indicates its use in treatment of psychiatric disorders, including major depression, bipolar disorder, and schizophrenia. It has been used to overcome colon and rectal polyps in people with familial adenomatous polyposis. [1]

There are twelve methods have been reported for the estimation of Celecoxib in pharmaceutical formulations, which include nine HPLC methods[2-10] and three UV Spectrophotometric methods.[11-13] Aim of the present study, there for; was to develop first order derivative UV Spectrophotometric method, which can be alternative to HPLC and better than zero order UV Spectrophotometric method.

EXPERIMENTAL SECTION

Materials:
Shimadzu 1800 spectronic UV Spectrophotometer with 1cm matched quartz cells was used for data collection and analysis. Methanol (95%) was used as a solvent for drug substance.

Methodology:
1. Preparation of standard stock solution:
Standard stock solution of Celecoxib was prepared by dissolving accurately weighed quantity of Celecoxib (62.5mg) in 25 ml of methanol and transferred it to 25 ml volumetric flask. Volume was made up to the mark with solvent methanol to obtain stock solution of 2500 µg/ml concentration. Dilutions were done to obtain the concentration of 250µg/ml.

2. Determination of amplitude:
The standard solution of Celecoxib (10µg/ml) was scanned in the range of 280-230 nm and the amplitude on First derivative spectrum was found to be 0.005A. (Figure 1)

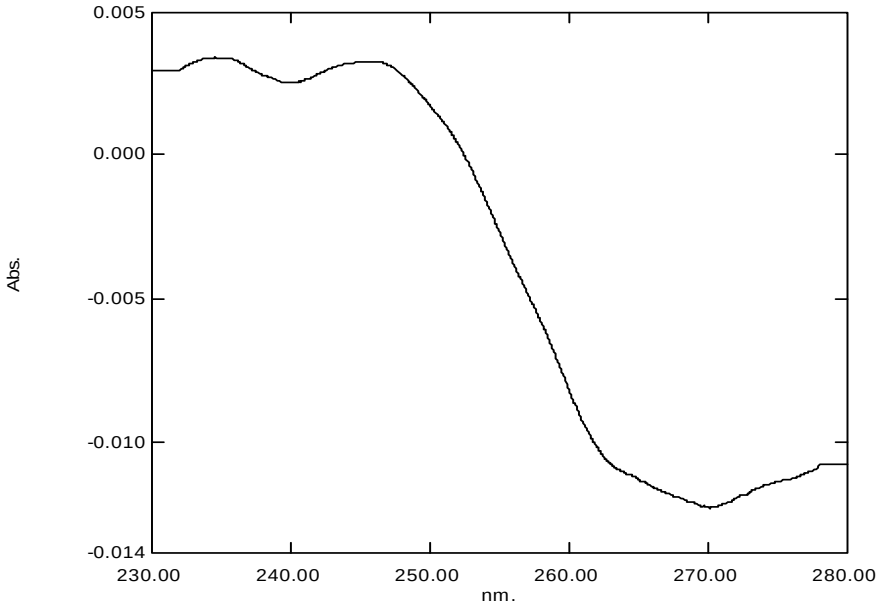


Figure 1: First derivative spectrum of Celecoxib

3. Stability of Drug in Selected Solvent:
The stability of drug in selected solvent was determined by measuring the absorbance of the drug solution (20µg/ml) at different time intervals. After every 5 min. the abs. was measured. And solution was found to be stable. The stability data is given in Table 1 for Celecoxib.

Table 1: Stability Data for Celecoxib

Sr. No.	Time(min.)	Absorbance
1	0	0.008
2	05	0.008
3	10	0.009
4	15	0.010
5	20	0.010
6	25	0.010
7	30	0.011

4. Selection of Analytical Wavelength Range:
Standard stock solution having 1000µg/ml of Celecoxib was prepared by dissolving 25mg of drug in 25 ml. the subsequent dilutions of standard stock solution was made with methanol to get final concentration (20µg/ml) of standard solution. These were scanned in the spectrum mode of an instrument from 280 nm to 230 nm. The first order derivative of the spectra's with N=5 were proposed to proceed for selection of analytical wavelength.

5. Linearity:

From the standard stock solution of Celecoxib, appropriate aliquots were pipette out into 25 ml of volumetric flask and dilutions were made with methanol for working standard solution of Celecoxib 5, 10, 15, 20, 25, 30 µg/ml. The difference in amplitude of Celecoxib were measured in the first derivative mode with N=5 of instrument at 252 nm. The calibration curve of the drug Celecoxib was plotted. (Figure 2)

The concentration range over which the drug fallowed linearity was chosen as an analytical concentration range i.e. 5-30 µg/ml for Celecoxib. (Table 2, Figure 3 to 8)

Table 2: Calibration Data for Celecoxib

Sr. No.	Conc.(µg/ml)	Amplitude
1.	05	0.003
2.	10	0.005
3.	15	0.007
4.	20	0.009
5.	25	0.011
6.	30	0.013
Regression Equation	y = 0.001+0.0004x	r^2 = 1.0000

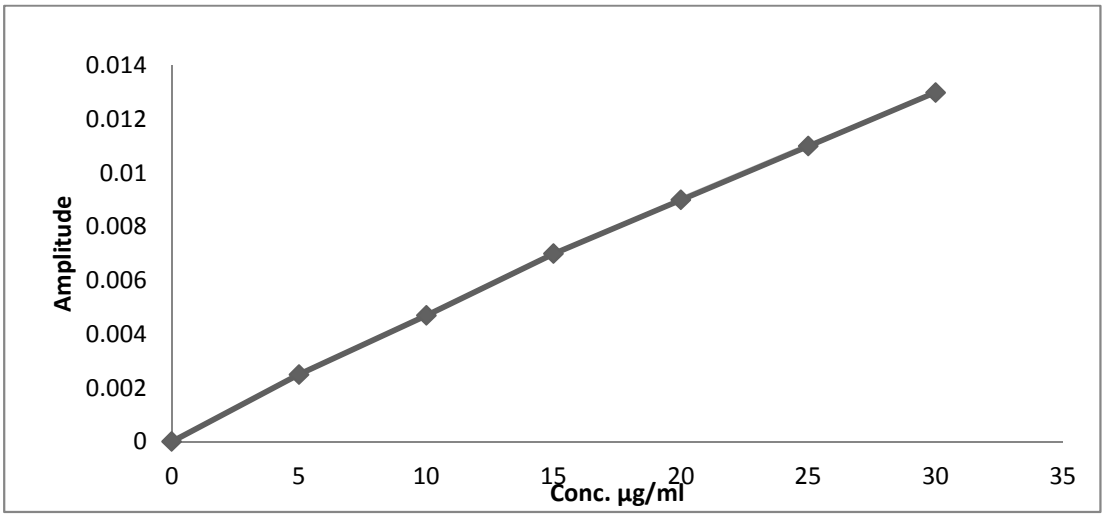


Figure 2: Calibration Plot of Celecoxib at 252nm

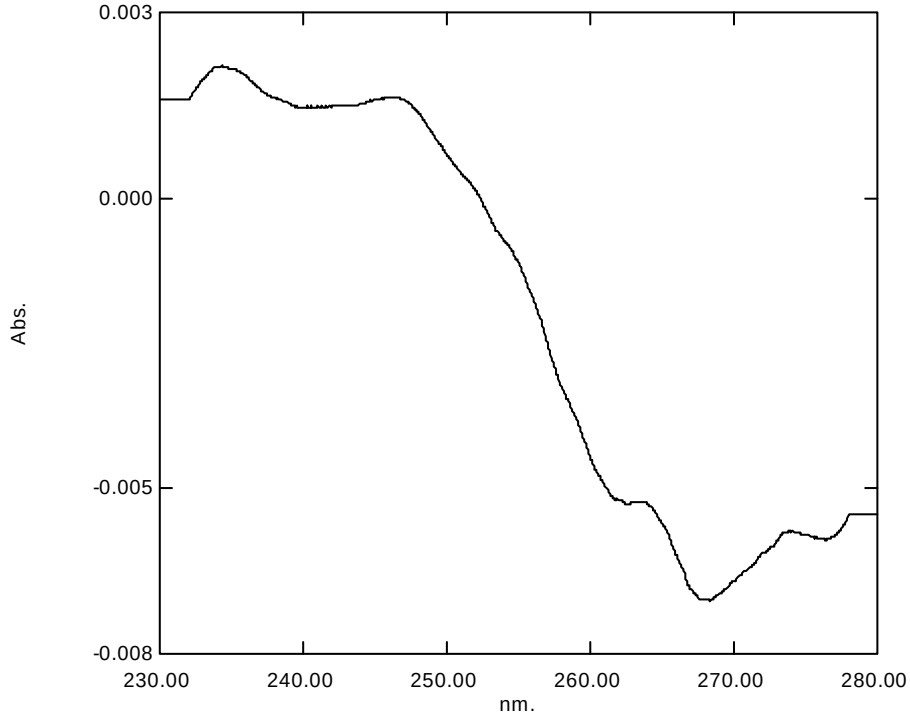


Figure 3: First derivative spectrum of Celecoxib 5µg/ml

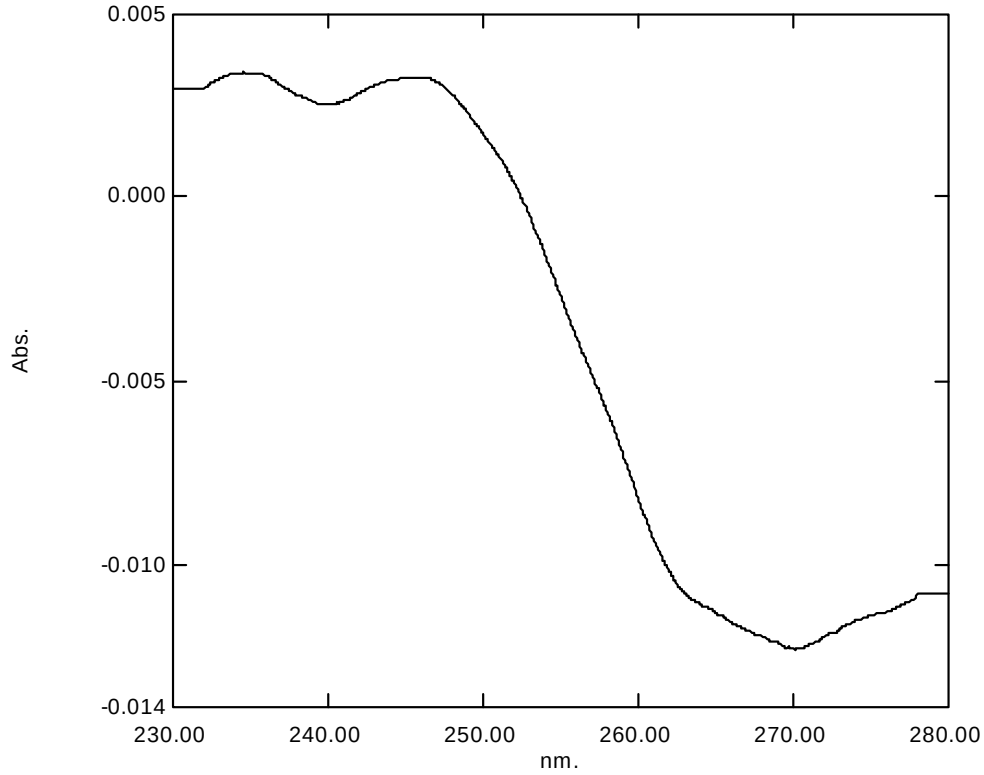


Figure 4: First derivative spectrum of Celecoxib 10µg/ml

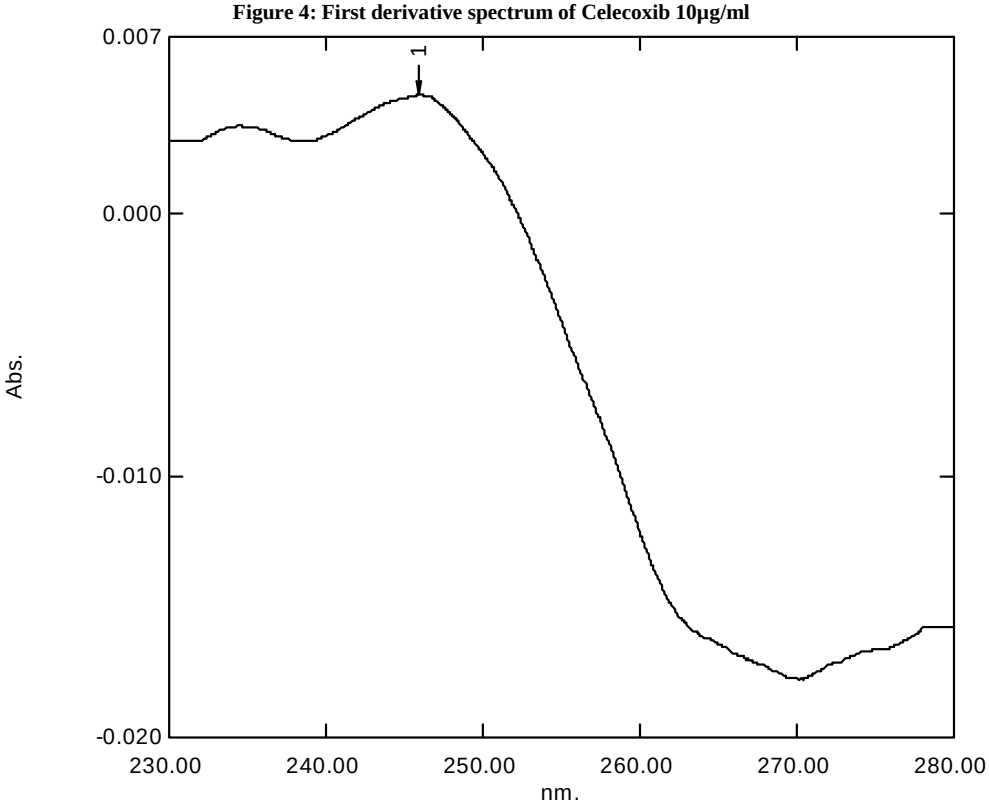


Figure 5: First derivative spectrum of Celecoxib 15µg/ml

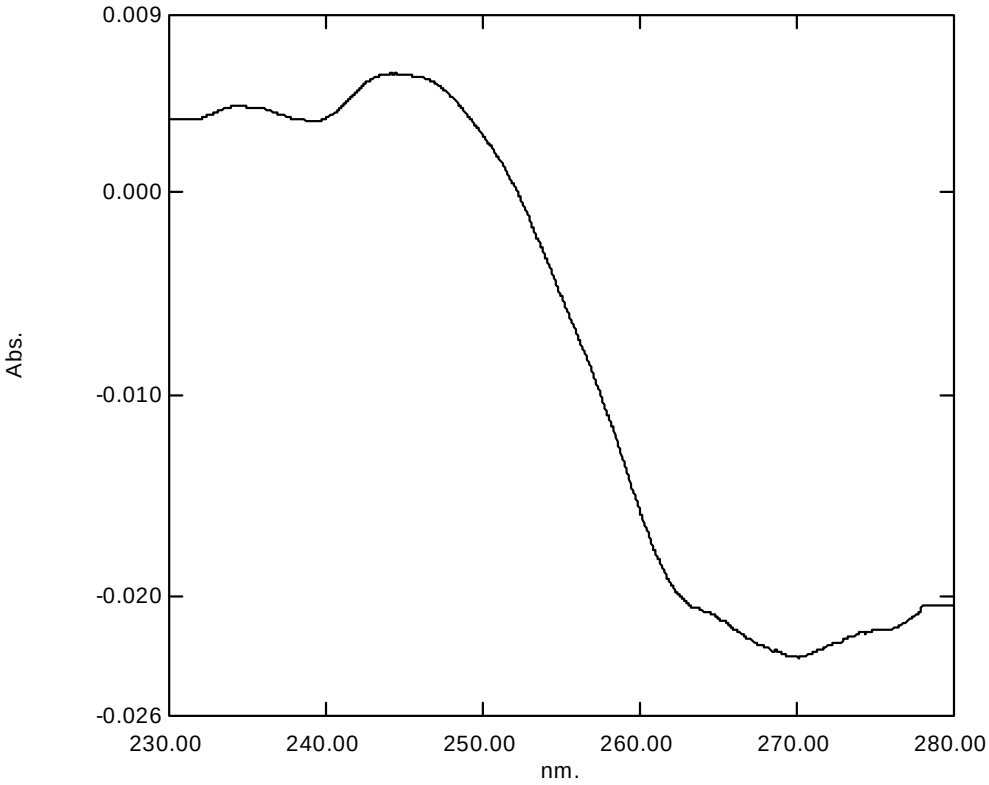


Figure 6: First derivative spectrum of Celecoxib 20µg/ml

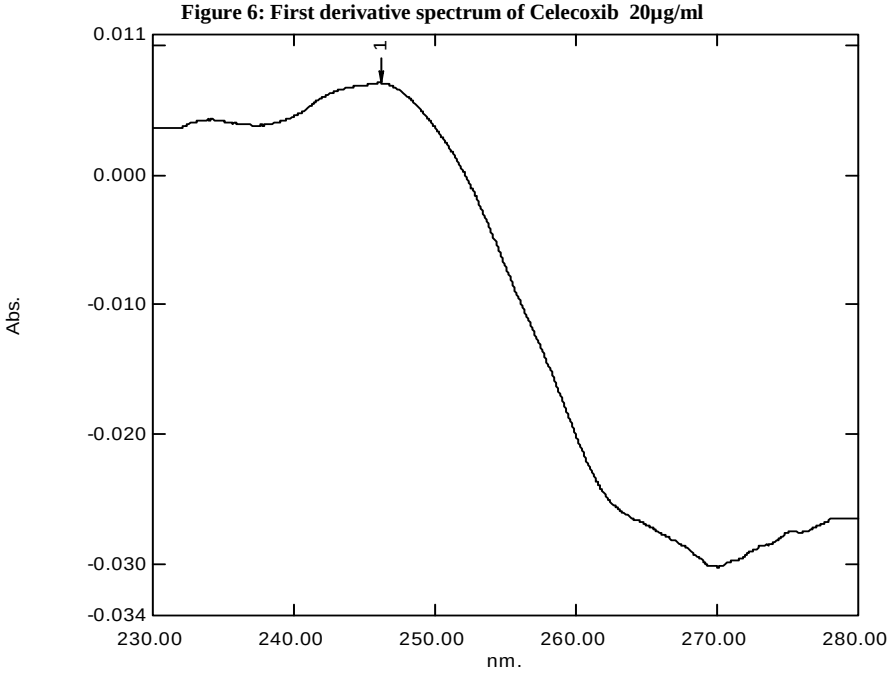


Figure 7: First derivative spectrum of Celecoxib 25µg/ml

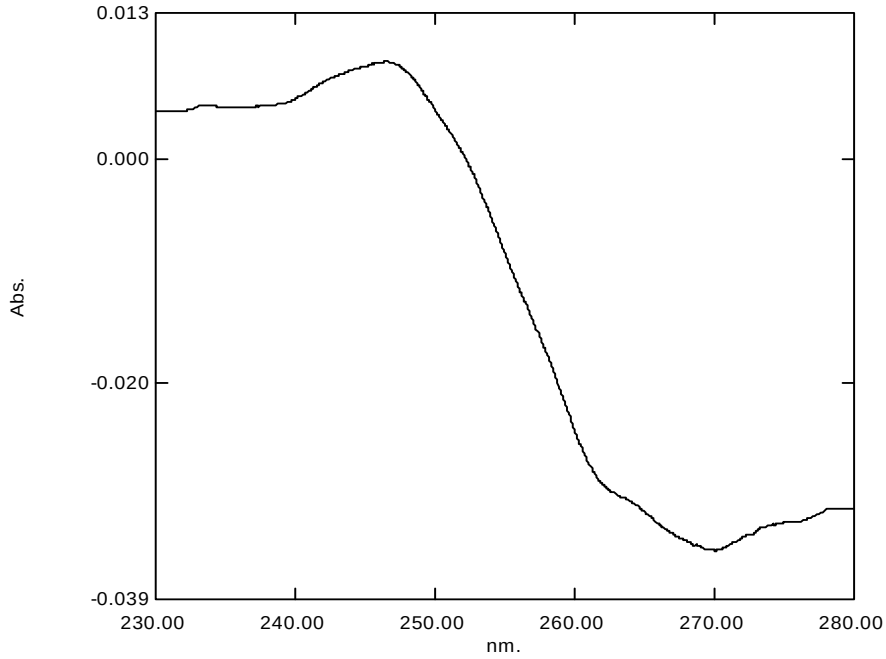


Figure 8: First derivative spectrum of Celecoxib 30µg/ml

6. Validation of the proposed method:

A. Estimation of Drug(Celecoxib) from Dosage Form: (capsule Assay Study)

Brand names: Celedol, Zycel

Standard:

From the standard stock solution of Celecoxib, appropriate aliquots were pipette out into 25 ml of volumetric flask and methanol is used for dilutions to obtain standard solution of Celecoxib 20µg/ml. This concentration was scanned at wavelength of 252nm in derivative mode with N=5.

Sample:

Twenty capsule contents of brand Celedol (Ipca Laboratories) and Zycel (Zydus healthcare) containing 200 mg of Celecoxib weighed, and finally powered. A quantity of powder sample from capsule to 31mg of Celedol and 46mg of Zycel was taken into different volumetric flask. Further dilutions were made to obtain concentration of 20µg/ml. respectively. These concentrations were scanned at wavelength of 252nm in derivative mode with N=5. (Table 3)

Table 3: Assay for Celedol and Zycel in Capsule Form by First Order Derivative Method

Brand Name	Label Claim (mg/capsule)	Amount Found (mg/capsule)	% Of Label claim	Mean	SD	CV
Celedol	200	199.58	99.79	100.034	0.2574	0.06628
	200	200.46	100.23			
	200	200.75	100.37			
	200	199.63	99.81			
	200	199.95	99.97			
Zycel	200	200.03	100.01	99.84	0.2458	0.06042
	200	200.08	100.04			
	200	199.23	99.61			
	200	200.07	100.03			
	200	199.10	99.55			

B. Accuracy (Recovery Study):

Accuracy of method was studied by using recovery experiments. The recovery study was carried out by adding known amount of powder sample from capsule.

Recovery was performed at 3 levels, 80, 100 and 120% of Celecoxib standard concentration.

The recovery samples were prepared in aforementioned procedure. 3 samples were prepared for each recovery level. The solutions were analyzed. % recoveries were calculated by using formula.

$$\%\ \boldsymbol{Recovery} = \frac{\boldsymbol{observed\ amount of compound in sample}}{\boldsymbol{Amount of all compound present in sample}} \times \mathbf{100}$$

The recovery values are summarized in following tables 4 and 5

Table 4: Accuracy parameters of Celecoxib for First Derivative Method (For Celedol)

Label % recovery	*Amount present (mg/capsule)	Amount of Standard added (mg/capsule)	Total Amount Recovered (mg/capsule)	% recovery	%mean recovery	SD	CV
80	200	160	359.84	99.90	100.003	0.2145	0.04603
80	200	160	360.40	100.25			
80	200	160	359.77	99.86			
100	200	200	399.18	99.59	99.90	0.4726	0.2234
100	200	200	399.36	99.68			
100	200	200	400.0 0	100.45			
120	200	240	439.32	99.72	100.21	0.4803	0.2307
120	200	240	440.55	100.23			
120	200	240	441.63	100.68			

Table 5: Accuracy parameters of Celecoxib for First Derivative Method (For Zycel)

Label % recovery	*Amount present (mg/capsule)	Amount of Standard added (mg/capsule)	Total Amount Recovered (mg/capsule)	% recovery	%mean recover	SD	CV
80	200	160	360.25	100.16	99.45	0.6285	0.3950
80	200	160	358.32	98.95			
80	200	160	358.81	99.26			
100	200	200	399.54	99.77	99.93	0.1600	0.0256
100	200	200	399.86	99.93			
100	200	200	400.18	100.09			
120	200	240	440.45	100.19	100.023	0.1700	0.0289
120	200	240	439.64	99.85			
120	200	240	440.07	100.03			

C. Precision:

The precision (inter–day) was evaluated by using four independent sample of Celecoxib. Intermediate precision (inter-day precision) of the process was also performed by using four different analysts in the same laboratory. The values obtained by four analysts were summarized in table 6

Table 6: Determination of Precision of Celecoxib First Order Derivative Method

Sample Number	Assay of Celecoxib as % of Labeled amount(inter – day precision)			
	Analyst 1	Analyst 2	Analyst 3	Analyst 4
1	99.86	100.35	99.97	100.13
2	99.53	99.82	100.02	99.74
3	100.05	99.95	100.05	99.46
4	99.85	99.82	100.09	100.12
Mean	99.82	99.82	100.03	99.86
SD	0.2156	0.2156	0.05058	0.3239
CV	0.04649	0.04649	0.00255	0.1049

RESULTS AND DISCUSSION

The standard solutions of Celecoxib in Methanol (10µg/ml each) subjected to a scan at the series of wave-lengths of 280nm to 230nm at First order and the derivative spectra were taken at N=5 using Shimadzu 1800 spectronic UV-Visible spectrophotometer. And amplitude found to be 0.005 (Figure 1). The calibration curve of Celecoxib was found to be linear at conc. Range 5 to 30 µg/ml at 252 nm Figure 2 to 8. There for, it was clear that Celecoxib can be determined in presence of methanol with no intervention of any irrelevant substance in pharmaceutical products.

With the intention of determining the practicability of the developed technique for the assessment of commercially available brands (Celedol and Zycel) of medicinal formulations, the technique was initially attempted on bulk drugs in their synthetic mixture sample as well as concentrations were estimated. Then the technique was subjected to the assay of in marketed dosage forms and satisfactory results were attained within the appropriate limits as per the

content of the label claim for Celecoxib.

The newly developed method was validated as per the international guidelines and parameters. The novel method for the quantitative investigation of Celecoxib was subjected to different validation parameters like specificity and selectivity in presence of formulation additives and excipients, studied for Linearity and range at different levels of concentrations and calibration standards where the determination range was optimized, accuracy was proved by recovery studies at different concentration levels, precision was established through inter day precision studies, where the samples were subjected to changed conditions other than optimized parameters.

CONCLUSION

From the above experimental studies it is concluded that First Order Derivative method developed for estimation of Celecoxib was suitable for the routine determination of Celecoxib. The proposed method for the selected drug Celecoxib was found to be precise and accurate. The most important striking features of spectrophotometric methods are their rapidity and simplicity. The newly developed method is alternative to HPLC methods and better than zero order UV spectrophotometric methods. Results of validation parameters demonstrate that these performed analytical procedures are suitable for its intended purpose and meet the criteria defined in ICHQ2A/B guidelines.

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