Simultaneous Spectrophotometric Estimation of Aceclofenac and Paracetamol in Tablet Dosage Form

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Three simple, accurate and economic methods; multicomponent, two wavelength and simultaneous equations using area under curve have been described for the simultaneous estimation of aceclofenac and paracetamol in

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tablet dosage form. Absorption maxima of aceclofenac and paracetamol in methanol diluted with glass double distilled water was found to be 274.5 nm and 244 nm, respectively. Beer's law was obeyed in the concentration range 2-20 μg/ml for aceclofenac and 5-40 μg/ml for paracetamol. The methods allow rapid analysis of binary pharmaceutical formulation with accuracy. Results of three methods were validated statistically and by recovery studies and were found to be satisfactory.

Aceclofenac (AC) and paracetamol (PC) are available in tablet dosage form in the ratio of 1:5. Aceclofenac is 2-[(2,6-dichlorophenyl) amino] benzene acetic acid carboxy methyl ester has analgesic and antiinflammatory activity[1,2]. Paracetamol is N-(4-hydroxyphenyl) acetamide has analgesic and antipyretic activity[1,2]. Aceclofenac is official in BP[3] while paracetamol is official in BP[3], USP[4] and IP[5]. Literature survey reveals that HPLC[3] method for AC and HPLC[3-5], UV[3,5] methods for analysis of PC as a single component system. There are no reported methods for analysis of both drugs in combination. Hence an attempt has been made to estimate them simultaneously by UV spectrophotometric analysis.

A Shimadzu UV/Vis double beam spectrophotometer, model 1601 was employed with spectral bandwidth of 2 nm and a pair of 1 cm quartz cell. Standard gift samples of AC and PC were obtained from Lupin Laboratories Ltd., Pune. Methanol AR grade was used as a solvent in the study and obtained from Qualigens Ltd, Mumbai. The stock solution (100 μg/ml) of AC and PC were prepared by dissolving accurately about 10 mg of drug in 25 ml methanol and volume was adjusted with glass double distilled water separately. The maximum absorbance of AC and PC was observed at 274.5 nm and 244 nm, respectively. AC and PC show linearity in absorbances in the concentration range 2-20 μg/ml and 5-40 μg/ml at their respective maximas. The coefficient of correlation was found to be 0.9994 for AC and 0.9996 for PC.

Three methods were developed for the simultaneous estimation of both drugs. For all methods, same mixed standards in the Beer- Lambert's range for each drug in the ratio of 1:5 from 2, 4, 6 and 8 μg/ml of AC and 10, 20, 30 and 40 μg/ml of PC were prepared by diluting appropriate volumes of standard stock solutions. The mixed standard solutions were scanned in the range of 400 nm to 200 nm.

In multicomponent analysis[6-10], two sampling wavelengths, 274.5 nm and 244 nm were selected for the estimation of AC and PC, respectively. The data were fed to the instrument and then mixed standards and sample solutions were scanned. An overlain spectrum of mixed standards was used to determine the concentration of two drugs in the tablet solutions. The instrument directly gives concentration of individual drug present in the mixture.

For estimation of one component by two-wavelength method[9-11], two wavelengths were selected, where the absorbances of other component were same. Therefore the difference in the absorbances in the mixed spectra at corresponding wavelengths will be directly proportional to the concentration of that component. For AC, 221.5 nm (λ1) and 257 nm (λ2) and for PC, 261 nm (λ1) and 278 nm (λ2) were selected. All the mixed standards were scanned at these selected wavelengths separately using quantitative mode of the instrument. The difference in the absorbance at selected wavelengths; λ1 and λ2 were plotted against the respective concentration to obtain the calibration curves. The sample solutions were scanned at selected wavelengths for AC and PC. From the absorbance difference values, the concentration of each component was obtained. The calibration equation for two wavelength method was found to be Y= 0.013X + 0.004 for AC and Y= 0.021X + 0.006 for PC, respectively.

In the simultaneous equation using AUC method[12], the 'X' values of 5 μg/ml of AC and 25 μg/ml of PC were determined at the selected wavelength ranges, 224 to 260 nm and 254 to 294 nm. The 'X' values were determined as, X= Area under curve of component between the selected wavelength range/Concentration of the component in g/l ..1. A set of two simultaneous equations were framed using these 'X' values are given below, A_1= 924.4 C_1 + 1663.9 C_2-2 and A_2= 891.8 C_1 + 685.0 C_2-3, where C_1 and C_2 are the concentrations of AC and PC, respectively in g/l in the sample solution. A_1 and A_2 are the area under curve of sample solutions at the wavelength range, 224 to 260 nm and 254 to 294 nm, respectively. The 'X' values at 224 to 260 nm for AC and PC were found to be 924.4 and 1663.9, respectively, while at 254 to 294 nm for AC and PC were found to be 891.8 and 685.0, respectively. The 'X' values reported are the mean of six independent determinations. By applying Cramer's rule and Matrices in Eqns. 2 and 3, concentrations C_1 and C_2 can be obtained as, C_1= (A_1× 685.0-A2 × 1663.9)/852.0-4 and C_2= (A2 × 924.4-A1 × 891.8)/852.0 (5). Area under curve (A_1 and A_2) of sample solution containing 5 μg/ml of AC and 25 μg/ml of PC

TABLE 1: ANALYSIS OF TABLET FORMULATION

Method	Label claim (mg/tab)		Amount found* mg/tab)		Label claim (%)		Standard deviation*		% Coefficient of variation*	
	AC	PC	AC	PC	AC	PC	AC	PC	AC	PC
A	100	500	100.21	1.082	0.335	1.080	0.332	500.40	100.21	100.80
B	100	500	99.68	0.896	0.334	0.899	0.334	500.05	99.68	100.01
C	100	500	100.24	0.847	0.310	0.845	0.310	500.34	100.24	100.07

A, B and C are multicomponent, two-wavelength and simultaneous equation using area under curve methods respectively. AC and PC denote aceclofenac and paracetamol, respectively. *indicates average of six estimations.

TABLE 2: RECOVERY STUDY DATA FOR TABLET FORMULATION

Method	Level of % recovery	% Mean recovery*		Standard deviation*		% Coefficient of variation* (%)		Stabdard Error*	
		AC	PC	AC	PC	AC	PC	AC	PC
A	80	100.24	99.80	1.042	0.074	1.04	0.074	0.602	0.043
	100	100.22	100.15	1.347	0.500	1.344	0.499	0.778	0.289
	120	99.45	100.12	0.264	0.534	0.266	0.533	0.153	0.308
B	80	99.71	100.08	0.948	0.275	0.950	0.275	0.548	0.159
	100	99.54	100.11	0.663	0.319	0.666	0.319	0.383	0.184
	120	99.07	99.99	0.255	0.487	0.257	0.487	0.147	0.282
C	80	100.33	99.81	0.727	0.074	0.725	0.074	0.420	0.043
	100	99.20	99.84	0.386	0.136	0.389	0.136	0.223	0.079
	120	99.18	99.80	0.380	0.50	0.383	0.50	0.220	0.290

A, B and C are multicomponent, two-wavelength and simultaneous equation using area under curve methods respectively. AC and PC denote aceclofenac and paracetamol, respectively. *indicates average of six estimations.

were recorded between 224 to 260 nm and 254 to 294 nm, respectively. The concentrations of two drugs in the sample were determined by substituting A_1 and A_2 values of sample solution in Eqns. 4 and 5, respectively.

Average weight of twenty tablets (Aceclo Plus, Aristo Pharmaceuticals, Daman) were determined and crushed to fine powder. The powder sample equivalent to 5 mg of AC and 25 mg of PC was weighed and transferred in 100 ml volumetric flask and dissolved in 25 ml methanol. The content was kept in ultrasonicator for 20 min. Finally the volume was made up to the mark with double distilled water and filtered through Whatmann's filter paper No. 41. The filtered solution was suitably diluted to obtain mixed sample solution containing 5 µg/ml of AC and 25 µg/ml of PC. This solution was scanned using different methods as discussed above. The results of tablet analysis were determined and recorded in Table 1. Recovery studies were carried out at 80%, 100% and 120% level of the label claim. The % recovery of AC and PC in the sample mixture was determined.

The results of tablet analysis and recovery studies obtained by proposed methods were validated by statistical evaluation and were recorded in Tables 1 and 2. All the developed methods were found to be simple, rapid and accurate for routine simultaneous estimation of AC and PC in 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.

The multicomponent method is rapid and easy method because it does not require manual calculations and gives marginally better results than other two methods[8-11]. However the method is specific for the instrument having multicomponent mode. Two wavelength method is based on the principle that the absorbance difference between two points on the mixture spectra is directly proportional to the concentration of the component of interest, independent of interfering component[10-12]. The third method employing simultaneous equations using area under curve is a very simple method. Once the 'X' values are determined, then it requires only determination of area under curve of the sample solution at selected wavelength range and few simple calculations.

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