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Simultaneous estimation of aspirin and omeprazole in laboratory sample by different UV spectrophotometric techniques

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Abstract

The aim of the present work is to develop simple, precise and economic UV- spectrophotometric methods for the simultaneous estimation of aspirin and omeprazole laboratory sample. The absorbance maxima (λ_{max}) for detection of aspirin and omeprazole were selected as 274 nm and 302 nm respectively for simultaneous equation method while wavelength range for detection of aspirin and omeprazole were selected as 270 nm - 276 nm and 300 nm - 305 nm respectively for area under curve method. Absorbance ratio method uses the ratio of absorbances at two selected wavelengths, one which is an isoabsorptive point and other being the λ_{max} of one of the two components. From the overlay spectra of two drugs, it is evident that aspirin and omeprazole show an isoabsorptive point at 238.6 nm. Zero crossing first derivative spectrophotometry, where Aspirin showed zero crossing point at 301nm and Omeprazole showed zero crossing point at 274nm. Linearity for Aspirin was between 25- 125 µg/mL and Omeprazole was 3-15 µg/mL. These methods were successfully applied for estimation of Aspirin and Omeprazole in laboratory sample.

Keywords: Aspirin, Omeprazole, Absorbance ratio method, First derivative zero crossing point method, Area under curve.

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1. Introduction

Chemically, Aspirin is 2-(acetyloxy) benzoic acid which is one of the widely used non- steroidal anti-inflammatory category drug. Aspirin is official in Indian Pharmacopeia, British Pharmacopoeia and United States Pharmacopoeia which describe acid-base titration for aspirin, Omeprazole (OME) is chemically (RS)-5-Methoxy-2-[[(4-methoxy-3,5-dimethyl-2- pyridinyl)methyl] sulfinyl]-1H-benzimidazoleis a antiulcerative (proton pump inhibitor) acts by suppressing gastric acid secretion by specific inhibition of the proton pump (H+/K+- ATPase pump) in the gastric parietal cell. It also inhibits gastric mucosal carbonic anhydrase. It is used to treat pepticulcer. It is official in United State Pharmacopeia. YOSPRALA is a combination of aspirin, an anti-platelet agent, and omeprazole, a proton pump inhibitor (PPI), indicated for patients who require aspirin for secondary prevention of cardiovascular and cerebrovascular events and who are at risk of developing aspirin associated gastric ulcers. The aspirin component of YOSPRALA is indicated for:

- Reducing the combined risk of death and nonfatal stroke in patients who have ischemic stroke or transient ischemia of the brain due to fibrin platelet emboli,
- Reducing the combined risk of death and nonfatal in

patients unstable angina pectoris,

- Reducing the combined risk of MI and sudden death in patients with chronic stable angina pectoris,
- Use in patients who have undergone revascularization procedures (Coronary Artery Bypass Graft [CABG] or Percutaneous Transluminal Coronary Angioplasty [PTCA]) when there is a pre-existing condition for which aspirin is already indicated.

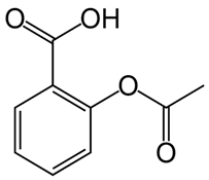


Fig.1 Structure of Aspirin

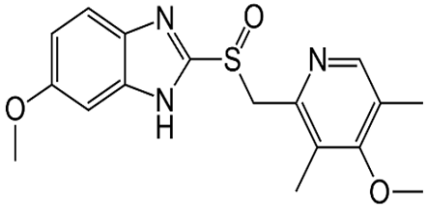


Figure 2: Structure of Omeprazole

The omeprazole component of YOSPRALA is indicated for decreasing the risk of developing aspirin associated gastric ulcers in patients at risk for developing aspirin-associated gastric ulcers due to age (≥ 55) or documented history of gastric ulcers.

However to best of our knowledge, there is no reported UV-spectrophotometric method available for simultaneous estimation of Aspirin and Omeprazole. The aim of the present work was to develop four simple, rapid, inexpensive, precise and accurate UV spectrophotometric methods for simultaneous estimation of Aspirin and Omeprazole.

2. Materials and Methods

JascoV-730 double beam spectrophotometer connected to a computer loaded with Spectramanager software was used for all the spectrophotometric measurements. The absorbance spectra of the reference and test solutions were carried out in 1cm quartz cells over the range of 200-600 nm. The samples were weighed on electronic analytical balance (Digital weighing balance Shimadzu).

2.1 Materials:

Gift samples of standards Aspirin and Omeprazole were provided Pell Tech Health Care Pvt. Ltd, Mumbai.

2.2 Reagents and chemicals

All chemicals and reagent used during the project work were either AR grade or LR. The reagents and chemicals used during experimental work are as Ethanol [AR grade].

2.3 Solvent selection:

Both the drugs were found to be soluble in Ethanol AR grade after several trials of various solvents like Water, Methanol, NaOH, and Acetonitrile. There for ethanol is selected as a solvent system. The selection was made after assessing the solubility and stability of the drug in different solvents.

2.4 Preparation of stock solution: [6-11]

10mg of Aspirin and Omeprazole were separately weighed accurately and transferred into two 10 mL volumetric flasks. Ethanol was added into the volumetric flasks to dissolve the standards and finally volume was made upto the mark with ethanol to obtain standard solutions of Aspirin (1000µg/mL) and Omeprazole (1000µg/mL) respectively.

2.5 Preparation of calibration curve of standard aspirin and omeprazole

From standard stock solution of Aspirin (1000µg/mL), aliquots of 0.25mL, 0.50mL, 0.75mL, 1.00mL and 1.25mL were withdrawn and transferred to 10mL volumetric flasks. Volume was made upto the mark with ethanol to produce 25µg/mL, 50µg/mL, 75µg/mL, 100µg/mL and 125µg/mL of aspirin respectively. From the working standard solution of Omeprazole (100µg/mL), aliquots of 0.3mL, 0.6mL, 0.9mL, 1.2mL and 1.5mL were transferred to 10mL volumetric flasks and volume was made upto the mark with ethanol to produce 3µg/mL, 6µg/mL, 9µg/mL, 12µg/mL and 15µg/mL of omeprazole respectively. Mixed standard solutions of Aspirin and Omeprazole were prepared in ratio of 1:2.025 as present in the marketed formulation.

2.5.1 Method I: Simultaneous equation method

For the simultaneous equation method development, the wavelength absorbance maxima (λmax) of both drugs are required. The working standard solutions containing 10µg/mL of Aspirin and 10µg/mL Omeprazole were scanned separately in the range of 200-600 nm for absorbance maxima (λmax) against ethanol as blank solution. Aspirin shows maximum absorption at 274 nm while Omeprazole at 301 nm. From the overlain spectra of both the drugs wavelength selected for quantification were 274 nm for aspirin and 301 nm for omeprazole. The absorptivity coefficients of these two drugs were determined at selected wavelength and the concentrations of both drugs are calculated by using the equations (1) and (2). The absorption spectrum was obtained for aspirin, omeprazole and their overlay is shown in fig.4.

Fig. 3: Absorption spectrum of (a) Omeprazole and (b) Aspirin

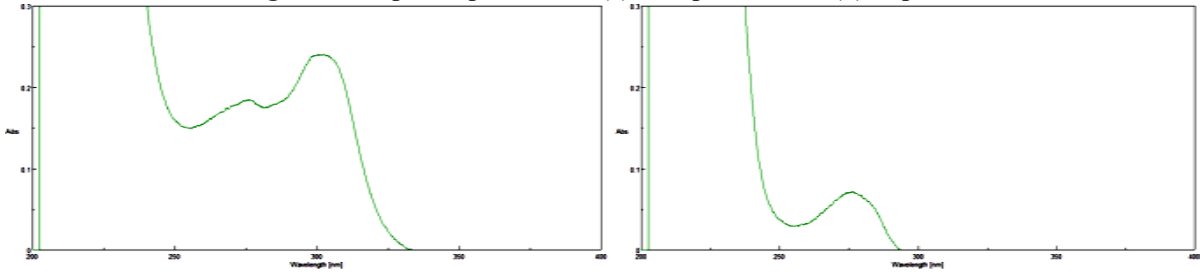
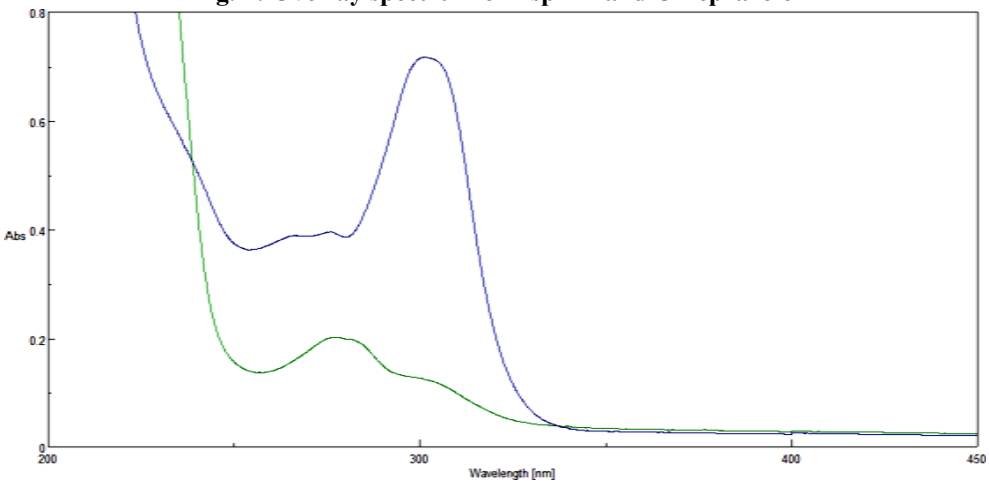


Fig. 4: Overlay spectrum of Aspirin and Omeprazole



$$c_x = \left(\frac{A_2 a_{y1} - A_1 a_{y2}}{a_{x2} a_{y1} - a_{x1} a_{y2}} \right) \quad \text{---------- (1)}$$

$$c_y = \left(\frac{A_1 a_{x2} - A_2 a_{x1}}{a_{x2} a_{y1} - a_{x1} a_{y2}} \right) \quad \text{---------- (2)}$$

Where, Cx and Cy = the concentrations of Aspirin and Omeprazole respectively in gm/100 mL; A1 and A2 = the absorbance of mixture at λ1 (274 nm) and λ2 (301 nm) respectively ax1 and ax2 = the absorptivities of Aspirin at λ1 (274 nm) and λ2 (301 nm) respectively ay1 and ay2 = the absorptivities of the Omeprazole at the λ1 (274 nm) and λ2 (301 nm) respectively.

2.5.2 Method II: Absorbance ratio method (Q-Analysis)

Absorbance ratio method uses the ratio of absorbances at two selected wavelengths one which is an isoabsorptive point and other being the λ max of one of the two components. From the overlay spectra of two drugs it is evident that aspirin and omeprazole show an isoabsorptive point at 238.6 nm. The second wavelength used is 274 nm which is the λ max of aspirin. Six working standard solutions having concentration 25, 50, 75, 100, 125µg/mL for aspirin and 3, 6, 9, 12, 15µg/mL for omeprazole were prepared in ethanol and the absorbances at 238.6 nm (isoabsorptive point) and 274 nm (λ max of Aspirin) were measured and absorptivity coefficients were calculated using calibration curve. The concentration of two drugs in the mixture can be calculated using equations:

$CX = [(QM - QY) / (QX - QY)] \times A1/ax_1$ .....(3)

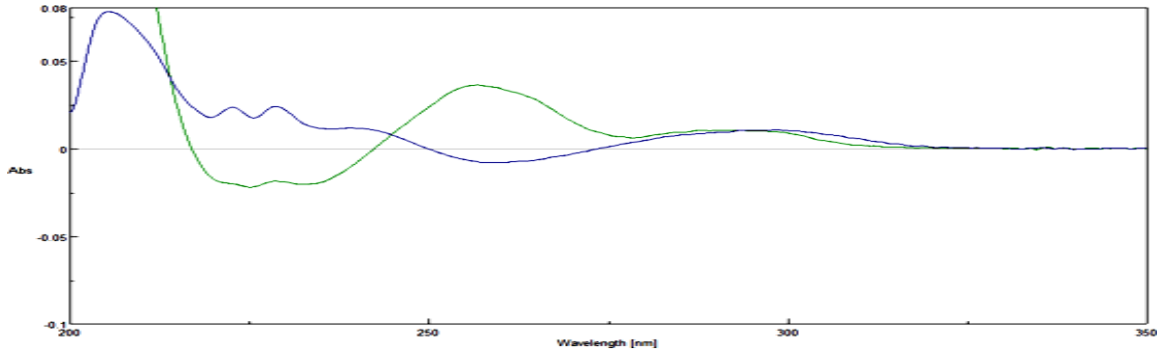
$CY = (A1/ax_1) - CX$ ..... (4)

Where, A1 and A2 are absorbances of mixture at 274 nm and 238.6 nm, and ax_1 and ay_1 are absorptivities of aspirin and omeprazole at 238.6 nm, ax_1 and ay_1 are absorptivities of aspirin and omeprazole respectively at 301nm and QM = A2 / A1, QX = ax_2 / ax_1 and QY = ay_2 / ay_1.

2.5.3 Method III: First derivative zero crossing point method: [13]

Derivative spectroscopy on the basis of zero-crossing measurements involves measurement of the absolute value of the total derivative spectrum at an abscissa value corresponding to the zero-crossing wavelength of the derivative spectra of individual components, which should be only a function of the concentration of other component. The absorption spectra of the solutions of aspirin and omeprazole were recorded in the range of 200 nm to 400 nm and were stored in the memory of the instrument and transformed to first derivative. Fig. 5 Show that at 274nm, aspirin shows zero crossing point and hence omeprazole can be determined while at 301nm, omeprazole shows zero crossing point and hence aspirin can be determined.

Fig. 5 First derivative zero crossing point method



2.5.4 Method IV:

Area under curve

For the simultaneous estimation using the area under curve method the working standard solution containing 10µg/mL of aspirin and 10µg/mL omeprazole were scanned separately in the range of 200-600nm for absorbance maxima (λmax) against ethanol as blank solution. Aspirin shows maximum absorption at 274nm while Omeprazole at 301nm. The area under curve of the both the drugs were determined at the selected wavelengths in the range of 270nm - 276nm (Aspirin) and 300 nm - 305 nm (Omeprazole). The absorptivity coefficients of these two drugs were determined at selected area under curve and the concentrations of both drugs are calculated by using the equations (5) and (6). The area under curve spectrum was obtained for Aspirin and Omeprazole is shown in Fig.6.

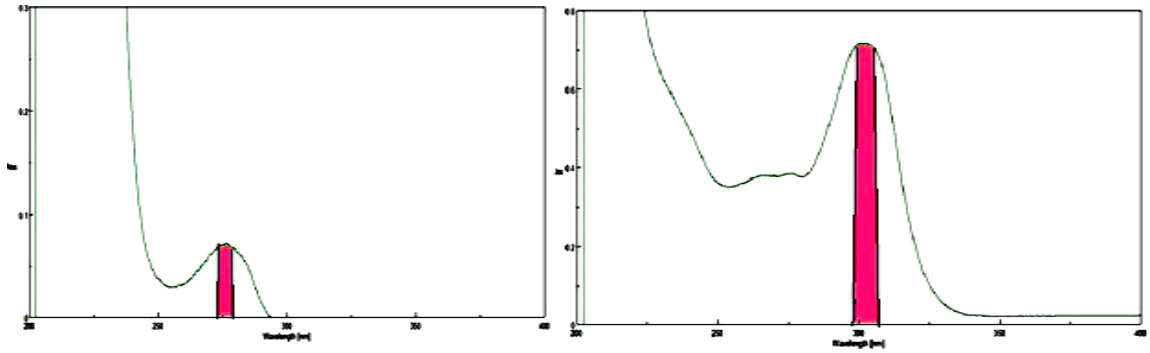


Fig. 6 AUC for Aspirin and Omeprazole

$$CA = \frac{(XB_2).(AUC\ M_1) - (XB_1).(AUC\ M_2)}{(XB2).(XA1) - (XB1).(XB1).(XB1)(XA2)} \quad \text{---------- (5)}$$

$$CB = \frac{(XA_2).(AUC\ M_2) - (XA_1).(AUC\ M_1)}{(XB2).(XA1) - (XB1).(XB1).(XB1)(XA2)} \quad \text{---------- (6)}$$

2.5.5 Preparation of calibration curve: [14-17]

A stock solution of 100µg/ml of Aspirin and Omeprazole was prepared in ethanol. Appropriate aliquots of Aspirin and Omeprazole from stock solution further diluted with methanol to obtain 25, 50, 75, 100, 125µg/ml and 3, 6, 9, 12, 15µg/ml concentration of Aspirin and Omeprazole respectively for both the methods. For the method-I, the absorbance of solution was measured at 274 nm and 301 nm and the calibration curves were plotted for these concentrations against absorbance value obtained at respective λ_{max} and they are shown in Fig. 5 respectively and data are given in Table I.

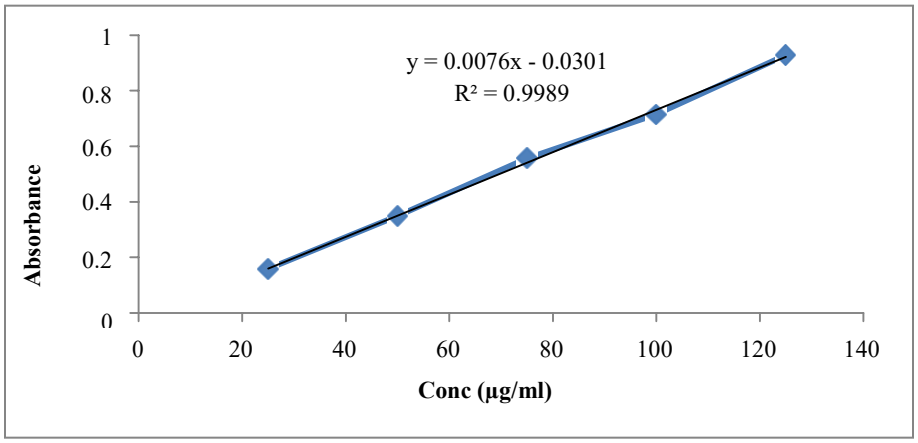


Fig. 7 Calibration curves Aspirin

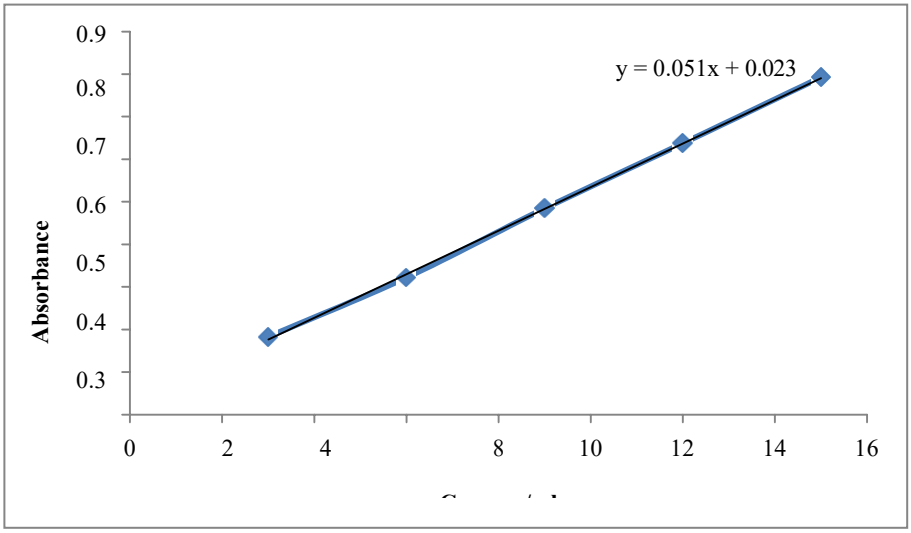


Fig. 8 Calibration curves Omeprazole

2.6 Validation of proposed method:

2.6.1 Linearity:

It is an analytical procedure is its ability (within a given range) to obtain test results which are directly proportional to the concentration (amount) of analyte in the sample.

Table I: Linearity results of Aspirin and Omeprazole

Sr. No	Aspirin		Omeprazole	
	Conc. (µg/ml)	Abs. at 274	Conc. (µg/ml)	Abs. at 301
1	25	0.1587	3	0.1828
2	50	0.3491	6	0.3221
3	75	0.5562	9	0.4841
4	100	0.7149	12	0.6371
5	125	0.9283	15	0.7923

According to ICH guidelines Acceptance criteria- the regression co-efficient should NLT 0.99

2.6.2 Precision:

An analytical procedure expresses the closeness of agreement (degree of scatter) between a series of measurements obtained from multiple sampling of the same homogeneous sample under the prescribed conditions.

Table II: Precision results of Aspirin and Omeprazole in lowest concentration:

Sr. No	Aspirin	Absorbance		Absorptivity		Omeprazole	Absorbance		Absorptivity	
	Conc. (µg/ml)	274nm	238.8nm	274nm (ax1)	238.8nm (ax2)	Conc (µg/ml)	301nm	238.8nm	301nm (ay1)	238.8nm (ay2)
1	25	0.1588	0.5132	15.88	5.132	3	0.1874	0.2980	18.74	2.980
2	25	0.1586	0.5158	15.86	5.158	3	0.1877	0.2981	18.77	2.981
3	25	0.1588	0.5173	15.88	5.173	3	0.1872	0.2981	18.72	2.981
4	25	0.1584	0.5182	15.84	5.182	3	0.1877	0.2983	18.77	2.983
5	25	0.1581	0.5119	15.81	5.119	3	0.1876	0.2989	18.76	2.989
			Mean	15.85	5.152			Mean	18.75	2.982
			SD	0.02	0.02			SD	0.02	0.003
			%RSD	0.18	0.51			%RSD	0.11	0.12

Table III: Precision results of Aspirin and Omeprazole in highest concentration:

Sr. No	Aspirin	Absorbance's		Absorptivity		Omeprazole	Absorbance's		Absorptivity	
	Conc. (µg/ml)	274nm	238.8 nm	274nm (ax1)	238.8 nm (ax2)	Conc (µg/ml)	301nm	238.8nm	301nm (ay1)	238.8 nm (ay2)
1	125	0.9358	1.609	93.58	6.09	15	0.7892	1.5497	78.92	5.496
2	125	0.9354	1.602	93.54	6.02	15	0.7885	1.5492	78.95	5.492
3	125	0.9360	1.602	93.60	6.02	15	0.7897	1.5496	78.97	5.496
4	125	0.9354	1.606	93.54	6.06	15	0.7894	1.5497	78.94	5.497
5	125	0.9334	1.605	93.34	6.05	15	0.7898	1.5496	78.98	5.496
			Mean	93.52	6.046			Mean	78.93	5.494
			SD	0.10	0.02			SD	0.051	0.003
			%RSD	0.11	0.47			%RSD	0.065	0.055

According to ICH guidelines acceptance criteria for precision the %RSD should NMT 2 %

2.6.3 Ruggedness and robustness:

An analytical procedure is a measure of its capacity to remain unaffected by small, deliberate variations in method parameters and provides an indication of its reliability during normal usage.

Ruggedness:

Table IV: Ruggedness result

Sr No	Drug	Conc. (µg/ml)	Instrument Employed			
1	Aspirin		Jasco V-630		Jasco V-730	
			ax_1	ax_2	ay_1	ay_2
		25	17.40	3.12	18.24	4.55
		SD	0.094	0.027	0.089	0.031
2	Omeprazole		ay1	ay2	ay1	ay2
		3	29.36	22.28	31.13	23.24
		SD	0.015	0.012	0.048	0.065

Robustness:

Table V: Robustness result

Sr. No	Drug	Conc. (µg/ml)	Temperature					
			0°C		-25°C		Room temperature	
1	Aspirin		ax_1	ax_2	ay_1	ay_2	az_1	az_2
		25	17.40	3.12	18.24	4.55	0.1582	5.02
		SD	0.094	0.027	0.089	0.031	0.074	0.241
2	Omeprazole		ay1	ay2	ay1	ay2	az1	az2
		3	29.36	22.28	31.13	23.24	0.1845	64.23
		SD	0.015	0.012	0.048	0.065	0.093	0.079

3. Results and Discussion

The proposed methods for simultaneous estimation of Aspirin and Omeprazole in combined dosage form were found to be accurate, simple and rapid. Since not a single method was reported for simultaneous analysis of the two drugs earlier, the developed methods can be used for routine analysis of two drugs in combined dosage forms. Absorbance ratio method uses the ratio of absorbances at two selected wavelengths, one which is an isoabsorptive point and other being the λ max of one of the two components. From the overlay spectra of two drugs, it is evident that aspirin and omeprazole show an isoabsorptive point at 238.6 nm. First derivative zero crossing point method shows that at 274 nm aspirin shows zero crossing point and hence omeprazole was determined. And while at 301nm omeprazole shows zero crossing point and hence aspirin was determined. Area under curve method involves formation and solving of simultaneous equation. Once the equations are formed, then only measurement of the area of sample solution at two wavelength ranges and simple calculations are required. It can be easily and conveniently adopted for routine quality control analysis.

4. Conclusion

The proposed methods for simultaneous estimation of Aspirin and Omeprazole in combined dosage form were found to be accurate, simple and rapid. Since not a single method was reported for simultaneous analysis of the two drugs earlier, the developed methods can be used for routine analysis of two drugs in combined dosage forms. This study is useful because these two drugs are commonly administered simultaneously.

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References

[1]. Indian Pharmacopoeia, Indian pharmacopoeia commission. Ghaziabad. 2014; Volume 2: 1091-1093.

[2]. British Pharmacopoeia, British pharmacopoeia commission, London. 2015; volume 1: 204.

[3]. The United States Pharmacopeia. The national formulary 30, the Official Compendia of Standards, Asian Edition, 2012; 196- 200.

[4]. Indian Pharmacopoeia, Indian pharmacopoeia commission. Ghaziabad. 2014; Volume 2: 2067-2070.

[5]. https://www.aralezpharmaceuticals.com (Accessed on 16 Dec, 2017)

[6]. Fanse S, Rajput S. Method development and validation for simultaneous estimation of aspirin and lansoprazole in bulk and laboratory sample by different UV spectrophotometric techniques, *Int J Pharm Sci Res,* 2015; 6(8): 3534-3543.

[7]. Satish D. *et al*, Spectrophotometric simultaneous estimation of omeprazole and cinitapride in bulk and formulation, *Asian J Pharm Clin Res* 2012; 5(4): 40-42.

[8]. Gujarathi C. *et al*, Spectrophotometric simultaneous determination of aspirin and ticlopidine in combined tablet dosage form by first order derivative spectroscopy, area under curve and ratio derivative spectrophotometric methods. *IJPS,* 2010; 3(1): 115-119.

[9]. Singh S, Dubey N and Jain D. Simultaneous estimation of atorvastatin, clopidogrel and aspirin in capsule dosage forms using uv-spectroscopy. *AJRC* 2010; 3(4): 885-887.

[10]. Alvi S, Patel M, Kathiriya P, Patel B, and Parmar S.Simultaneous determination of prasugrel and aspirin by second order and ratio first order derivative ultraviolet spectrophotometry. *J. Spectroscopy,* 2013; 1(5): 1-7.

[11]. Choudhary N, Siddiqui I, Rai J, Singh S, Surabhi S, Gautam H. Simultaneous estimation of lansoprazole and naproxen by using uv spectrophotometer in tablet dosage form. *Int J Pharm Tech Res,* 2013; 5(2): 67-74.

[12]. http://www.rxlist.com/prevacid-drug.htm (Accessed on 15 Jan 2017)

[13]. Beckett AH, Stenlake J B.Practical Pharmaceutical Chemistry, 4th Edition, part 2, New Delhi, CBS Publishers and distributors: 278-306.

[14]. Kalyankar T, Panchakshari P, Wadher S, Pekamwar S, Simultaneous estimation of duloxetine and methylcobalamin in combined dosage form by ultra-violet spectrophotometry, *Int J PharmTech Res,* 2013; 5(4): 1572-1580.

[15]. Kalyankar T, Wadher S, Kulkarni P, Panchakshari P, Simultaneous estimation and development of uv spectroscopic method for determination of cinnarizine and domperidone in bulk and pharmaceutical formulation, *Int J PharmTech Res,* 2014; 6(1): 323-329.

[16]. Ramachandra B, Sivarami K, Niranjan T, Venkatasubba N, Spectrophotometric method for the determination of dasatinib in pharmaceutical formulations and human blood samples with bpb, *Inter J Chem Concepts,* 2015; 1(1): 26-33.

[17]. Sevda R. *et al*, UV spectrophotometric estimation of rosuvastatin calcium and fenofibrate in bulk drug and dosage form using simultaneous equation method, *Inter Journal ChemTech Research,* 2011; 3(2): 629-635.