JGTPS, 2015, Vol. 6(4): 2945 - 2951

ISSN- 2230-7346

Journal of Global Trends in Pharmaceutical Sciences

Journal home page: www.jgtps.com

SIMULTANEOUS QUANTITATION OF TAPENTADOL AND PARACETAMOL IN TABLET DOSAGE FORM BY UV SPECTROPHOTOMETER

M. Madhu*,
E. Gireesh Kumar,
S Chand Basha,
V. S Thiruvengadarajan,
C. Gopinath

Annamacharya College of Pharmacy, Rajampet, Kadapa, Andra Pradesh, India

ABSTRACT

At present, simultaneous determination of drugs in the combination dosage forms has been enjoying renaissance in the field of pharmaceutical analysis. Tapentadol is a centrally-acting Opioid analgesic that readily crosses the blood-brain barrier, and. Paracetamol, is an effective classical antipyretic drug. From the reviewed literature, simultaneous UV-spectrophotometric methods have not yet been developed for the quantification of Tapentadol and Paracetamol. So the present study involves the simultaneous quantitation of Tapentadol and Paracetamol in tablet dosage form by UV Spectrophotometer. The λmax of Tapentadol was 239 nm and Paracetamol was 265 in 0.1N NaOH. The correlation coefficients for both Tapentadol and Paracetamol were found to be 0.999. The precision of the method was confirmed by intra-day and inter-day analysis. The % RSD values of intra-day and inter-day analysis were found to be 0.1261 and 0.34135 for Tapentadol and 0.3352 and 0.5739 for Paracetamol. The mean percentage recovery was found to be in the range of 98.4–99.92% for Tapentadol and 99.47–100.4% for Paracetamol proving that the method was accurate.

Keywords: Simultaneous determination, Opioid analgesic, antispasmodic drug, blood-brain barrier.

INTRODUCTION:

Tapentadol is chemically 3-[(1R, 2R)-3-(di methyl amino)-1-ethyl-2 methyl propyl] phenol mono hydrochloride, is a centrally-acting Opioid analgesic that readily crosses the blood-brain barrier. Paracetamol chemically known as N-(4-Hydroxyphenyl) acetanilide is an effective classical antipyretic drug. From the literature reviewed it was found that only individual determination of Tapentadol and Paracetamol or simultaneous determination of Paracetamol along with other drug using UV-Spectrophotometry, HPLCwere available. However, simultaneous quantitation of Tapentadol and Paracetamol in tablet dosage form by UV spectrophotometer was not yet been developed so far which is the present method of interest. The survey on literature performed for Combination of Tapentadol & Paracetamol for their physiochemical properties, solubility, and pharmacology and for analytical techniques. So this basic information gives notion for method development.

The present work aims to develop and validate the simple, specific, reliable and

Address for correspondence

M. Madhu*
Assistant Professor
Annamacharya College of Pharmacy,
Rajampet, Kadapa, Andra Pradesh, India
E-mail: creativemadhum@gmail.com

economical method for the simultaneous quantitation of Tapentadol and Paracetamol in table dosage form1.

MATERIALS AND METHODS

Procurement of authentic Tapentadol and Paracetamol active pharmaceutical ingredients were obtained as gift samples. Tapentadol and Paracetamol combined tablet dosage form was commercially bought from the local market. Double distilled Milli Q water, sodium hydroxide (Rankem), and A Schimadzu 1800 version 1.12- double beam UV-Visible spectrophotometer were used for the present study.

Tapentadol (10 µg/ml) and Paracetamol (200 µg/ml) working standards were prepared separately. 20 tablets were weighed and finely powdered. Weigh the tablet powder equivalent to 187mg of Paracetamol and dissolve it in distilled water and further dilutions was made with the same solvent. The final conc. for determination was6 µg/ml.

Method Development

Preparation of standard stock solution

Weigh accurately 100mg of Tapentadol and 100mg of Paracetamol working standards in a 100 ml volumetric flask. Add 50 ml 0.1 N NaOH and mix well, and then make up to the final volume. Further dilution was made by pipetting 1 ml of mother liquor into 100 ml volumetric flask and make up to the volume with same solvent. The final conc. of Tapentadol and Paracetamol samples were 10 g/ml and 200 g/ml respectively. The solutions were scanned in UV region in the wavelength range from 200 to 400 nm.

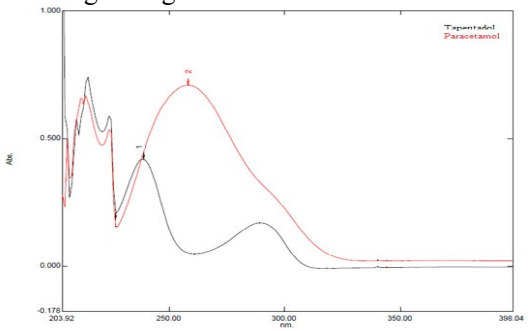

Figure 1. Overlay spectrum of mixture of Tapentadol and Paracetamol

Preparation of sample solution:

20 tablets were weighed and finely powdered. Weigh accurately about 187mg of tablet content and dissolvein to 100 ml volumetric standard flask and add 50 ml 0.1 N NaOH and mix well, then make up to the final volume. Further dilution was made by pipetting 1 ml of mother liquor into 100 ml volumetric flask and make up to the volume with solvent. The final conc. of sample was 6 g/ml. The solutions were scanned in UV region in the wavelength range from 200 to 400 nm.

Method Validation:

The proposed method was validated as per ICH guidelines for specificity, accuracy, precision, intermediate precision, linearity and range.

RESULTS AND DISCUSSION

Development of the spectrophotometric method

Proper wave length selection of the methods depends upon the nature of the sample and its solubility. To develop a rugged and suitable spectrophotometric method for the simultaneous quantification of Tapentadol and Paracetamol, the analytical condition were selected after testing the different parameters such as diluents, diluents concentration, diluents pH and other conditions.

Table 1. Calibration data forTapentadol and Paracetamol

S. No	Concentration (µg/ml)	Absorbance
1.	4	0.136
2.	6	0.246
3.	8	0.365
4.	10	0.467
5.	12	0.576
6.	14	0.686
7.	16	0.775
8.	50	0.086
9.	100	0.214
10.	150	0.326
11.	200	0.457
12.	250	0.562
13.	300	0.679

Selection of wavelengths for estimation

The selection of wavelengths for the estimation Tapentadol and Paracetamol a suitable diluted stock solution contain 6 g/ml of each and the solutions were scanned between 200 – 400 nm by using methanol as blank. From the overlain spectra, by the observation of spectral characteristics of Tapentadol and Paracetamol were selected for simultaneous estimation. The wavelengths selected were 239 nm and 265 nm.

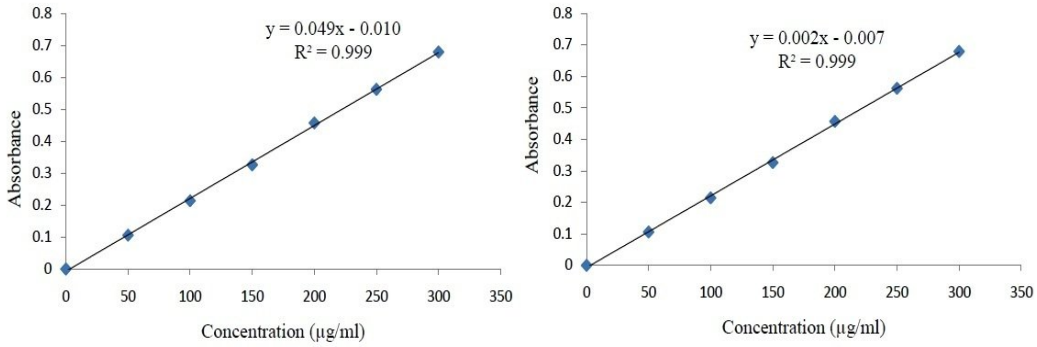

Figure 2. Calibration curve for Tapentadol and Paracetamol

Determination of absorptivities at λmax

The absorbances of solution of Tapentadol and Paracetamol were measured at the selected wavelength. The absorbances were divided by the concentration to get absorptivities.

Validation of developed method

Specificity

The specificity of the method is established by known concentration of Tapentadol and Paracetamol was taken in different solvents and estimated as per analytical method. Both placebo and analytes were scanned in UV range, resulting spectra shows the there is no interference between sample and placebo it proves the method specificity.

Linearity & Range

The calibration curves constructed were evaluated by using correlation coefficient. The absorbances ofTapentadol were linear with the concentration range of 4–16 □g/ml andParacetamol were linear with the concentration range of 50–300□g/ml in 0.1 N NaOH(Fig No. 2 & 3). The average absorbance of each concentration obtained was plotted against the concentration of the analyte. The correlation coefficient for the data was calculated as 0.999. The regression line were observed to be in the form of y = 0.049 x - 0.010 for Tapentadol and 0.007x-0.002 for Paracetamol. The results are summarized in Table No.1.

Precision

The precision of the method was calculated from the reproducibility of percentage assay of six Tapentadol and Paracetamol samples. The results are summarized in Table No 2. The results showed that the precision of the method is good.

Intermediate Precision

Further the precision of the method was confirmed by intra-day and inter-day analysis. The analysis of formulation was carried out for

Table 2.Precision Study Data

S. No	System Precision		Method Precision	
	Tapentadol λ max at 239nm	Paracetamol λat 265nm	Tapentadol λ max at 239nm	Paracetamol λat 265nm
1	0.418	0.457	0.561	0.354
2	0.415	0.456	0.562	0.359
3	0.419	0.449	0.563	0.357
4	0.418	0.451	0.562	0.357
5	0.418	0.454	0.561	0.358
6	0.419	0.457	0.560	0.359
Mean	0.417833	0.454	0.5615	0.357333
SD	0.001472	0.003347	0.001049	0.001862
% RSD	0.352284	0.737145	0.186787	0.521054

Table 3. Intraday precision data for Tapentadol & Paracetamol

Parameter	Tapentadol λ max in 0.1N NaOH		Paracetamol λ max in 0.1N NaOH	
	Standard(239nm)	Sample(215)	Standard(265nm)	Sample(258nm)
Absorbance at λ max	0.458	0.566	0.457	0.354
	0.457	0.565	0.456	0.359
	0.458	0.569	0.454	0.357
Mean	0.457667	0.566667	0.455667	0.356667
SD	0.000577	0.002082	0.001528	0.002517
%RSD	0.126151	0.367353	0.335229	0.705592

Table 4. Interday precision data for Tapentadol & Paracetamol

Parameter	Tapentadol				Paracetamol			
	Day-1		Day-2		Day-1		Day-2	
	Std	Sample	Std	Sample	Std	Sample	Std	Sample
Day to day	0.458	0.566	0.538	0.561	0.457	0.359	0.451	0.501
	0.456	0.565	0.534	0.562	0.449	0.357	0.449	0.501
	0.458	0.566	0.538	0.562	0.454	0.358	0.451	0.505
Mean	0.4573	0.5657	0.5367	0.5616	0.4533	0.358	0.4503	0.5023
SD	0.0011	0.0005	0.0023	0.0005	0.0040	0.001	0.0011	0.0023
%RSD	0.2524	0.1020	0.4303	0.1027	0.8914	0.2793	0.2564	0.4597

Table 5. Ruggedness data for Tapentadol & Paracetamol standard

Parameter	Tapentadol			Paracetamol		
	Analyst 1	Analyst 2	Analyst 3	Analyst 1	Analyst 2	Analyst 3
Analyst to Analyst	0.458	0.453	0.456	0.459	0.457	0.451
	0.459	0.455	0.458	0.457	0.456	0.455
	0.452	0.458	0.459	0.455	0.452	0.457
Mean	0.456333	0.455333	0.457667	0.457	0.455	0.454333
SD	0.003786	0.002517	0.001528	0.002	0.002646	0.003055
%RSD	0.829643	0.552697	0.333764	0.437637	0.581484	0.672425

Table 6. Ruggedness data for Tapentadol & Paracetamol sample

Parameter	Tapentadol in 0.1N NaOH			Paracetamol in 0.1N NaOH		
	Analyst 1	Analyst 2	Analyst 3	Analyst 1	Analyst 2	Analyst 3
Analyst to Analyst	0.566	0.569	0.569	0.354	0.351	0.355
	0.569	0.566	0.562	0.359	0.358	0.354
	0.566	0.564	0.563	0.352	0.359	0.359
Mean	0.567	0.56633	0.564667	0.355	0.356	0.356
SD	0.001732	0.002517	0.003786	0.003606	0.004359	0.002646
%RSD	0.305476	0.444369	0.670473	1.015648	1.22441	0.743189

Table 7. Accuracy- Recovery studies

Accuracy level	Tapentadol	Amount (µg/ml)	%Recovery (Average)	Paracetamol	Amount (µg/ml)	%Recovery (Average)
80%	0.427	4.8	98.40	0.237	4.8	98.47
	0.413			0.233		
	0.413			0.235		
100%	0.561	6	99.92	0.359	6	99.88
	0.562			0.357		
	0.562			0.358		
120%	0.750	7.2	99.68	0.651	7.2	100.4
	0.745			0.650		
	0.737			0.649		

Table 8. Robustness data for Tapentadol

S. No	Standard Absorbance			Sample Absorbance		
	238	239	240	214	215	216
1	0.448	0.458	0.478	0.566	0.566	0.585
2	0.445	0.457	0.481	0.565	0.565	0.591
3	0.442	0.458	0.479	0.569	0.569	0.587
Mean	0.445	0.457	0.479	0.566	0.566	0.587
SD	0.003	0.001	0.002	0.002	0.002	0.003

Three time in the three consecutive days. The % RSD values of intraday analysis were shown in Table No 3, 4,5& 6. The results were well within acceptable limits of % RSD less than 2.0% for all parameters viz., intraday, inter day and analyst to analyst variation. These results indicated that the developed method is rugged.

Accuracy

Accuracy of the method was expressed in terms of recovery of added compound at 80%, 100% and 120% level of sample. Mean % recovery and % RSD were calculated and were summarized in Table No 7. The result shown that best recoveries (98.40 – 99.92% forTapentadol and 98.47 – 100.40 % for Paracetamol) of the drugs were obtained at each added concentration, indicating that the method was accurate.

Robustness

The evaluation of robustness should show the reliability of an analysis with respect to deliberate variations in method parameters.If measurements are susceptible to variation in analytical conditions, the analytical condition should be suitably controlled or a precautionary statement should be included in the procedure. The result of robustness study of the developed assay method was established in Table No 8 & 9.The result shown that during all variance conditions, assay value of the test preparation solution was not affected and it was in accordance with that of actual. System suitability parameters were also found satisfactory; hence the analytical method would be concluded as robust.

Table 10. Robustness data for Paracetamol

S. No	Standard Absorbance			Sample Absorbance		
	264	265	266	257	258	259
1	0.440	0.457	0.483	0.334	0.354	0.379
2	0.437	0.456	0.486	0.339	0.359	0.381
3	0.439	0.454	0.484	0.337	0.357	0.378
Mean	0.438	0.455	0.484	0.336	0.356	0.379
SD	0.001	0.0005	0.001	0.0026	0.0025	0.0015
%RSD	0.348	0.335	0.315	0.747	0.705	0.402

System suitability

A system suitability test of the

Table 9. Validation Data

S. No	Parameter	Tapentadol	Paracetamol
1	**Specificity**	No interference	No interference
2	**Accuracy** **%Recovery**	98.4–99.92	99.47–100.4
3	**Precision** **Intraday Analysis** **Interday Analysis** **Inter Analyst Analysis** **(% RSD)**	0.126151 0.1020&0.1027 0.829643,0.552697, & 0.333764	0.335229 0.2793&0.4597 0.437637, 0.581484, & 0.672425
4	**Linearity**	4-16 mcg/ml	50-300 mcg/ml
5	**Correlation coefficient**	0.99941	0.99904
6	**Slope**	0.049	0.002
7	**y-intercept**	0.010	0.007

spectrophotometric system was performed before each validation run. Six replicate reading of standard preparation were taken and % RSD of standard reading were taken for same. Acceptance criteria for system suitability, % RSD of standard reading not more than 2.0%, were full fill during all validation parameter.

The optical parameters like molar absorptivity, correlation coefficient, slope, intercept, LOD, LOQ and standard error were calculated and results were shown in Table No 10.

CONCLUSION

The present analytical method was validated as per ICH Q2 (R1) guideline and it meets to specific acceptance criteria. It is concluded that the analytical method was specific, precise, linear, accurate, robust and it proves all validation characteristics, hence the present developed analytical method was suitable for quality control of raw materials and formulations and can be used for its intended purpose.

ACKNOWLEDGEMENT

The authors thank Sri. C. Gangi Reddy, Founder, Annamacharya Educational Trust for providing all the facilities for graduate studies and dissertation work. They also thank to RA ChemPharma, Ltd, Hyderabad, India for providing standard Cyproheptadine HCl. They also thank the faculty of Annamacharya College of Pharmacy for their valuable suggestions and constant encouragement during research work.

REFERENCES:

1. International Conference on Harmonisation Guideline on Validation of Analytical Procedures: Text and Methodology; Q2 (R1), 2005.
2. A.H.Becket and J.B.Stenlak, Practical Pharmaceutical Chemistry, 4th Edition-part-2,284-285.
3. International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use, ICH Harmonised Tripartite Guidelines, Validation of Analytical Procedures: Text and Methodology Q2 (R1), Current Step 4 version, Nov. 1996, Geneva, Nov. 2005.
4. Coulter C, Taruc M, Tuyay J, Moore C, Determination of tapentadol and its metabolite N-desmethyltapentadol in urine and oral fluid using liquid chromatography with tandem mass spectral detection, J. Anal. Toxicol. 34 (2010) 458–463.
5. Terlinden, R., Ossig, J., Fliegert, F.,Gohler, K. "Pharmacokinetics, Excretion and Metabolism of TapentadolHCl, a Novel Centrally Acting Analgesic in Healthy Subjects". Program and Abstracts of the 25th Annual Scientific Meeting of the American Pain Society; May 3–6, (2006) San Antonio, Texas. Poster 689.
6. Granberg RA, Rasmuson AC (1999). "Solubility of Paracetamol in pure solvents". Journal of Chemical & Engineering Data 44 (6): 1391–95.
7. Hinz, B.; Cheremina, O.; Brune, K. (2008). "Acetaminophen (Paracetamol) is a selective cyclooxygenase-2 inhibitor in man". The FASEB journal : official publication of the Federation of American Societies for Experimental Biology 22 (2): 383–390
8. Madhu M, RamyaSmruthi Raj N, Swathi V, Yasmeen R, Mohammed Ishaq B., "Development and validation of UV spectroscopic method for the estimation of Temozolomide in capsule dosage form" International Journal of Biological & Pharmaceutical Research. 2014; 5(8): 701-705.
9. Madhu M, Latha S, MadhusudhanaChetty C, Pradeepkumar Y,Hrushikeshreddy Y, Jaya sankar Reddy V., "analytical method development and validation of simultaneousdetermination of Atorvastatin calcium and Amlodipine besilatin tablet dosage form by RP-HPLC" .Journal of Global Trends in Pharmaceutical Sciences, April-June 2011; 2 (2): 149-160.
10. Madhu M, Swathi V, RamyaSmruthi Raj N, Yasmeen R, Pradeep Kumar Y., "Analytical method development and validation of Temozolomide in phosphate

buffer using UV spectrophotometer" International Journal of Biological & Pharmaceutical Research. 2014; 5(7): 598-602.

11. Sravani S, MadhuM ,Vineetkumar, Dipankarkaunakar, Achhrishgoel., "analytical method development & validation for simultaneous estimation of AMBROXOL HCL AND Montelukast sodium in oral syrup by RP-HPLC method" International Journal Of Pharma Professional'sResearch, Oct-2014; 5 (4): 1125-1132.
12. MadhavaRao M, Gireesh Kumar E, Madhu M, Sushmitha A, Tiruvengadarajan V.S, Gopinath C., "development and validation of UV spectrophotometric method for the assay of Tramadol HCl in its capsule formulation". International Journal of Advances in Pharmaceutical Research. Oct.2014; 5(10): 400 – 405.
13. Venkata Prasad G, Sravani S, Mohammed Ishaq B, Madhu M, SreenivasuluMunna,Gopinath C., "Development and Validation of UV-Spectrophotometric Method for Determination of Cephalexin". Asian J. Research Chem., May 2013; 6(5): 490-494.

How to cite this article:
M. Madhu, E. Gireesh Kumar, S Chand Basha, V. S Thiruvengadarajan, C. Gopinath, simultaneous quantitation of tapentadol and paracetamol in tablet dosage form by uv spectrophotometer, 6 (4): 2945 - 2951 (2015)