RESEARCH ARTICLE

Analytical Method Development and Validation of First Order Derivative Spectrophotometric Method for Simultaneous Estimation of Telmisartan and Metformin Hydrochloride in their Combined Pharmaceutical Dosage Form

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ABSTRACT

Ultra Violet (UV) Sectrophotomertic method has been developed for simultaneous estimation of telmisartan and metformin hydrochloride in bulk drug in their combined dosage form by first-order derivative. This method developed by using Methanol: Water (50: 50 v/v). Linearity was found near to 1, for telmisartan and Metformin hydrochloride. For Intraday, Interday, Intermediate precision, Robustness, %RSD was found less than 2. % Recovery was found to be between ranges 98-106% for both the drugs. These results indicate that the method is accurate, precise, and simple. All validation Parameter results comply with ICH guidelines.

Keywords: Metformin, Simultaneous estimation, Telmisartan, UV Spectroscopy, Validation.

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INTRODUCTION

Spectrophotometric Methods of Analysis[1,2]

The ultraviolet-visible spectrophotometry method is important in pharmaceutical analysis. It involves the measurement of the amount of ultraviolet (190–380 mm) or visible (380–800 mm) radiation absorbed by a substance in solution. Instruments that measure the ratio or a function of the ratio, of the intensity of two beams of light in the UV-visible region are called UV-visible spectrophotometers. Absorption of light in both the UV and visible regions of the electromagnetic spectrum occurs when the energy of the light matches that required to induce in the molecule an electronic transition and its associated vibrational and rotational transitions. It is thus convenient to consider the techniques of UV and visible spectrophotometry together.

Derivative Method[3]

Derivative spectroscopy involves the conversion of a normal spectrum (fundamental, zero-order spectrum) to its first, second or higher derivative spectra by differentiating absorbance of the sample with respect to wavelength (λ). The differentiation of the zero-order spectrum can lead to separation of overlapped signals, elimination of background caused by presence of other compounds in a sample, improvement of resolution of mixtures as it enhances the detectability of mirror spectral features and enhancement of sensitivity and specificity.

Derivative spectra yield a more characteristic profile in comparison to the parent one: new maxima and minima appeared and points, where derivative spectra cross the X-axis Derivative spectra, keeps all laws of classical spectrophotometry, e.g., dependence of derivative value on analyte concentration and additives law. These features allow the determination of several components in a mixture by measuring the amplitude of the derivative spectrum of mixture at several wavelengths. If the measured height of the derivative peak of analyte is performed at those wavelengths at which spectra of other components undergo zeroing, the measured amplitude is proportional only to the concentration of this analyte. This approach of quantitative determination is called the "zero-crossing technique." This has been used for the simultaneous determination of different mixtures in pharmaceutical formulation.

Drug Analysis

Analytical chemistry is a branch of science which includes the nature and identity of the components and its composition.

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It is pharmaceutical science, which includes quality of the product and separation of the components. It gives both qualitative and quantitative analysis data for the product.

MATERIALS AND METHODS

Steps Involved in Spectroscopic Method[19]

Selection of Solvent

Solute must be easily soluble in solvent and not interact with the solute.

All solvents show absorption at some point in the UV region, and care must be taken to choose a solvent for a particular determination, which does not absorb in the wavelength region. Any impurities present in the solvents may affect the absorption at certain wavelength and it is necessary to employ materials of the highest purity.

Selection of Wavelength

It is important to avoid making measurements in the region where the molar absorptivity (ε) changes rapidly with the wavelength. In such a region, even small changes in setting the wavelength scale will result in a large apparent molar absorptivity.

Types of various methods for multi-component Analysis

- Simultaneous equation method
- Absorbance ratio method (Q-absorbance method)
- Absorbance correction method
- Difference spectrophotometry
- Ratio spectra derivative method
- Dual-wavelength method
- Orthogonal polynomial method
- Area under curve method
- Derivative method

Analytical Method Validation[16,6]

The objective of validation of an analytical procedure is to demonstrate that it is suitable for its intended purpose. Validation is documented evidence, which provides a high degree of assurance for a specific method.

Validation Parameters[6]

- Specificity
- Accuracy
- Precision
- Repeatability
- Intermediate precision
- Reproducibility
- Detection limit
- Quantitation limit
- Linearity
- Range
- Robustness

Solubility Study[4,5]

Solubility Parameter

Table 1: Solubility of metformin HCl and telmisartan were determined by taking 10 mg of each drug in 100mL volumetric flask, adding the required quantity of solvent at room temperature, and shaking for a few minutes.

Descriptive term	*Approximate volume of solvent in milliliters per gram of solute*
Very soluble	Less than 1
Freely soluble	From 1 to 10
Soluble	From 10 to 30
Sparingly soluble	From 30 to 100
Slightly soluble	From 100 to 1000
Very slightly soluble	From 1 000 to 10,000
Practically insoluble	More than 10,000

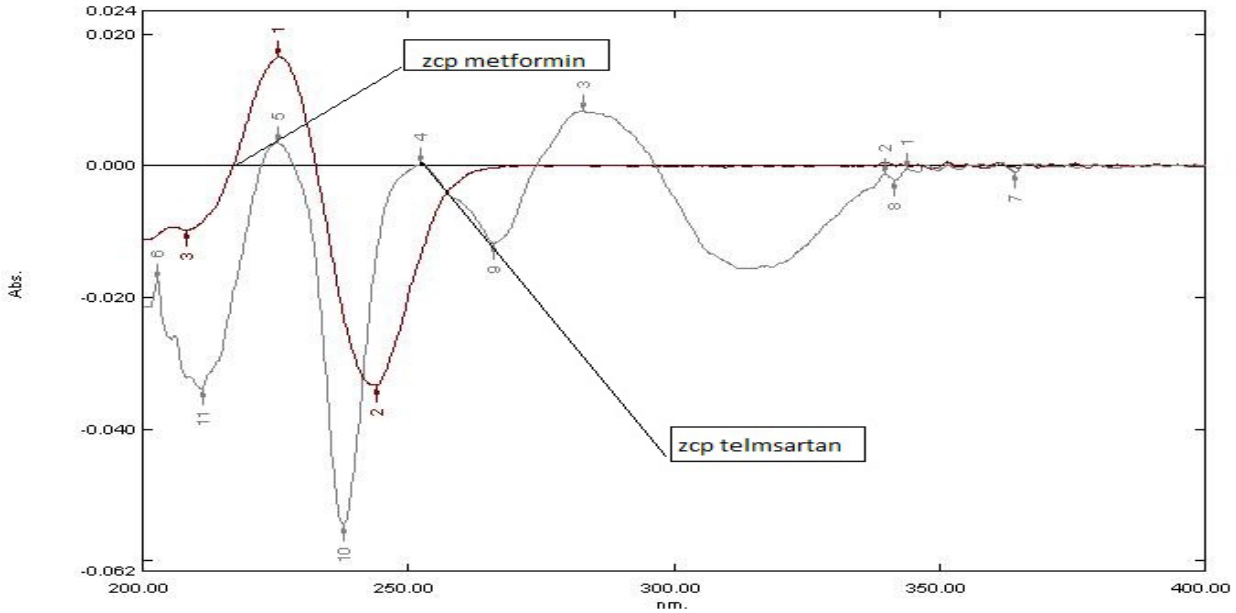

Figure 1: The first derivative overlay spectra of both drugs for wavelength selection
Zcp of Telmisartan: Zero crossing point of telmisartan Where the absorbance of Metformin is measured
Zcp of metformin: Zero crossing point of Metformin Where the absorbance of telmisartan is measured

Identification of Drugs[6]

Identification by Melting Point Study

The determination of melting point was carried out by capillary method. The powdered drug was filled in capillary (5 cm length and 1mm width diameter) and it was put into melting point apparatus (Model: VMP-D). Melting point apparatus show the temperature at which the drug started to convert liquid and temperature at which drug completely convert into liquid was noted from display as the range of melting point

Identification by Fourier transform infrared (FT-IR) spectroscopy

FT-IR spectrum for pure drug was taken by the FT-IR spectrophotometer using the KBr (Potassium bromide) disk method (Bruker, Germany). The sample was grinded and dispersed with micronized IR grade KBr powder followed by application of 7-12 kpa pressure in the hydraulic KBr press to prepare the disc. The disc was then subjected for FT-IR analysis, and comparison was done with the standard spectrum.

Then FT-IR spectra were interpreted and comparison of spectra with reference spectra of respective drugs.

DEVELOPMENT AND VALIDATION

Selection of Solvent

Metformin was freely soluble in water, methanol, 0.1N NaOH (sodium hydroxide), and 0.1N HCl (Hydrochloric acid). It was insoluble in acetone and acetonitrile. Telmisartan was soluble in 0.1N NaOH and sparingly soluble in methanol. It was insoluble in HCl and water. So methanol and water were selected as solvents.

Selection of Wavelength

To determine the concentration of compounds in multi-component mixture present by overlay spectra and by applying first-order derivatives with respect to wavelength as function of wavelength. These plots reveal details that were lost in an ordinary spectrum, and the concentration of an analyte in the presence of interference or two or more analytes in a mixture can be determined more easily and more accurately.

Selection of Wavelength

Standard drug solution of telmisartan and metformin HCl were scanned separately in the range of 200-400nm. Their first derivative curves were obtained, and their ZCP were found to be 251nm and 217nm, respectively. The absorbance of metformin and telmisartan were obtained at these ZCPs.

Preparation of Solutions[7-9]

Preparation of Stock Solution for Metformin hydrochloride[9-11]

An accurately weighed quantity of Metformin Hydrochloride (10mg) was transferred into 100mL volumetric flask, 10-15mL of distilled water was added and sonicated for 5 minutes and diluted up to the mark 100mL with distilled water

Preparation of Stock Solution for Telmisartan

An accurately weighed quantity of telmisartan (10mg) was transferred into 100mL volumetric flask, 10-15ml of methanol was added and sonicated for 5 min and diluted upto the mark 100mL with distilled water.

Preparation of working standard solution for Metformin hydrochloride

From standard stock solution(100µg/mL) of Metformin Hydrochloride (0.6, 0.8, 1.0, 1.2, 1.4, and 1.6) were taken and transferred in 10ml volumetric flask and make up the volume with distilled water, which gives (6, 8, 10, 12, 14, 16) µg/ml. Further absorbance of above Prepared solutions were measured.

Preparation of working standard solution for telmisartan

From standard stock solution (100µg/mL) of telmisartan (0.6, 0.8, 1.0, 1.2, 1.4, and 1.6) were taken and transferred in 10ml volumetric flask and make up the volume with distilled water, which gives (6, 8, 10, 12, 14, 16) µg/mL. Further absorbance of Above Prepared solutions were measured.

METHOD VALIDATION[6]

Linearity and Range

- The linearity response was determined by analyzing6 concentrations in the range of 6-16µg/mL for Metformin Hydrochloride and 6-16µg/mL for telmisartan. Accurately measured standard stock solutions of each Metformin Hydrochloride and Telmisaratn (0.6, 0.8, 1.0, 1.2, 1.4, 1.6,1.8) were transferred into 10mL volumetric flask and make up the volume with distilled water. Spectra of each were obtained, and their the first-order derivatives absorbance were measured at 251nm and 217nm, respectively.
- Range in a term which calibration curve constructed by plotting absorbance of the first derivative Vs concentration.

Precision

Repeatability

- Repeatability of Metformin Hydrochloride and telmisartan checked by repeated measurement of absorbance of solution (n = 6) of 10µg/mL (Metformin Hydrochloride) and 10µg/mL (telmisartan) measured and %RSD was calculated.
  Acceptance criteria: %RSD should be less than 2.

Intraday Precision

- Three replicates of three concentrations of metformin hydrochloride (10, 12, 14 µg/mL) and telmisartan (10, 12, 14 µg/mL) total nine determinations were analyzed at same day within a short time interval and their first derivative absorbance were measured and % RSD was calculated.
  Acceptance criteria:- %RSD should be less than 2.

Intermediate Precision

Interday Precision

- Three replicates of three concentrations of Metformin Hydrochloride (10, 12, 14 µg/mL) and telmisartan (10, 12, 14 µg/mL) total nine determinations were analyzed at three consecutive days, and their first derivative absorbance was measured and % RSD was calculated.
  Acceptance criteria: %RSD should be less than 2.

Different analyte

- Different analytes analyzed three concentrations of metformin Hydrochloride (10, 12, 14µg/mL) and telmisartan (10, 12, 14 µg/mL) total nine determinations on the same day, and their first derivative absorbance was measured and %RSD was calculated.

  Acceptance criteria: - %RSD should be less than 2.

Robustness

- Three different concentrations of Metformin Hydrochloride (10, 12, 14 µg/mL) and telmisartan (10, 12, 14 µg/mL) were prepared and analyzed by different wavelengths. The solution of Metformin Hydrochloride were analyzed at 251nm, 250nm, 252nm, and telmisartan (20, 22, 24 µg/mL) were analyzed at 216nm, 217nm, 218nm. Absorbance at each wavelength were measured, and %RSD was calculated.

  Acceptance criteria: %RSD should be less than 2.

Limit of Detection (LoD)

- The LoD was estimated from the set of 5 calibration curves used to determine Method linearity. The LOD may be calculated as,

  LoD = 3.3(SD/Slope)

  Where SD = Standard deviation of the Y- intercepts of the 5-calibration curves

  Slope = Mean slope of the 5-calibration curves.

Limit of Quantification (LoQ)

- The LoD was estimated from the set of 5 calibration curves used to determine Method linearity. The LOD may be calculated as,

  LoQ = 10 (SD/Slope)

  Where, SD = Standard deviation of the Y- intercepts of the 5-calibration curves

  Slope= Mean slope of the 5-calibration curves

Accuracy

- Three different concentrations of metformin hydrochloride (10, 12, 14µg/mL) telmisartan (10, 12, 14µg/mL) were prepared, and their first derivative absorbance were measured at ZCPs. The concentration of the drug substance was obtained from the calibration curve using a straight-line equation using the following equation to calculate % accuracy.

  % accuracy = (experimental value/ true value) x 100

  Three sets were carried out.

Analysis of drugs in synthetic mixture

- The first derivative response of the sample solution was measured at 217nm and 251nm. The amount of metformin hydrochloride and Telmisartan present in sample solution were calculated.

Preparation of sample solution:

- A 50 mg of metformin and 4mg of telmisartan were measured accurately and dissolved in 10 mL of methanol and diluted with distilled water up to the mark in 100mL volumetric flask. 2mL of the solution was pipette out and diluted upto 10mL in a volumetric flask.
- Then scanned in the UV region, and the spectrum was converted to first derivative spectra and absorbance (A1) noted at 217nm and absorbance (A2) at 251nm. At this point, quantified Telmisartan and Metformin Hydrochloride concentration, respectively.

RESULT AND DISCUSSION

Solubility Study

Solubility of Metformin hydrochloride and Telmisartan

Identification of Telmisartan and Metformin hydrochloride[9]

Identification by Melting Point

M*e*lting points of both the drugs have complied with the standard specification.

Melting point of metformin hydrochloride and Telmisartan

Identification by FT-IR spectra

FT-IR SPECTRA

The functional characteristic peaks of Telmisartan and Metformin Hydrochloride,

FT-IR spectra were observed similar to the standard FT-IR spectra of Telmisartan and Metformin Hydrochloride.

Fourier transform infrared spectra of Telmisartan (Reference)

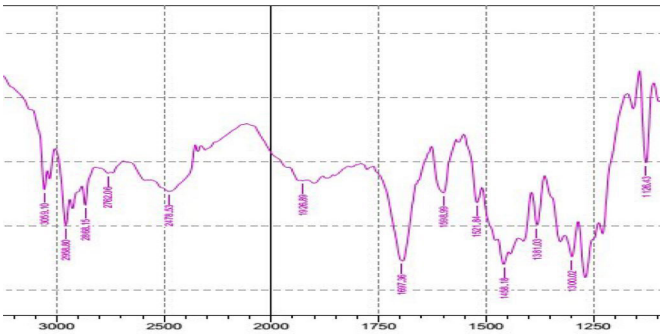

Figure: 1: Fourier Transform Infrared (FTIR)Spectra of Telmisartan (Reference)

Table 2: Solubility study of Metformin and Telmisartan (NAOH-sodium hydroxide, N-normal, HCL-hydrochloric acid)

Solvent	*Telmisartan*	*Metformin hydrochloride*
Water	Insoluble	Freely soluble
Methanol	Sparingly soluble	Soluble
Acetonitrile	Slightly soluble	Soluble
0.1N NaOH	Soluble	Soluble
0.1N HCl	Insoluble	Freely soluble

Table 3: Melting points of both the drugs complied with the standard specification.

Drug	*Actual melting point*	*Reported melting point*
telmisartan	260–262°C	261–263°C
Metformin hydrochloride	223–226°C	222–226°C

Fourier transform infrared spectra of telmisartan (sample)
FTIR spectra of metformin hydrochloride (Reference)
FTIR spectra of metformin hydrochloride (Sample)
Interpretation of FT-IR spectra of telmisartan
Interpretation of FTIR spectra of metformin hydrochloride

METHOD DEVELOPMENT AND VALIDATION17

Selection of solvent

Telmisartan and metformin hydrochloride was soluble in water and methanol. Hence water and methanol were selected for method development.

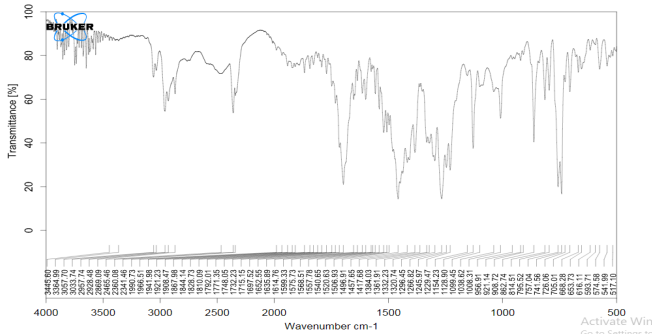

Figure 3: FTIR Spectra of telmisartan (Sample)

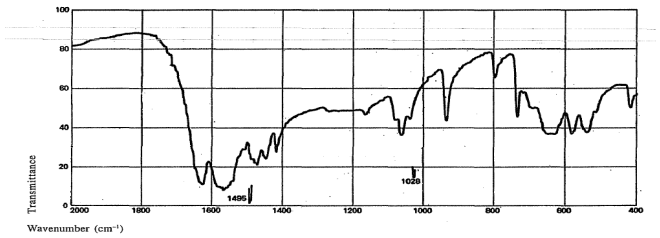

Figure 4: Standard FT-IR spectra spectrum of metformin hydrochloride (Reference)

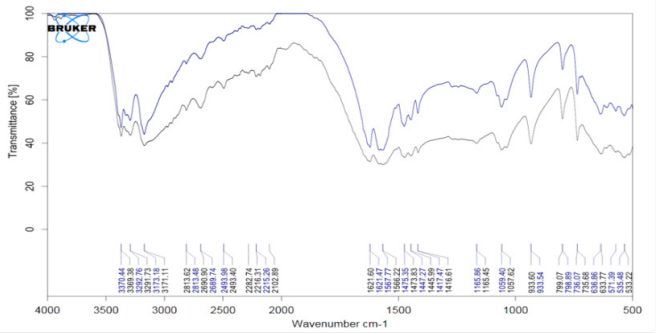

Figure 5: FT-IR spectrum of Metformin hydrochloride (sample)

Table 4: Interpretation of FTIR spectra of telmisartan

Wavelength	*Functional group*
3000-3100	C-H stretching (heterocyclic aromatic ring)
1430	C-C stressing of the ring (aromatic substitution)
1715	C-O stretching (carbonyl group)
1260-1050	C-O stressing

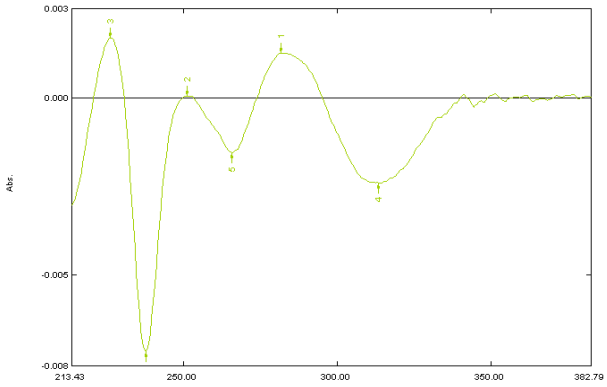

Figure 6: From the spectra of telmisartan the wavelength maxima selected for estimation at 243 nm (first derivative spectrum of temisartan showing zero crossing point)

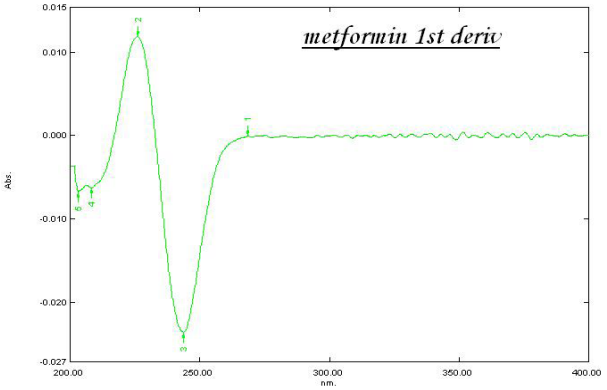

Figure 7: From the spectra of metformin hydrochloride the wavelength maxima selected for estimation at 233 nm.((First derivative spectrum of metformin hydrochloride showing zero crossing point)

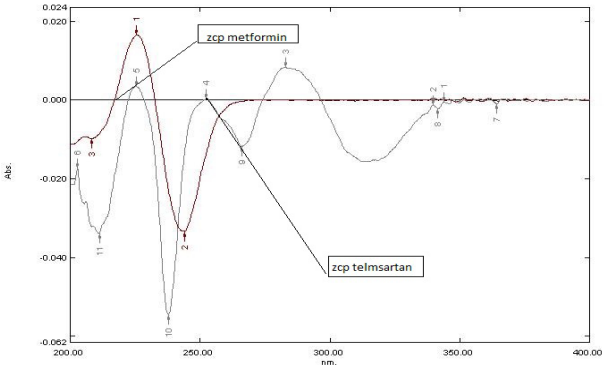

Figure 8: First derivative spectra of telmisartan and metformin overlay

Table 5: Interpretation of FTIR spectra of metformin hydrochloride

Recorded wavenumber(cm^{-1})	*Reported wavenumber(cm^{-1})*	*Functional group*
3369,3291	3500-3100	-N-H Stretching (Primary amine)
3171	3500-3100	-N-H Stretching (Secondary amine)
2813	3000-2800	-C-H Stretching (Aliphatic)
1621	1690-1640	-C=N Stretching (Imine)

Selection of Wavelength

Selection of wavelength (Telmisartan)

Selection of wavelength (Metformin)

Overlay spectra of Telmisartan and Metformin

VALIDATION OF SIMULTANEOUS EQUATION METHOD

Linearity and Range

Linearity study was carried out for both the drugs at different concentration levels. The linearity of Telmisartan and Metformin Hydrochloride was in the range of 6-16 µg/mL and 6–16 µg/mL, respectively.

Linearity and Range

Linearity spectra of different concentration of telmisartan

Linearity spectra of different concentration of Metformin Hydrochloride

Data for linearity and range of telmisartan and metformin hydrochloride

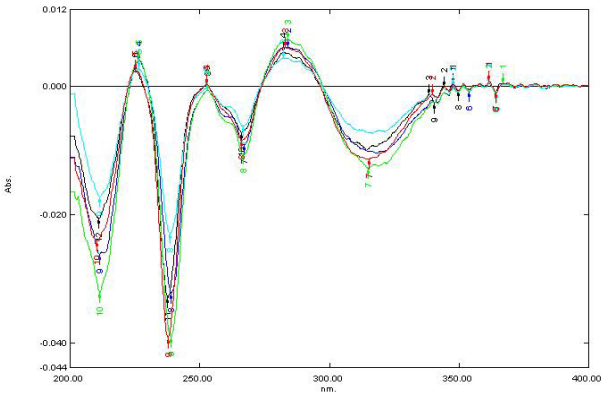

Figure 9: Linearity spectra of different concentration of telmisartan

Calibration curve of metformin

Calibration curve of telmisartan

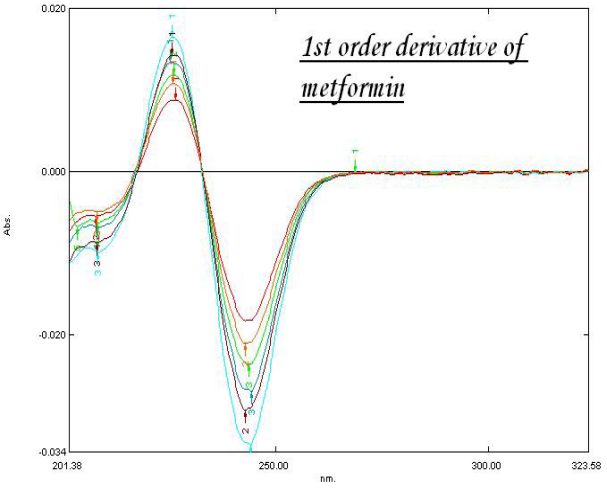

Figure 10: Linearity spectra of different concentration of metformin hydrochloride

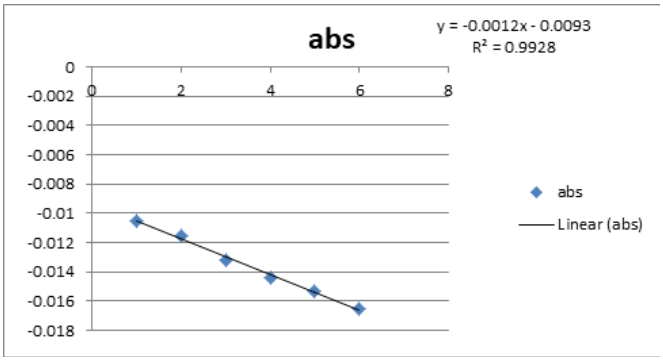

Figure 11: Calibration curve for Metformin Hydrochloride at 251 nm

Table 6: Data for linearity and range of telmisartan and metformin hydrochloride

	Concentration(µg/mL)		*ZCP of telmisartan at 251nm*		*ZCP of metformin at 217nm*	
Sr.No.	*Telmisartan*	*Metformin*	*Telmisartan*	*Metformin*	*Telmisartan*	*Metformin*
1	6	6	0	-0.0105	-0.0086	0
2	8	8	0	-0.0115	-0.0104	0
3	10	10	0	-0.0132	-0.0123	0
4	12	12	0	-0.0144	-0.0139	0
5	14	14	0	-0.0153	-0.0150	0
6	16	16	0	-0.0165	-0.0166	0

Table 7: Repeatability data of Telmisartan and Metformin HC. The data for repeatability of absorbance measurement for Telmisartan (10µg/mL) and metformin hydrochloride (10µg/ml) based on six-measurement of the same solution of Telmisartan and Metformin hydrochloride The % RSD, was found to be <2

Concentration (10:10µg/mL)	*Telmisartan at 217 nm*	*Metformin HCL at 251nm*
1	-0.0129	-0.0243
2	-0.0130	-0.0248
3	0.0131	0.0242
4	0.0128	-0.024
5	-0.013	-0.025
6	-0.0133	-0.024
Mean	-0.01302	-0.0246
Standard deviation	0.000172	0.000303
%RSD	0.3232	1.232

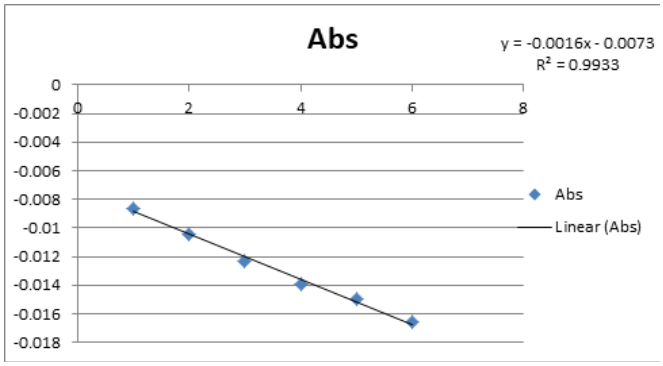

Figure 12: Calibration curve for telmisartan at 217 nm

Precision

Repeatability

The data for repeatability of absorbance measurement for Telmisartan (10µg/mL) and Metformin Hydrochloride (10µg/mL) based on six measurements of the same solution of telmisartan and metformin hydrochloride. The % RSD was found to be < 2.

Repeatability Data

Intermediate Precision

- Interday Precision

Interday Precision: Data for telmisartan and metformin HCl at 243nm

- Intraday Precision

Intraday Precision Data for Telmisartan and Metformin at 243nm:

- Different Analysts

Different Instrument: Data for Telmisartan and Metformin Hydrochloride at 243nm

Robustness

Different wavelength data for metformin hydrochloride at 217 nm

Different wavelength data for metformin hydrochloride at 251 nm.

Limit of Detection (LoD) and Limit of Quantification (LoQ)

Calibration curves were repeated for five, and standard deviation of the intercept was calculated, then LoD and LoQ were calculated.

Table 8: Three replicates of 3 concentrations of a standard solution of telmisartan and metformin HCl, a total of 9 determinations were analyzed at three consecutive day and first derivative absorbance were measured at 217 nm and 251 nm. %RSD was calculated.

Drug	*Concentration*	*Day 1*	*Day 2*	*Day 3*	*Mean*	*SD*	*%RSD*
Telmisartan	(µg/ml)						
	10	-0.0129	-0.0132	-0.0128	-0.01297	0.000208	1.6054
	12	-0.0143	-0.0144	-0.0140	-0.01423	0.000208	1.4625
	14	-0.0163	-0.0160	-0.0165	-0.01627	0.000252	1.5471
Metformin hydrochloride	10	-0.0241	-0.0230	-0.0235	-0.02353	0.000551	2.3403
	12	-0.0213	-0.0214	-0.0220	-0.02157	0.000379	1.7554
	14	-0.0270	-0.0274	-0.0272	-0.0272	0.000200	0.7352

Table 9: It was performed by taking three replicates of a standard solution of telmisartan and metformin hydrochloride using that 3 concentration (10, 12, 14µg/mL) and (10, 12, 14µg/mL) were Prepared thus total nine determination were analyzed within the short period interval. The % RSD was found to be < 2.

Drug	*Concentration (µg/ml)*	*At 10 am*	*At 12 pm*	*At 3 Pm*	*Mean*	*Standard deviation*	*%RSD*
	10	-0.0129	-0.0130	-0.0131	-0.013	0.0001	0.76923
Telmisartan	12	-0.0141	-0.0143	-0.0140	-0.01413	0.000153	1.0808
	14	-0.0162	-0.0165	-0.0166	-0.01643	0.00020	1.26673
	10	-0.0212	-0.0218	-0.0216	-0.02153	0.00030	1.41875
Metformin hydrochloride	12	-0.0242	-0.0240	-0.0238	-0.024	0.0002	0.8333
	14	-0.0270	-0.0268	-0.0274	-0.02707	0.00036	1.1287

Table 10: Three different concentrations of telmisartan and metformin hydrochloride were analyzed by different analysts on the same day using the same instrument. %RSD was calculated

Drug	*concentration (µg/mL)*	*A*	*B*	*Mean*	*Standard deviation*	*%RSD*
Telmisartan	10	-0.0132	-0.0136	-0.0134	0.000283	2.1107
	12	-0.0144	-0.0140	-0.0142	0.000283	1.9918
	14	-0.0160	-0.0158	-0.0159	0.000141	0.8894
Metformin hydrochloride	10	-0.0213	-0.0220	-0.02165	0.000495	2.2862
	12	-0.0256	-0.0249	-0.02525	0.000495	1.9603
	14	-0.0272	-0.0276	-0.0274	0.000283	1.0322

Table 11: Robustness carried by changing wavelength ± 1.0 nm. Different wavelength Data for Metformin Hydrochloride at 217nm

Drug concentration (µg/mL) telmisartan	*216 nm*	*217 nm*	*218 Nm*	*Mean*	*SD*	*%RSD*
10	-0.0127	-0.0129	-0.013	-0.01287	0.000153	1.1872
12	-0.0141	-0.0143	-0.0144	-0.01427	0.000153	1.0707

Table 12: Robustness carried by changing wavelength ± 1.0 nm. Different wavelength data for metformin hydrochloride at 251nm

Drug Concentration (µg/mL) Metformin	*250 nm*	*251 nm*	*252 nm*	*Mean*	*SD*	*%RSD*
10	-0.0211	-0.0213	-0.0213	-0.02123	0.000115	0.5438
12	-0.0272	-0.0273	-0.0274	-0.0273	0.0001	0.3663

Table 13: Calibration curves were repeated for five and a standard deviation of intercept was calculated, then LOD and LOQ were calculated

Parameters	*Telmisartan at 217nm*	*Metformin hydrochloride at 251nm*
SD of the Y-intercepts of 5 calibration curve	0.0007	0.0005
Mean slope of 5 calibration curve	-0.0014	-0.00165
LOD(µg/mL)	1.6500	1.0000
LOQ(µg/mL)	5.0000	3.0300

Table 14: From marketed formulation at three levels of standard addition accuracy of the method was confirmed by recovery study. %recovery of Telmisartan and metformin hydrochloride were found between 98 to 102%.

NAME	*True Concentration*	*Absorbance*	*Experimental value*	*%Accuaracy*
	10	-0.019	9.72	98.6
Telmisartan	12	-0.021	12.22	101
	14	-0.023	13.74	98.9
	10	-0.034	10.36	101.8
Metformin	12	-0.036	12.24	102
	14	0.039	15.44	106

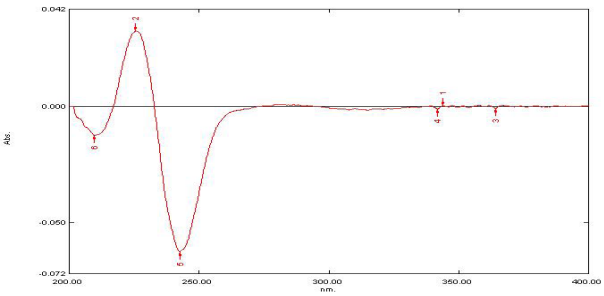

Figure 13: First derivative of telmisartan and metformin Hydrochloride

LoD and LoQ Data for telmisartan and metformin Hydrochloride

Accuracy

From marketed formulation at three level of standard addition accuracy of the method was confirmed by recovery study. % recovery of telmisartan and metformin Hydrochloride were found between 98% to 102%.

Percentage (%) Recovery

Percentage (%) recovery data for telmisartan and metformin Hydrochloride

Analysis of Telmisartan and Metformin Hydrochloride

DISCUSSION

The first derivative for simultaneous estimation was developed and validated for Telmisartanand Metformin hydrochloride. Linearity was found near to 1, for telmisartanand Metformin hydrochloride. For intraday, interday, intermediate precision, robustness, % RSD was found less than 2. % recovery was found to be between ranges 98-106% for both the drugs. These results indicate that the method is accurate, precise, and simple.

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REFERENCES

1. Khristi AP, Mardia RB, Suhagia BN. UV Spectrophotometric method development and validation of first derivative method for simultaneous estimation of sildenafil citrate and aspirin in bulk and tablet dosage form, J. Indo American Journal of Pharmaceutical Research. 2015 Sep;5(9):2231-6876.

2. Backett AH, and Stenlake JB. Practical Pharmaceutical Chemistry. 4th ed. New Delhi: CBS Publications and Distributors; Part- II;2001.p. 285-297.
3. Bonde S, Gaikwad A, Kataleb D, Gavalib S. A Simple And Sensitive Method For Determination Of Metformin And Sitagliptin In Human Plasma Using Liquid Chromatography And Tandem Mass Spectrometry. Int J Pharm Pharm Sci. [Internet] 2013 Jun [cited 2016 Aug 26];5(3): [about 8pp.] Available from http://www.ijppsjournal.com/Vol5Suppl3/7371.pdf
4. British Pharmacopoeia, The Department of Health, Social Service and Public Safety: Published by The Stationery Office on behalf of the Medicines and Healthcare products Regulatory Agency (MHRA); 2009. III. p.2758.
5. Chatwal GR, Anand SK. Instrumental Methods of Chemical Analysis:5th ed.Himalaya Publishing House; p.2.177, 2.78, 2.340, 2.185, 2.272.
6. Ewing GW. Instrumental methods of chemical analysis: 5th ed. New York: Mc Graw – Hill book company; 1985.p.1-7.
7. Joshi H, Khristi A. UV Spectrophotometric Method Development and Validation of Absorbance ratio method for the simultaneous estimation of Teneligliptine (TEN) and Metformin Hydrochloride (MET) in tablet dosage form. International Research Journal of Pharmacy. 2018; 9(1): 47-55.
8. Joshi H, Khristi A. Simultaneous Equation Method Development and Validation for the Simultaneous Estimation of Teneligliptine hydrobromide hydrate (TEN) and Metformin hydrochloride (MET) in Tablet Dosage Form Int. J. Pharm. Sci. Rev. Res., 49(2), March-April 2018; Article No. 04, Pages: 9-15.
9. Indian Pharmacopoeia, Government of India, Ministry of Health & Family Welfare and Indian Pharmacopoeia Commission: New Delhi; 2014.III.p. 2186-2187.
10. ICH guideline, ICH Q2R1, Text on Validation of analytical procedures Methodology, 1996.
11. Ito Masanori Egusa Kenji. Pharmaceutical Composition Comprising Metformin And Dpp-4 Inhibitor Or Sglt-2 Inhibitor. JP2016000756 A,2016.
12. Jajow S, Chandaka M, Mallepelli S. Analytical Method Development and Method Validation for the Simultaneous Estimation of Metformin hydrochloride and Pioglitazone hydrochloride in Tablet Dosage Form by RP-HPLC. Asian J. Pharm; Ana. [Internet]2012 [cited Aug 24]; 2(3): [about 5pp.] Available from www.asianpharmaonline.org
13. Jt Walter Santos, Brazil BRMU8602970U, Medicine "Telmisartan + metformin" in combined form for cardiovascular disease [internet] 2007.
14. K Neelima, Prasad R. Analytical Method Development and Validation of Metformin, Voglibose, Glimepiride in Bulk and Combined Tablet Dosage Form by Gradient RP-HPLC. Pharmaceutical Methods. [Internet] 2014 Jan-Jun [cited Aug 24];5(1): [about 7pp.] Available from http://citeseerx.ist.psu.edu/viewdoc/dow oad?doi=10.1.1.683.9438&rep=rep1&type=pdf
15. Klaus Dugi, eva Ulrike Graefe-Mody, Ruth Harper Hans-Juergen Woerle, united states US8853156B2, Treatment of diabetes inpatient inappropriate for metformin therapy. [internet] 2014.
16. Lara Ochoa José. Pharmaceutical Composition Containing Glimepiride and Metformin Hydrochloride. United States Patents US2016051511 A1,2016.
17. Loni A, Ghante M, Sawant S. Simultaneous UV spectrophotometric method for estimation of sitagliptin phosphate and metformin hydrochloride in bulk and tablet dosage form. Scholar research library. [Internet] 2012 [cited Aug 20]; 4(3): [about 6pp.] available from http://derpharmachemica.com/archive.html
18. Madhukar A, Prince A, Vijay Kumar R, Sanjeeva Y, Jagadeeshwar K, Raghupratap D. Simple And Sensitive Analytical Method Development And Validation Of Metformin Hydrochloride By Rp-hplc. Int. J. Pharm Pharm Sci [Internet]. 2016 Aug [cited 2016 Aug 17]; 3(3): [about 4pp.]
19. Maria, T.Z, Osvaldo K. Artur. Treatment of obesity, hypertension and diabetes syndrome Hypertension. Journal of American heart association,2001,38(2),705-708.
20. Metformin Hydrochloride (Accessed on January 2019), www.drugbank.ca/drugs/DB00331
21. Pandya R, Rathod R, Maheswari D. Bioanalytical Method Development and Validation For Simultaneous Determination of Linagliptin and Metformin Drugs In Human Plasma By Rp-HPLC Method.Pharmacophore. [Internet]2014 [cited September 2];5(2): [about 8pp.]Available from http://www.pharmacophorejournal. com/issue/Pharmacophore_March-April_2014_article1.pdf
22. Patil S, Bonde C. Development and Validation of analytical method for Simultaneous Estimation of Glibenclamide and Metformin HCl in Bulk and Tablets. Int.J. ChemTech. [Internet]. 2009 oct-dec [cited 2016 Aug 20];1(4): [about 5pp.] Available from http://sphinxsai.com/CTVOL4/ct_pdf_vol_4/CT=16%20(905-909).pdf
23. Rania M. Salama, Mona F. Schalam; Effectiveness of Telmisartan as adjunct to Metformin in Treating Type II diabetes Mellitus in Rats, open journal of endocrine and metabolic disease 2013,3,186- 196.
24. Skoog BK., West DM., and Hollar DF. Fundamentals of Analytical Chemistry: 8th ed. Meerut: Saunders Collage Publishing;2004. p1-6.
25. "Telmisartan" (Accessed on December 2018), Available from:http://pubchem.ncbi.nlm.nih/gov/compound/Telmisartan
26. Theore, w.k. New treatment strategies for patients with Hypertension and insulin resistance. The American Journal of medicine, 200, 119(5A) 24-30.
27. United States of Pharmacopoeia 30 National Formulary 25, The standard of quality, United State Pharmacopoeial Convention; 2008.p. 2640-2641.
28. Xu Yanfa Zhao Baolong. Compound metformin drop pill and preparation method thereof. Chinese Patents CN105412586 A, 2016.