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VALIDATED RP-HPLC METHOD FOR SIMULTANEOUS ESTIMATION OF RANITIDINE AND MAGALDRATE IN BULK AND TABLET DOSAGE FORM

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ABSTRACT

A reliable and efficient Reverse Phase High-Performance Liquid Chromatography (RP-HPLC) method has been developed and validated for the simultaneous estimation of Ranitidine and Magaldrate in bulk and tablet dosage forms. The chromatographic separation was achieved using a Phenomenex Luna C18 column (4.6 × 250 mm, 5 µm) with a mobile phase composed of methanol and water in a ratio of 65:35 (v/v). The column temperature was maintained at 35°C, and the detection wavelength was set at 220 nm. The method utilized a flow rate of 1.0 mL/min and an injection volume of 10 µL. The total run time for the analysis was 7 minutes. The method was validated according to ICH guidelines, demonstrating robust performance across several critical parameters. Specificity was confirmed by the absence of interference from excipients. Linearity was established with correlation coefficients exceeding 0.999 for both Ranitidine and Magaldrate. Accuracy was verified through recovery studies, achieving mean recovery rates within acceptable ranges. Precision studies showed intra-day and inter-day RSD values below 2%, indicating high reproducibility. The limits of detection and quantification were satisfactorily low, allowing for sensitive detection of both compounds.

The validated RP-HPLC method is effective for the routine analysis of Ranitidine and Magaldrate in both bulk substances and tablet formulations, offering a precise and efficient tool for quality control and assurance in pharmaceutical analysis.

Keywords: RP-HPLC, Ranitidine, Magaldrate, Phenomenex Luna C18, simultaneous estimation, validation.

1. INTRODUCTION

Simethicone decreases the gas bubbles' surface pressure and stops the GI gadget from shaping gas pockets and Magaldrates could be a complex of hydroxyl magnesium aluminate which is promptly changed into Mg(OH)2 and Al(OH)3 by gastric acid, which is ineffectively ingested and thus features an enduring effect on stomach settling agent.

2. METHODOLOGY

Preparation of standard solution:

Accurately weigh and transfer 10 mg of Ranitidine and Magaldrate working standard into a 10ml of clean dry volumetric flasks add about 7ml of Methanol and sonicate to dissolve and removal of air completely and make volume up to the mark with the same Methanol.

Further pipette 2.25ml of the above Ranitidine and 0.45ml of the Magaldrate stock solutions into a 10ml volumetric flask and dilute up to the mark with Methanol.

2.1. Procedure:

Inject the samples by changing the chromatographic conditions and record the chromatograms, note the conditions of proper peak elution for performing validation parameters as per ICH guidelines.

2.2. Mobile Phase Optimization:

Initially the mobile phase tried was Methanol: Water, Acetonitrile: Water with varying proportions. Finally, the mobile phase was optimized to Methanol and water in proportion 65:35 v/v respectively.

2.3. Optimization of Column:

The method was performed with various columns like C18 column, X- bridge column, Xterra. Phenomenex Luna C18 (4.6 x 150mm, 5µm) was found to be ideal as it gave good peak shape and resolution at 1ml/min flow.

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2.4. METHOD VALIDATION PARAMETERS

2.4.1. SYSTEM SUITABILITY

Accurately weigh and transfer 10 mg of Ranitidine and Magaldrate working standard into a 10ml of clean dry volumetric flasks add about 7mL of Diluents and sonicate to dissolve it completely and make volume up to the mark with the same solvent. (Stock solution)

Further pipette 2.25ml of the above Ranitidine and 0.45ml of the Magaldrate stock solutions into a 10ml volumetric flask and dilute up to the mark with Methanol.

The standard solution was injected for five times and measured the area for all five injections in HPLC. The %RSD for the area of five replicate injections was found to be within the specified limits.

2.4.2. SPECIFICITY STUDY OF DRUG:

Preparation of Standard Solution:

Accurately weigh and transfer 10 mg of Ranitidine and Magaldrate working standard into a 10ml of clean dry volumetric flasks add about 7ml of Diluents and sonicate to dissolve it completely and make volume up to the mark with the same solvent. (Stock solution)

Further pipette 2.25ml of the above Ranitidine and 0.45ml of the Magaldrate stock solutions into a 10ml volumetric flask and dilute up to the mark with Diluent.

Preparation of Sample Solution:

Take average weight of the Tablet and crush in a mortar by using pestle and weight 10 mg equivalent weight ofRanitidine and Magaldrate sample into a 10mL clean dry volumetric flask and add about 7mL of Diluent and sonicate to dissolve it completely and make volume up to the mark with the same solvent.

Further pipette 2.25ml of Ranitidine and Magaldrate above stock solution into a 10ml volumetric flask and dilute up to the mark with diluent.

Inject the three replicate injections of standard and sample solutions and calculate the assay by using formula:

$$\%ASSAY = \frac{\text{Sample area}}{\text{Standard area}} \times \frac{\text{Weight of standard}}{\text{Dilution of standard}} \times \frac{\text{Dilution of sample}}{\text{Weight of sample}} \times \frac{\text{Purity}}{100} \times \frac{\text{Weight of tablet}}{\text{Label claim}} \times 100$$

2.4.3. PREPARATION OF DRUG SOLUTIONS FOR LINEARITY:

Accurately weigh and transfer 10 mg of Ranitidine and Magaldrate working standard into a 10ml of clean dry volumetric flasks add about 7ml of Diluents and sonicate to dissolve it completely and make volume up to the mark with the same solvent. (Stock solution)

Preparation of Level – I (75ppm of Ranitidine and 15ppm of Telmisartan):

Pipette out 0.75ml of the Ranitidine and 0.15ml of the Magaldrate from the above stock solutions in to a 10ml of volumetric flask and dilute the solution. Performes sonication for 10minutes.

Preparation of Level – II (150ppm of Ranitidine and 30ppm of Telmisartan):

Pipette out 1.5ml of the Ranitidine and 0.3ml of the Magaldrate from the above stock solutions in to a 10ml of volumetric flask and dilute the solution. Performes sonication for 10minutes.

Preparation of Level – III (225ppm of Ranitidine and 45ppm of Telmisartan):

Pipette out 2.25ml of the Ranitidine and 0.45ml of the Magaldrate from the above stock solutions in to a 10ml of volumetric flask and dilute the solution. Performes sonication for 10minutes.

Preparation of Level – IV (300ppm of Ranitidine and 60ppm of Telmisartan):

Pipette out 3.0ml of the Ranitidine and 0.6ml of the Magaldrate from the above stock solutions in to a 10ml of volumetric flask and dilute the solution. Performes sonication for 10minutes.

Preparation of Level – V (375ppm of Ranitidine and 75ppm of Telmisartan):

Pipette out 3.75ml of the Ranitidine and 0.75ml of the Magaldrate from the above stock solutions in to a 10ml of volumetric flask and dilute the solution. Performs sonication for 10 minutes.

Inject each level into the chromatographic system and measure the peak area.Plot a graph of peak area versus concentration (on X-axis concentration and on Y-axis Peak area) and calculate the correlation coefficient.

2.4.4. PRECISION REPEATABILITY

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Accurately weigh and transfer 10 mg of Ranitidine and Magaldrate working standard into a 10ml of clean dry volumetric flasks add about 7ml of Diluents and sonicate to dissolve it completely and make volume up to the mark with the same solvent. (Stock solution)

Further pipette 2.25ml of the above Ranitidine and 0.45ml of the Magaldrate stock solutions into a 10ml volumetric flask and dilute up to the mark with Diluent.

The standard solution was injected for five times and measured the area for all five injections in HPLC. The %RSD for the area of five replicate injections was found to be within the specified limits.

2.4.5. INTERMEDIATE PRECISION:

To evaluate the intermediate precision (also known as Ruggedness) of the method, Precision was performed on different days by maintaining same conditions.

Procedure:

DAY 1:

The standard solution was injected for Six times and measured the area for all Six injections in HPLC. The %RSD for the area of Six replicate injections was found to be within the specified limits.

DAY 2:

The standard solution was injected for Six times and measured the area for all Six injections in HPLC. The %RSD for the area of Six replicate injections was found to be within the specified limits.

Accuracy:

For preparation of 50% Standard stock solution:

Accurately weigh and transfer 10 mg of Ranitidine and Magaldrate working standard into a 10ml of clean dry volumetric flasks add about 7mL of Diluents and sonicate to dissolve it completely and make volume up to the mark with the same solvent. (Stock solution)

Further pipette 1.12ml of the above Ranitidine and 0.225ml of the Magaldrate stock solutions into a 10ml volumetric flask and dilute up to the mark with Diluent.

2.4.6. ROBUSTNESS:

Accurately weigh and transfer 10 mg of Ranitidine and Magaldrate working standard into a 10ml of clean dry volumetric flasks add about 7mL of Diluents and sonicate to dissolve it completely and make volume up to the mark with the same solvent. (Stock solution)

Further pipette 2.25ml of the above Ranitidine and 0.45ml of the Magaldrate stock solutions into a 10ml volumetric flask and dilute up to the mark with Diluent.

Effect of Variation of flow conditions:

The sample was analyzed at 0.9 ml/min and 1.1 ml/min instead of 1ml/min, remaining conditions are same. 10µl of the above sample was injected and chromatograms were recorded

Effect of Variation of mobile phase organic composition:

The sample was analyzed by variation of mobile phase i.e. Methanol: Water was taken in the ratio and 60:40, 70:30 instead of 65:35, remaining conditions are same. 10µl of the above sample was injected and chromatograms were recorded.

3. RESULTS AND DISCUSSION

3.1. System suitability for Ranitidine

Table 1. system suitability for Ranitidine

S.No			Area (µV*sec)	Height (µV)		
1	Ranitidine	3.200	2391746	394171	8952	1.2
2	Ranitidine	3.248	2391647	381946	9561	1.2
3	Ranitidine	3.299	2381647	391746	6572	1.2
4	Ranitidine	3.297	2385631	386562	6452	1.2
5	Ranitidine	3.297	2385635	389164	7452	1.2
Mean			2387261			

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Std.Dev.			4363.771			
%RSD			0.182794			

Acceptance criteria:

- %RSD of five different sample solutions should not more than 2.
- The %RSD obtained is within the limit, hence the method is suitable.

Table 2. system suitability for Magaldrate

S.No	Peak Name	RT	Area (µV*sec)	Height (µV)	USP Plate Count	USP Tailing
1	Magaldrate	5.413	198362	7917	5272	1.1
2	Magaldrate	5.484	197486	7486	6291	1.1
3	Magaldrate	5.405	198354	7859	6184	1.1
4	Magaldrate	5.405	197352	7926	7145	1.1
5	Magaldrate	5.409	198453	7946	6946	1.1
Mean			198001.4			
Std.Dev.			535.1774			
%RSD			0.27029			

Acceptance Criteria:

- %RSD for sample should be NMT 2.
- The %RSD for the standard solution is below 1, which is within the limits hence method is precise.

3.2. SPECIFICITY

The ICH documents define specificity as the ability to assess unequivocally the analyte in the presence of components that may be expected to be present, such as impurities, degradation products, and matrix components. Analytical method was tested for specificity to measure accurately quantitate Ranitidine and Magaldrate in drug product.

Table 3. Peak Results for Assay Standard

S.No	Name	RT	Area	Height	USPTailing	USPPlateCount
1	Ranitidine	3.211	2397162	397161	1.2	9472
2	Ranitidine	3.222	2394721	389173	1.2	9745
3	Ranitidine	3.254	2389461	391723	1.2	8917

S.No	Name	RT	Area	Height	USPTailing	USPPlateCount	Resolution
1	Magaldrate	5.414	198462	7811	1.1	8492	7.49
2	Magaldrate	5.453	198472	8193	1.1	8916	7.52
3	Magaldrate	5.424	198735	7972	1.1	9372	7.44

3.3. LINEARITY

Table 4: Linearity study of Ranitidine:

Concentraion µg/ml	Average Peak Area
75	909889
150	1583641
225	2395378
300	3185089
375	3943725

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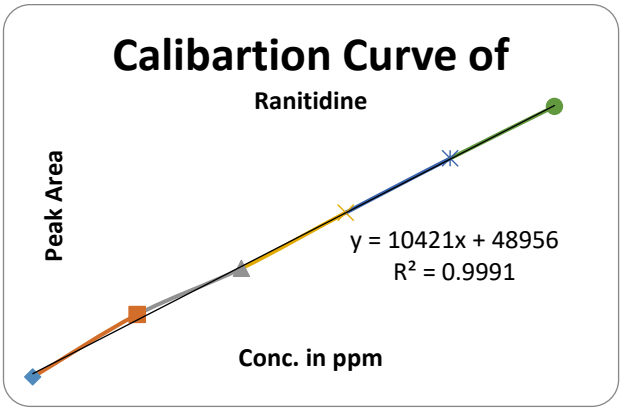

Figure1: Calibration graph for Ranitidine

Table 4: Linearity study of Magaldrate

Concentration µg/ml	Average Peak Area
15	61953
30	130213
45	198697
60	267002
75	321658

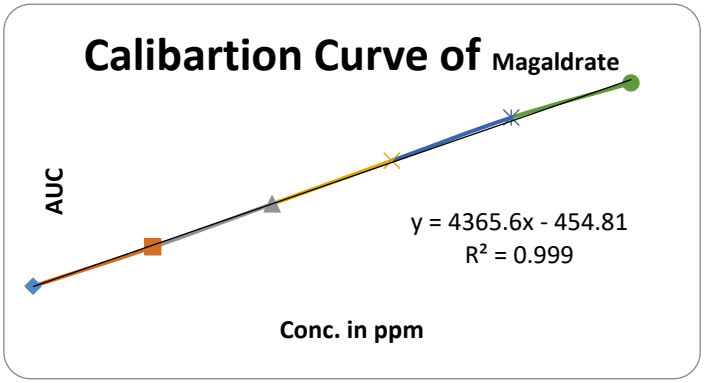

Figure2: Calibration graph for Magaldrate

Table 5: Results of repeatability for Ranitidine

S.No.	Name	Rt	Area	Height	USP plate count	USP Tailing
1	Ranitidine	3.213	2397164	381741	8155	1.2
2	Ranitidine	3.253	2391741	371742	9174	1.2
3	Ranitidine	3.297	2371846	391746	7154	1.2
4	Ranitidine	3.215	2361748	391847	9917	1.2
5	Ranitidine	3.254	2371649	384622	9247	1.2
Mean			2378830			
Std.dev			14958			
%RSD			0.628797			

Table-6: Results of method precision for Magaldrate:

S.No.	Name	Rt	Area	Height	USP plate count	USP Tailing
1	Magaldrate	5.441	198464	7291	6274	1.1
2	Magaldrate	5.442	193643	7219	6592	1.1
3	Magaldrate	5.409	196462	7194	6028	1.1

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4	Magaldrate	5.520	194644	8174	6927	1.1
5	Magaldrate	5.424	198464	8653	5920	1.1
Mean			196335.4			
Std.dev			2190.191			
%RSD			1.115536			

3.4. ACCURACY:

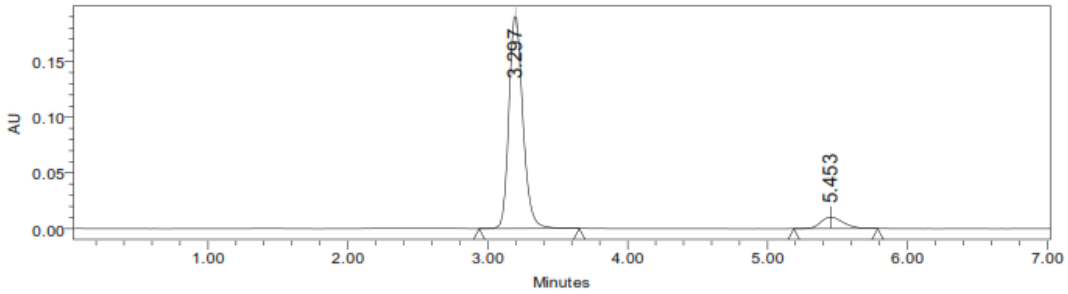

Fig-3: Chromatogram showing accuracy-50% injection

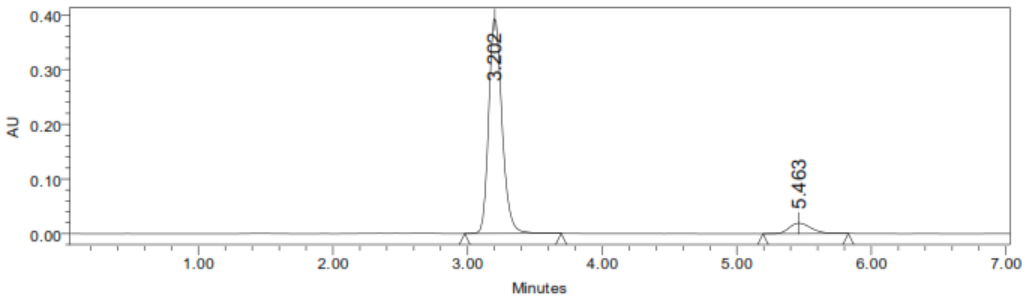

Fig 4: Chromatogram showing accuracy-100% injection

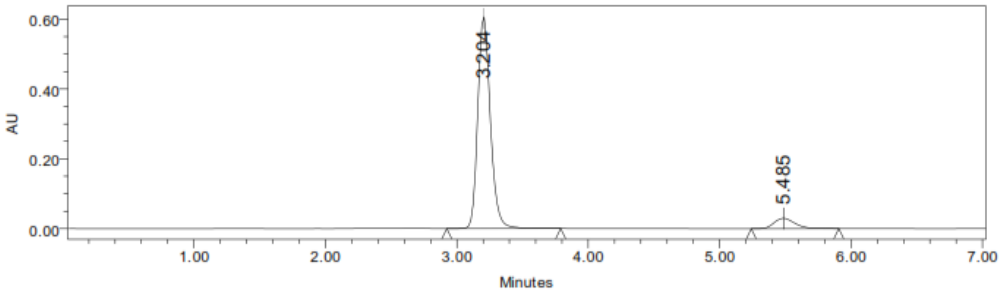

Fig-5: Chromatogram showing accuracy-150% injection

3.5. LIMIT OF DETECTION

Ranitidine:= 12.5µg/ml

Magaldrate:= 3.7µg/ml

3.6. LIMIT OF QUANTITATION

Ranitidine:= 38.1µg/ml

Magaldrate= 11.4µg/ml

3.7. ROBUSTNESS

Table7-: Results for Ranitidine Robustness

Parameter used for sample analysis	Peak Area	Retention Time	Theoretical plates	Tailing factor
Actual Flow rate of 1.0mL/min	2391746	3.202	9028	1.2
Less Flow rate of 0.9mL/min	2371831	3.639	7381	1.2
More Flow rate of 1.1mL/min	2218319	2.859	9311	1.1

Less organic phase (about 5 % decrease in organic phase)	2294821	3.460	7462	1.2
More organic phase (about 5 % Increase in organic phase)	2394811	3.022	6817	1.1

Table 8-: Results for Acceclofenac Robustness

Parameter used for sample analysis	Peak Area	Retention Time	Theoretical plates	Tailing factor
Actual Flow rate of 1.1mL/min	194627	5.463	7398	1.1
Less Flow rate of 0.9mL/min	183738	6.250	6883	1.1
More Flow rate of 0.8mL/min	198373	4.863	9917	1.2
Less organic phase (about 5 % decrease in organic phase)	178471	6.196	8372	1.1
More organic phase (about 5 % Increase in organic phase)	189462	5.010	7716	1.2

4. CONCLUSION

A robust and efficient Reverse Phase High-Performance Liquid Chromatography (RP-HPLC) method has been developed and validated for the simultaneous determination of Ranitidine and Magaldrate. The method employs a Phenomenex Luna C18 column (4.6 × 250 mm, 5 µm) and utilizes a mobile phase consisting of methanol and water in a 65:35 (v/v) ratio. The column is maintained at 35°C, and detection is performed at 220 nm. With a flow rate of 1.0 mL/min and an injection volume of 10 µL, the method achieves complete analysis within a 7-minute run time. Validation according to ICH guidelines confirmed the method's specificity, linearity, accuracy, and precision. Linearity was demonstrated with correlation coefficients exceeding 0.999 for both analytes. Accuracy was supported by recovery studies within acceptable limits, and precision was validated with intra-day and inter-day relative standard deviations (RSD) below 2%.

The limits of detection and quantification were suitably low, ensuring sensitive detection.

The RP-HPLC method developed is highly effective for the simultaneous estimation of Ranitidine and Magaldrate in both bulk drug substances and tablet dosage forms. The method's validation demonstrates its robustness and reliability, with excellent performance across key analytical parameters. The high specificity, linearity, accuracy, and precision make this method a valuable tool for routine quality control and assurance in pharmaceutical analysis. Its efficiency in separating and quantifying the two compounds within a short run time of 7 minutes further underscores its practical utility in pharmaceutical settings.

5. REFERENCES

[1] Berry RI, Nash AR. Pharmaceutical process validation, Analytical method validation, Marcel Dekker Inc. New work, 1993; 57, pp 411-28

[2] Badgujar, V. L.; Ahmed, Ansari Yaasir; Shaikh, T. J.; Deore, Hemant; Chauhan, Nidhi; Gomase, Pravin; Sehjad, Surti; Azeem, Syed Abdul; Seema, Patel; Patel, Chirag; Miran, Shaikh. Stability Indicating Rp-Hplc Method Development And Validation For Determination Of Ranitidine In Bulk And Pharmaceutical Dosage Form.Biochemical & Cellular Archives, 2024, Vol 24, Issue 1, p353.1

[3] Subrata Paul, Labani Barai, Md. Faruk Husen, Sabarni Sarker, Tarun Kumar Pal, Puja Bal, Md. Abdul Matin Sarker, Syeda Saima Alam and Sheta Biswas.Orient. J. Chem., Vol. 36(6), 1161-1167 (2020).

[4] Krishnasis Chakraborty, Mubeen G, Lalitha N, Ritu Kimbahune. RP-HPLC method Development and Validation studies of Ranitidine Hydrochloride, Domperidone in Tablets.The Pharma Innovation Journal 2015;4(8): 97-101.

[5] P.N. Arora, P.K. Malhan. Biostatistics, Himalaya publishers house, India, P.113,139-140,154.

[6] Shubham Borse, Sufiyan Ahmad, A. U. Tatiya, Method Development and Validation for the Simultaneous Estimation of Tizanidine and Magaldrate by (UHPLC) RP-HPLC in Bulk and Tablet Dosage Forms. J. Pharm. Sci. & Res. Vol. 13(8), 2021, pp 502-507.