



PREPARATION AND IN VITRO CHARACTERIZATION OF SOLID DOSAGE FORM (TABLET) CONTAINING COMBINE DRUGS FOR GASTRIC DISORDER

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ABSTRACT

The present study was undertaken to develop and evaluate sustained-release matrix tablets containing Andrographolide and Pantoprazole for the management of gastric disorders. Pre-formulation studies including organoleptic properties, solubility, pH, melting point, UV spectrophotometry, and FTIR analysis were performed to establish the physicochemical characteristics and compatibility of the drugs. Six formulations (F1–F6) were prepared by direct compression using HPMC K-100 and Eudragit RLPO as matrix-forming polymers. The prepared tablets were evaluated for thickness, hardness, friability, weight variation, drug content, and in vitro drug release. All formulations exhibited satisfactory post-compression characteristics and complied with pharmacopeial requirements. Among the formulations, F3 showed the highest drug content (98.86%) and the most desirable sustained-release profile, with approximately complete drug release within 13 h. Release kinetic analysis demonstrated the highest correlation with the Higuchi model ($R^2 = 0.983$): indicating diffusion-controlled drug release from the matrix system. Stability studies conducted for three months under long-term ($30 \pm 2^\circ\text{C}/65 \pm 5\% \text{ RH}$) and accelerated ($40 \pm 2^\circ\text{C}/75 \pm 5\% \text{ RH}$) conditions showed no significant changes in physical characteristics, drug content, or dissolution behavior. Thus, F3 was identified as the optimized formulation and demonstrated potential as a sustained-release combined dosage form for prolonged gastric disorder management, reduced dosing frequency, and improved patient compliance.

KEYWORDS: Andrographolide, Pantoprazole, Sustained-release tablet, Matrix tablet, HPMC K-100, Eudragit RLPO, Gastric disorders, Stability study.

1. INTRODUCTION

Gastric disorders represent a major group of gastrointestinal conditions that affect individuals across different age groups and may significantly impair quality of life. Common gastric disorders include peptic ulcer disease, gastritis, gastroesophageal reflux disease (GERD); hyperacidity, and dyspepsia (Gallo *et al.*, 2024). These conditions are frequently associated with excessive gastric acid secretion, impaired gastric mucosal protection, inflammation, and disturbances in normal gastrointestinal motility. Factors such as prolonged use of non-steroidal anti-inflammatory drugs (NSAIDs); infection with *Helicobacter pylori*, unhealthy

dietary habits, alcohol consumption, psychological stress, smoking, and irregular meal patterns may contribute to the development or worsening of gastric disorders. Although several therapeutic agents are available for the management of these conditions, treatment may require the administration of more than one drug to address different pathological mechanisms (Yegen, 2018).

Pharmacological management of gastric disorders commonly involves acid-suppressing agents, antacids, mucosal protective agents, and drugs that improve gastrointestinal motility or control associated symptoms.

Proton pump inhibitors (PPIs): histamine H₂-receptor antagonists, antacids, and cytoprotective agents are widely used either individually or in combination depending on the severity and type of gastric disorder (**Bucan *et al.*, 2025**). Combination therapy can provide complementary or synergistic therapeutic effects by acting on different targets involved in gastric pathology. In particular, the simultaneous administration of drugs with different mechanisms of action may improve symptom control, reduce gastric acid-mediated injury, and enhance therapeutic outcomes compared with single-drug therapy in appropriate clinical situations (**Mohammadi Zonouz *et al.*, 2026**).

Tablets have been used since later part of 19th century. Tablets are solid unit dosage form of medicaments with or without suitable diluents and prepared either by molding or compression. They are very greatly in shape, size and weight which depend upon amount of medicament used and mode of administration (**Awad *et al.*, 2021**). Usually they are disc, flat or biconvex in shape. They also vary in hardness, thickness, disintegration and dissolution characteristic and in other aspect depending upon their intended use and method of manufacture. Tablets are the most widely used solid dosage form of medicament. Because of their advantages, their popularity is increased day by day, and ruling the world (**Ubhe and Gedam, 2020**).

The objective of tablet formulation and fabrication is to deliver an accurate dose of the drug in an appropriate dosage form to the desired site of action at a predetermined rate and for a suitable duration. An ideal tablet should possess an elegant appearance, distinct identity, and should be free from defects such as cracks, chips, contamination, discoloration, and other physical imperfections (**Kumar *et al.*, 2021**). It should maintain adequate physical and chemical stability throughout its intended shelf life and should protect the medicament from undesirable changes in its chemical and physical properties. The tablet should also possess sufficient mechanical strength to withstand the stresses and shocks encountered during manufacturing, packaging, transportation, storage, and dispensing. Furthermore, an ideal tablet should release the incorporated drug in a predictable, reproducible, and controlled manner, thereby ensuring consistent therapeutic performance and improving patient convenience and compliance (**Atre and Rizvi, 2025**).

In vitro characterization provides important information regarding the quality and performance of the developed dosage form. Evaluation of tablets generally includes parameters such as appearance, thickness, diameter, weight variation, hardness, friability, disintegration time, drug content uniformity, and in vitro dissolution (**Alburyhi, 2024**). Depending on the formulation objective, dissolution studies can be performed using appropriate dissolution media representing gastric or gastrointestinal conditions. Analysis of the dissolution

profile helps determine the rate and extent of drug release and provides an indication of whether the formulation can deliver the incorporated drugs in a reproducible manner (**Ranjan and Jha, 2022**).

The present study is therefore focused on the preparation and in vitro characterization of a solid dosage form containing a combination of drugs intended for the management of gastric disorders. The study aims to develop a pharmaceutically acceptable tablet formulation by selecting suitable excipients and an appropriate manufacturing approach, followed by comprehensive evaluation of its physicochemical properties, drug content, disintegration behavior, and *in vitro* drug-release characteristics.

2. MATERIAL AND METHODS

2.1 Chemicals

HPMC, Xanthan gum, Ethyl cellulose, PVP, Magnesium stearate, Talc and Lactose were obtained from Merck India Ltd. Mumbai, India. Andrographolide provided the BMW PHARMACO INDIA PVT.

2.2 Pre formulation Study

Preliminary analysis in pre-formulation research involves assessing the substance's color, taste, and odor. Visual inspection is used color, consistency, and transparency of material. The objective of pre-formulation research is provide a scientific foundation for formulation strategies, enhancing likelihood of developing suitable product. These studies also support the drug product's quality. Pre-formulation involves analyzing the physical, chemical, and characteristics of sustained-release matrix tablet material, alone and with excipients.

2.2.1 Organoleptic parameters

The organoleptic profile of Andrographolide and Pantoprazole was characterized its visual attributes color, odor, and overall appearance. The substance appeared as a white to off-white powder, exhibited no discernible odor, and had mildly bitter taste (**Sahu *et al.*, 2026**).

2.2.2 Solubility study

The solubility study of Andrographolide and Pantoprazole was introducing 1 mg drug into various selected solvents. These included polar solvents like water, ethanol, and methanol, along with non-polar solvents like chloroform and petroleum ether. Each sample in separate test tube and vigorously shaken. After allowing the mixtures to settle, they were visually assessed to determine clarity and existence of any undissolved drug particles. A solution was indicative of good solubility, whereas appearance of turbidity or sediment signified poor solubility. This preliminary solubility assessment provides essential information for understanding solubility profile of Andrographolide and Pantoprazole and assists in appropriate selection of solvents for formulation (**Jain and Verma 2020**).

2.2.3 Melting Point

Andrographolide and Pantoprazole melting point was determined using open capillary method with Thiele's tube apparatus (Chowk, M. I. 2020).

2.2.4 Determination of Lambda max and calibration curve

2.2.4.1 Lambda (λ) max

A stock solution of Andrographolide and Pantoprazole was prepared at concentration about 1 mg/mL using 80% methanol as solvent. From this, a working standard solution containing 100 μ g/mL of Andrographolide and Pantoprazole was obtained by appropriate dilution with same solvent. The working solution was then scanned in the UV-visible range of 200–400 nm using Shimadzu 1700 Double beam spectrophotometer. The wavelength corresponding to maximum absorbance (λ max) was identified and recorded further analytical work (Kumbhar and Salunkhe 2013).

2.2.5 Standard calibration curve

An accurately weighed quantity of 10-milliliter volumetric flask, 10 milligrams of Andrographolide and Pantoprazole were added, dissolved in 80% methanol, and the volume adjusted to mark with the same solvent to prepare primary stock solution (1 mg/mL). From this stock, 1 ml pipetted into another 10 ml of volumetric flask that diluted to volume with 80% methanol to secondary stock solution (100 μ g/mL). This solution was scanned in wavelength range of 200–400 nm by UV-visible spectrophotometer to determine absorption maximum (λ max). Based on λ max obtained, series of dilutions were prepared (typically in range of 5–25 μ g/mL): and their absorbance were measured at the identified λ max to construct the standard calibration curve. A plot of absorbance versus concentration used to establish linearity and generate the calibration equation.

2.2.6 Preparation of calibration curve

The previously prepared stock solution of Andrographolide and Pantoprazole was further diluted with 80% methanol to obtain working standard solutions at concentrations, 5, 10, 15, 20 and 25 μ g/mL. Measurements of each solution's absorbance were made at the previously determined λ max, using 80% methanol as the blank. Plotting the Andrographolide and Pantoprazole concentration (μ g/mL) on the X-axis and the corresponding absorbance values on Y-axis allowed for formation of a standard calibration curve. This calibration curve followed Beer's law within the concentration range of 10–50 μ g/mL and assess the linearity of method (Behera *et al.*, 2012).

2.2.7 Fourier transmission Infra-Red Spectroscopy

The FT-IR spectrum of Andrographolide and Pantoprazole was recorded range of 4000–400 cm^{-1} using method of KBr pellet. To prepare KBr disc, 1mg Andrographolide and Pantoprazole was thoroughly mixed with 100 mg of spectroscopic-grade KBr, which had been dried using an infrared lamp to remove any

absorbed moisture. The mixture was finely ground to homogeneous powder to ensure uniform dispersion of sample within KBr matrix.

A hydraulic press was then compressing the prepared powder under pressure (about 8 tons) to form clear disk. This disc was placed into FT-IR spectrometer for study. The resulting spectrum provided detailed information about functional groups and molecular structure of Andrographolide and Pantoprazole (Puri, 2021).

2.3 Powder Property

2.3.1 Flow property (Angle of repose) (Rosland Abel *et al.*, 2020).

The rest angle was computed using the funnel method. Powder was poured using a vertically moving funnel until the maximum cone height, h , was attained. The diameter of Heap D was computed. The formula the angle of repose was measured using i .

$$\tan \theta = h / r$$

$$\theta = \tan^{-1}(h/r)$$

Where, θ is radius, h is height in centimeters, and i is angle of repose.

2.3.2 Bulk density

A funnel was used gently add a precisely weighed sample of measurement cylinder, granulation. The volume was then noted. A graded cylinder fixed on a mechanical tapping device served as apparatus's means of measuring packing's volume.

Apparent bulk density examined by formula.

$$BU = M/V_u$$

Where M =Mass of granulation V_u =volume of granulation (Initial untapped volume).

2.3.3 Tapped density

The above procedure was followed. Until no more volume reduction was detected, final volume was tapped. The formula that follows was used to get packed bulk density.

$$DB = m/V_b$$

Therefore, m = mass of granulation in gm V_b = volume of granulation.

2.3.4 Carr's Index

It shows in percentages and is represented by.

$$I = \frac{D_t - D_b}{D_t}$$

Where, D_b represents the powder bulk density along with D_t represents its tapped density.

2.3.5 Housner Ratio

In percentage terms, it is represented by.

$$H = \frac{D_t}{D_b}$$

Therefore, D_t is powder's tapped density, while D_b is its bulk density. Lower Hausner ratio (< 1.25) indicates better flow than higher ones (> 1.25).

2.4 Development of tablet

To create Andrographolide and Pantoprazole matrix tablets, direct compression was involved in different polymers ratios. The matrix tablets composition given in table -4. With exception of lubricant and glidant, each ingredient was separately run through a 60-mesh sieve. The Andrographolide and Pantoprazole amounts needed

for formulation polymer (HPMC K-100 and Eudragit RLPO); were precisely weighed with composition and mixed in polybag for about 30 to 45 minutes. The obtained blend was lubricated with magnesium stearate and talc for another 5 minutes. A rotary tablet press fitted with flat-faced punches was used to weigh the mixture and crush it at the precise compression force needed to create tablets with hardness of kg/cm². For future use, all tablets were kept in sealed containers (Pardo *et al.*, 2026).

Table 1: Compositions of Andrographolide and Pantoprazole tablet.

Ingredients(mg)	Formulations					
	F1	F2	F3	F4	F5	F6
Andrographolide and Pantoprazole (80mg)	1:1	1:1	1:1	1:1	1:1	1:1
HPMC K-100	25.0	50.0	75.0			
Eudragit RLPO				25.0	50.0	75.0
PVP	15.0	15.0	15.0	15.0	15.0	15.0
Magnesium stearate	5.0	5.0	5.0	5.0	5.0	5.0
MCC	10.0	10.0	10.0	10.0	10.0	10.0
Talc	65.0	40.0	15.0	65.0	40.0	15.0
Total Weight	200.0	200.0	200.0	200.0	200.0	200.0

2.5 Matrix tablet assessment (Dinesh *et al.*, 2014)

2.5.1 Hardness

Hardness tester made by Monsanto was evaluate tablets hardness. The tester is comprised up of two plungers and a barrel with compressible spring within. A zero reading was by touching tablet with lower plunger. After that, a threaded bold was turned to drive and push the plunger against a spring till the tablet broke. A pointer travels along a gauge in the barrel to show force when the spring compresses. The zero-force reading was subtracted from force of fracture, which was noted. Every formulation underwent testing on ten tablets.

2.5.2 Friability

Friability of tablets was by friabilator (Erweka, TAP, and Germany). It subjected subjecting tablets to shock and abrasion, plastic chamber revolves dropping tablet for 4 min at 25 rpm six inches high each revolution. They reweighed tablets. The tablets were reweighed after being cleaned with a gentle cotton towel.

2.5.3 Weight variation

Twenty pills were chosen at random, separately weighed, and their weights compared to mean weight that was determined. Using this procedure, deviation of no more than 2 pills should exceed the pharmacopoeia limitations by $\pm 5\%$ of weight.

2.5.4 Drug Content

10 tablets was selected at random. Each pill was put to a 50mL volumetric flask, dissolved, and diluted to 50 mL with phosphate buffer pH 6.8. The 1 ml solution was diluted using 100 milliliters of pH 6.8 phosphate buffer. The drug amount in each tablet was evaluated by UV spectroscopy at 237.0nm.

2.5.5 In-vitro dissolution rate

The release frequency of Andrographolide and Pantoprazole from tablets was ascertained USP Dissolution Testing Equipment II. 900 ml of phosphate buffer pH 6.8, kept at $37 \pm 0.50^\circ\text{C}$, served as the dissolving media. The paddle speed was kept at 50 rpm throughout the study. At 5-minute intervals, 5 ml of samples were extracted and diluted to 10 ml before being replaced with 5 ml fresh dissolving media at same temperature. The samples were spectrophotometrically measured at 237.0 nm with a blank of phosphate buffer pH 6.8 (Dhruba *et al.*, 2014).

2.6 Kinetic studies

The in vitro drug release data were evaluated using zero-order, first-order, and Higuchi kinetic models to determine the release pattern and mechanism. Zero-order kinetics describes drug release at a constant rate independent of drug concentration, whereas first-order kinetics describes concentration-dependent drug release. The Higuchi model explains drug release primarily through Fickian diffusion, where the amount of drug released is proportional to the square root of time.

Zero-Order Kinetics

$$A_t = A_0 - K_0t$$

where A_t is the amount of drug released at time t , A_0 is the initial drug concentration, and K_0 is the zero-order release rate constant. A plot of cumulative percentage drug released versus time indicates zero-order kinetics when linear.

First-Order Kinetics

$$\log C = \log C_0 - Kt/2.303$$

where C is the amount of drug remaining at time t , C_0 is the initial drug amount, and K is the first-order rate constant. A linear plot of log cumulative percentage drug remaining versus time indicates first-order kinetics.

Higuchi Model

$$Q \propto \sqrt{t}$$

The Higuchi model describes diffusion-controlled drug release from a matrix system. Here, Q represents the amount of drug released at time t . A linear relationship between cumulative amount of drug released and the square root of time indicates diffusion-controlled release.

2.7 Stability Studies

The optimized tablet formulation was subjected to stability studies according to ICH guidelines for three

months under accelerated conditions of $30 \pm 2^\circ\text{C}/65 \pm 5\% \text{ RH}$ and $40 \pm 2^\circ\text{C}/75 \pm 5\% \text{ RH}$. Samples were evaluated at 0, 1, 2, and 3 months for appearance, hardness, friability, weight variation, drug content, disintegration time, and in vitro drug release. The formulation was considered stable when no significant changes in physicochemical properties or drug-release characteristics were observed during storage (Aulton *et al.*, 2013).

3. RESULTS AND DISCUSSION

3.1 pre-formulation studies

Pre-formulation studies were performed. The result is given below.

3.1.1 Organoleptic evaluation

Table 2: Organoleptic evaluation of Andrographolide and Pantoprazole.

Drug	Organoleptic properties	Observation (Andrographolide)	Observation (Pantoprazole)
Andrographolide and Pantoprazole	Color	White to off-white	White
	Odor	Odourless	Odorless
	Appearance	Solid crystals	Solid
	State	Crystalline solid	Crystalline powder

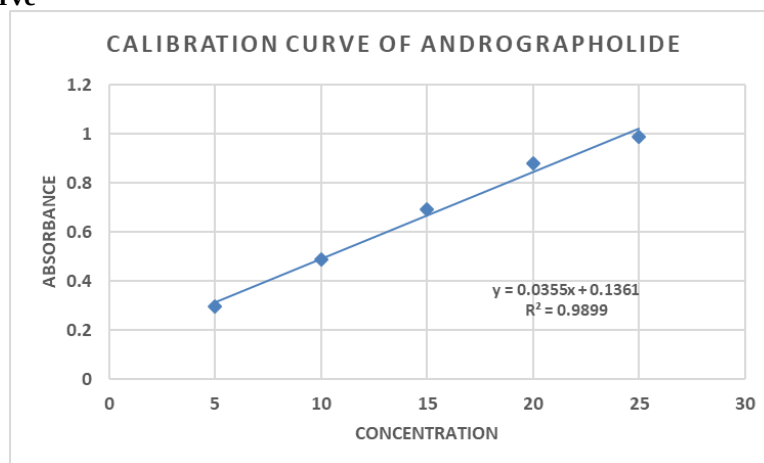
3.1.2 pH and Melting point determination.

Table 3: pH and Melting point of Andrographolide and Pantoprazole.

Drugs	Observed (pH)	Specification (Melting point)	Inference (Melting point)
Andrographolide	6.4	232°C	230–235°C
Pantoprazole	7.1	140°C	139 – 142°C

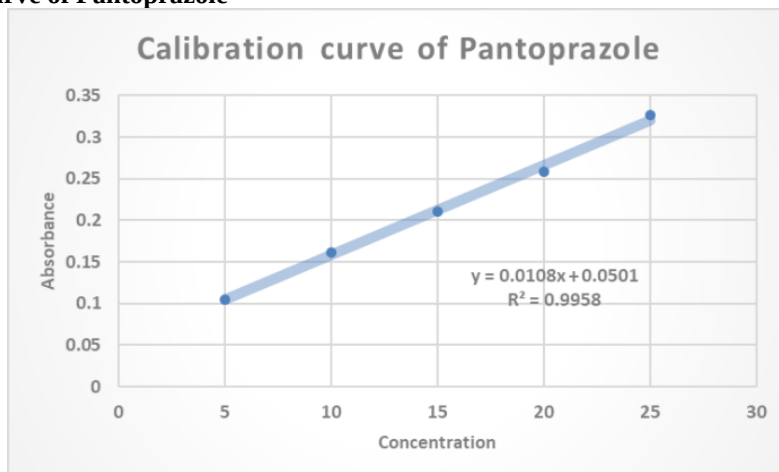
3.1.3 Standard calibration curve of Andrographolide and Pantoprazole

3.1.3.1 Calibration curve



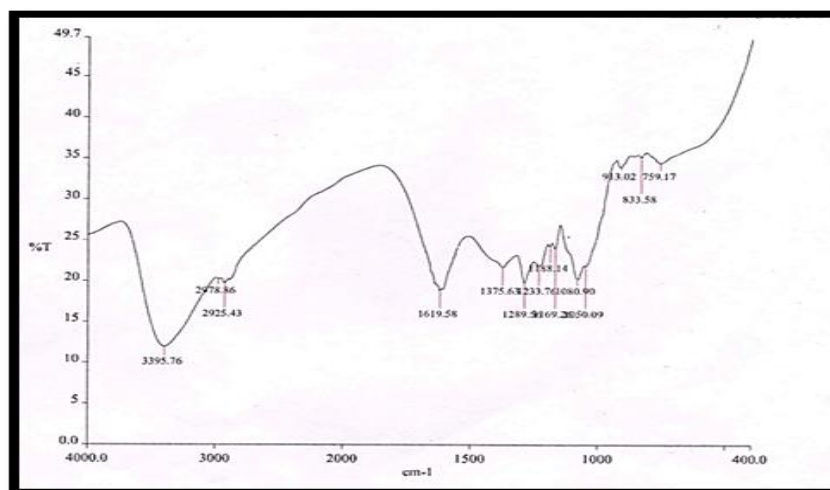
Graph 1: Calibration curve of Andrographolide.

3.1.3.2 Calibration curve of Pantoprazole

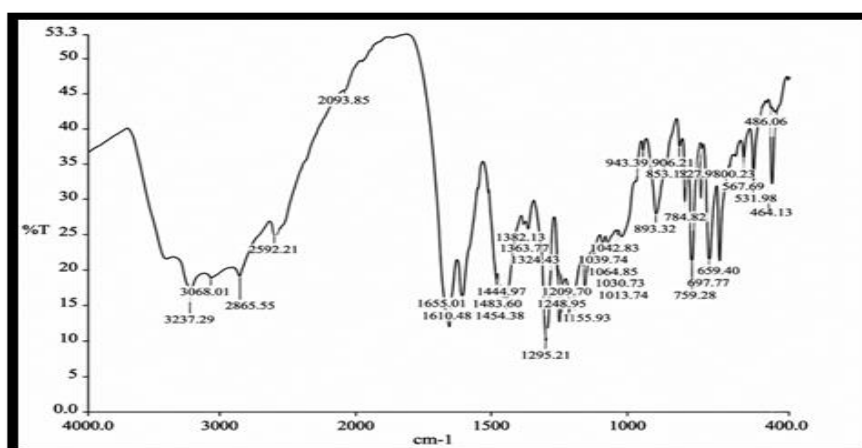


Graph 2: Calibration curve of Pantoprazole.

3.1.4 FTIR



Graph 3: FTIR graph of Andrographolide.



Graph 4: FTIR graph of Pantoprazole.

3.2 Powder Property

Table 4: Flow ability properties of granules.

Formu-	Angle of repose	Bulk	Tapped	Carr's index	Hausner's	Loss on
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lation		Density	density	ratio	ratio	dying
F 1	29.42±0.56	0.412±0.01	0.460±0.01	10.43±0.18	1.11±0.013	0.86
F 2	24.11±0.55	0.312±0.03	0.363±0.03	14.04±0.23	1.16±0.008	0.99
F 3	28.63±0.76	0.269±0.08	0.322±0.05	16.45±0.52	1.19±0.006	0.93
F 4	22.63±0.13	0.318±0.04	0.326±0.08	2.45±0.18	1.02±0.007	1.05
F 5	21.52±0.44	0.309±0.06	0.349±0.07	11.46±0.55	1.12±0.005	0.85
F 6	24.36±0.24	0.325±0.01	0.376±0.07	13.56±0.28	1.15±0.012	0.67

3.3 Matrix tablet assessment

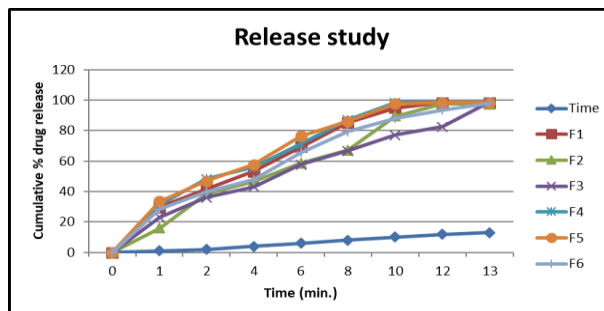
Table 5: Evaluation of tablet.

Formulation	Thickness (mm)	Hardness (kg/cm ²)	Friability (%)	Weight variation (%)	Drug content (%)
F 1	5.8±0.01	4.1±0.12	0.46±0.03	200±0.88	96.23
F 2	5.7±0.03	3.9±0.05	0.56±0.05	201±1.54	97.26
F 3	6.1±0.03	4.2±0.06	0.56±0.07	199±1.29	98.86
F 4	6.0±0.04	4.3±0.06	0.23±0.08	201±1.57	96.38
F 5	6.0±0.08	4.3±0.09	0.78±0.09	202±1.87	96.11
F 6	5.8±0.07	4.4±0.03	0.88±0.03	200±1.97	97.56

3.3.1 In-vitro release of drug.

Table 6: Release study of formulations (F1 to F6).

Time	F1	F2	F3	F4	F5	F6
0	0	0	0	0	0	0
1	29.63	16.02	23.11	31.23	33.47	28.36
2	41.53	38.56	36.1	48.27	46.78	39.63
4	53.11	46.63	43.13	55.96	57.63	47.86
6	69.13	58.55	57.59	71.28	76.34	65.56
8	85.22	67.22	66.83	87.13	86.13	79.35
10	95.03	89.56	77.17	98.33	97.58	88.23
12	98.25	97.36	82.41	98.34	98.35	93.66
13	---	----	98.69	---	98.35	98.04



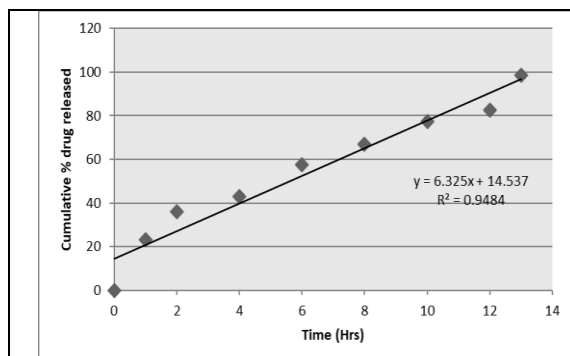
Graph 5: Release study.

Table 7: Release kinetics study of tablet formulation (F3 formulation).

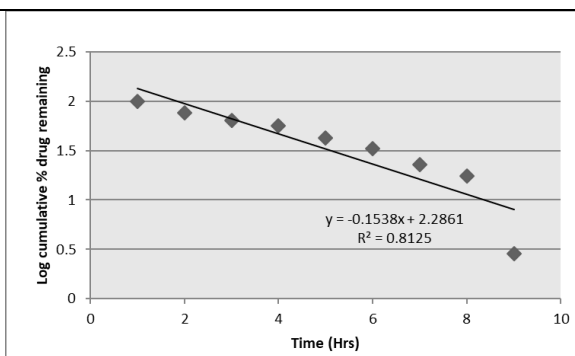
Time (Hr)	cumulative % drug released	% drug remaining	Square root time	log Cumu % drug remaining	log time	log Cumu % drug released
0	0	100	0.000	2.000	0.000	0.000
1	23.11	76.89	1.000	1.886	0.000	1.364
2	36.1	63.9	1.414	1.806	0.301	1.558
4	43.13	56.87	2.000	1.755	0.602	1.635
6	57.59	42.41	2.449	1.627	0.778	1.760
8	66.83	33.17	2.828	1.521	0.903	1.825
10	77.17	22.83	3.162	1.359	1.000	1.887
12	82.41	17.59	3.464	1.245	1.079	1.916
13	98.69	2.86	3.606	0.456	1.114	1.987

Table 8: Correlation value (R^2 value)

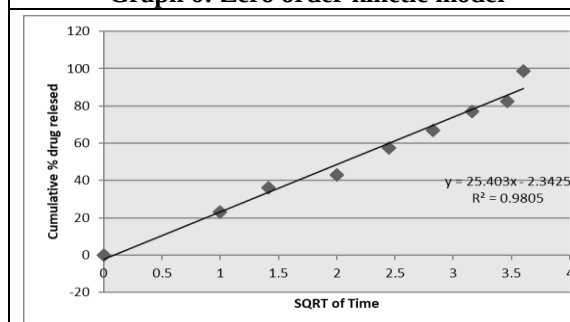
Formulation	Model	Kinetic parameter values
Tablet formulation	Zero Order	$R^2 = 0.948$
	First Order	$R^2 = 0.812$
	Higuchi	$R^2 = 0.983$
	Korsmeyerpeppas	$R^2 = 0.609$



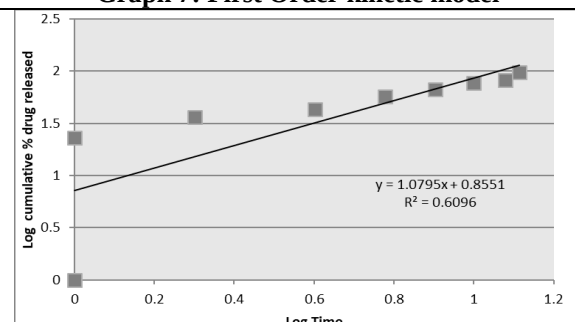
Graph 6: Zero order kinetic model



Graph 7: First Order kinetic model



Graph 8: Higuchi model



Graph 9: Korsmeyer peppas

3.4 Stability study

Table 9: Stability Study of Optimized Tablet Formulation at $30 \pm 2^\circ\text{C}$ / $65 \pm 5\%$ RH.

Parameters	Initial	After 1 Month	After 2 Months	After 3 Months
Appearance	Smooth and uniform	No change	No change	No change
Thickness (mm)	6.0 ± 0.03	6.0 ± 0.02	6.0 ± 0.04	6.1 ± 0.03
Hardness (kg/cm^2)	4.3 ± 0.05	4.3 ± 0.04	4.2 ± 0.03	4.2 ± 0.05
Friability (%)	0.23 ± 0.08	0.24 ± 0.04	0.25 ± 0.03	0.27 ± 0.05
Weight Variation (mg)	201 ± 1.57	201 ± 1.44	200 ± 1.51	200 ± 1.62
Drug Content (%)	98.86 ± 0.24	98.63 ± 0.18	98.21 ± 0.26	97.92 ± 0.29
Disintegration Time (min)	8.2 ± 0.12	8.3 ± 0.11	8.4 ± 0.14	8.5 ± 0.16
Cumulative Drug Release (%)	98.12 ± 0.32	97.96 ± 0.28	97.72 ± 0.35	97.48 ± 0.31

Table 10: Accelerated Stability Study of Optimized Tablet Formulation $40 \pm 2^\circ\text{C}$ / $75 \pm 5\%$ RH.

Parameters	Initial	After 1 Month	After 2 Months	After 3 Months
Appearance	Smooth and uniform	No change	No change	No change
Thickness (mm)	6.0 ± 0.03	6.0 ± 0.04	6.1 ± 0.02	6.1 ± 0.03
Hardness (kg/cm^2)	4.3 ± 0.05	4.2 ± 0.04	4.2 ± 0.03	4.1 ± 0.05
Friability (%)	0.23 ± 0.08	0.25 ± 0.05	0.28 ± 0.04	0.31 ± 0.06
Weight Variation (mg)	201 ± 1.57	201 ± 1.42	200 ± 1.66	200 ± 1.71
Drug Content (%)	98.86 ± 0.24	98.42 ± 0.36	97.95 ± 0.28	97.48 ± 0.31
Disintegration Time (min)	8.2 ± 0.12	8.4 ± 0.15	8.5 ± 0.16	8.7 ± 0.14
Cumulative Drug Release (%)	98.12 ± 0.32	97.84 ± 0.26	97.41 ± 0.41	96.96 ± 0.37

DISCUSSION

The pre-formulation studies confirmed the identity, purity, and suitability of Andrographolide and Pantoprazole for tablet formulation. Both drugs showed

acceptable physicochemical characteristics, while FTIR analysis indicated good compatibility with the selected excipients. The prepared formulations (F1–F6) exhibited satisfactory post-compression properties, including

acceptable thickness, hardness, friability, weight variation, and drug content. Formulation F3 showed the highest drug content (98.86%) and the most desirable drug-release profile. Kinetic analysis demonstrated that F3 followed the Higuchi model with the highest correlation coefficient ($R^2 = 0.983$): indicating diffusion-controlled drug release. Stability studies under long-term and accelerated conditions showed no significant changes in the formulation characteristics, confirming the satisfactory stability of the optimized F3 formulation.

4. CONCLUSION

The present study successfully developed and evaluated sustained-release matrix tablets containing Andrographolide and Pantoprazole for gastric disorder management. Pre-formulation studies confirmed the suitability and compatibility of the drugs with selected excipients. The formulations prepared using HPMC K-100 and Eudragit RLPO showed satisfactory physicochemical properties and sustained drug release. Among all formulations, F3 exhibited the most desirable release profile, providing nearly complete drug release over 13 hours and following the Higuchi diffusion model. Stability studies further confirmed the formulation's stability under long-term and accelerated conditions. Overall, F3 was identified as the optimized formulation with potential to provide prolonged therapeutic action, reduce dosing frequency, and improve patient compliance in gastric disorder management.

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