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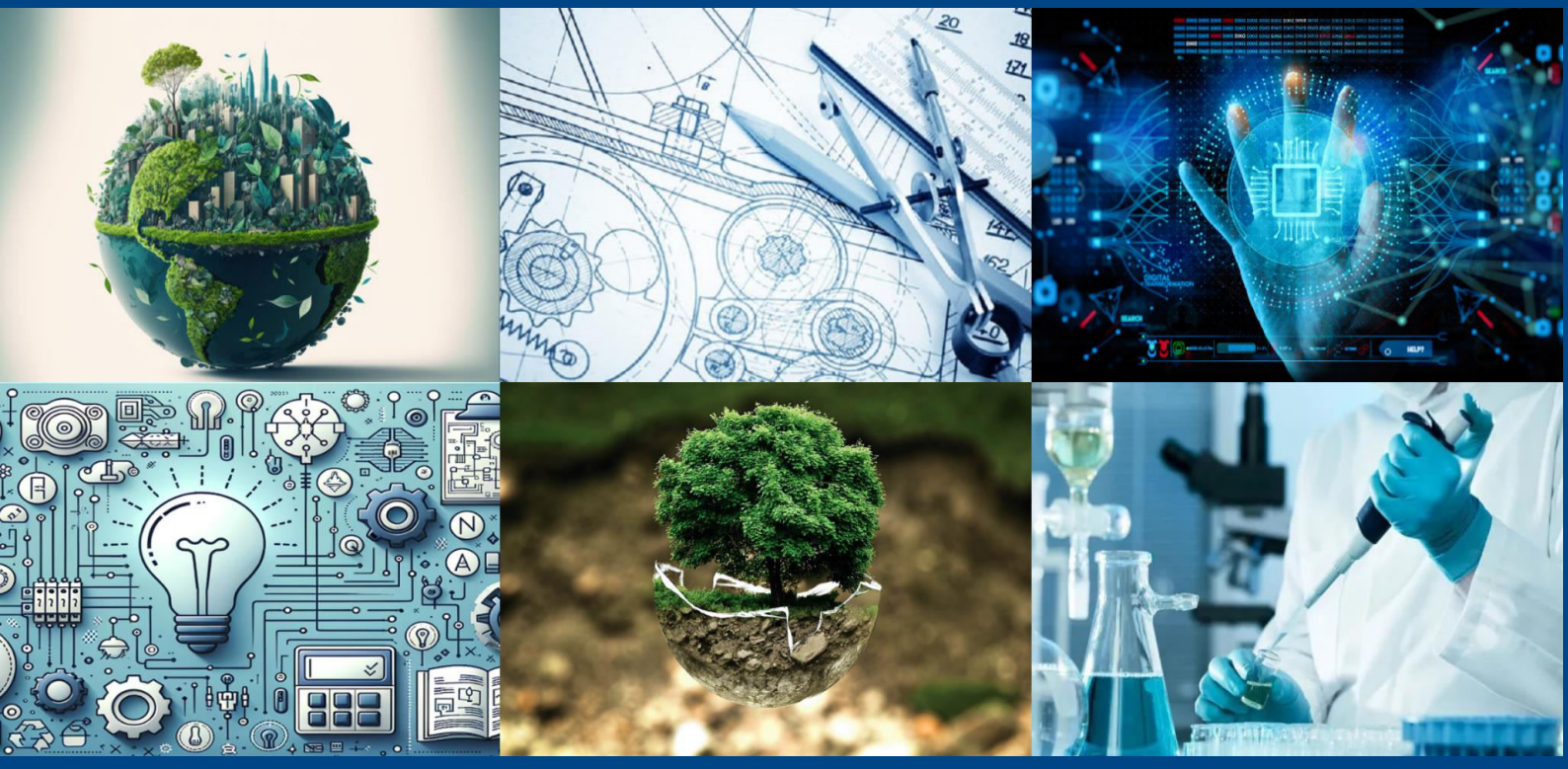

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Development of Herbal Tablet for Alleviating Symptoms of Myasthenia Gravis

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ABSTRACT: Myasthenia Gravis (MG) is a chronic autoimmune disorder that impairs communication between nerves and muscles, causing weakness and fatigue. Conventional treatments, while effective, often present limitations such as side effects and incomplete symptom relief. This study explores the development of a herbal tablet formulation using *Withania somnifera* (Ashwagandha) to provide a natural therapeutic alternative. Ashwagandha's adaptogenic, anti-inflammatory, and neuroprotective properties make it a suitable candidate for MG management.The formulation was prepared using the wet granulation method, combining Ashwagandha with excipients like Lactose (filler), Magnesium Stearate (lubricant), Tragacanth (binder), Crospovidone (disintegrant), and Talc (glidant). Preformulation studies, including organoleptic properties, phytochemical screening, and flow characteristics, ensured the stability and quality of the tablet. The prepared tablets underwent standard evaluations for hardness, friability, weight variation, disintegration, and dissolution. Results demonstrated that the developed formulation effectively met pharmaceutical standards, offering potential benefits in improving muscle strength, reducing fatigue, and supporting neuromuscular function.This study highlights the promising role of Ashwagandha in complementary MG treatment. Further clinical trials, bioavailability analysis, and long-term stability studies are recommended to establish its efficacy and safety profile.

KEYWORDS: Myasthenia Gravis, Ashwagandha, Herbal Tablet, Neuromuscular Disorder, Adaptogen

I. INTRODUCTION

Ashwagandha is one of the most revered plants in traditional Ayurvedic medicine in India. It is an erect, greyish, subshrub with inconspicuous yellow or greenish flowers followed by small, spherical, orangish-red berries containing yellow, kidney shaped seeds. It grows three to five feet tall, mainly on waste land, but is cultivated widely as the whole plant. Most commonly the root and leaf are used medicinally (Engels and Brinckmann, 2013) [5].

Ashwagandha is a reputed health food and herbal tonic and used for cardiovascular diseases in ethno medicine. It is available for human use either as a single herb or an ingredient of polyherbal or herbomineral formulations. The human doses of *Ashwagandha* are generally in the range of 4-6 g/day and expected to be safe and non-toxic. Withania contains active ingredients like steroidal alkaloids and lactones known "Withanolides". Withaferin A and withanolide D are the two main withanolides that contribute to most of the biological actions of withania (Matsuda *et al.*, 2001; Sharma *et al.*, 2011) [10, 14].

Survey of literature shows that most of the researches are on the medicinal, clinical properties of ashwagandha root powder but very rare information on the physicochemical properties of ashwagandha root powder. So the prime role of this investigation with objectives to evaluate functional, physical, chemical and overall other quality attributed of ashwagandha root powder.

II. MATERIAL AND METHOD

2.1 List of Chemicals

These are the chemical which are used in below formulation for formulating herbal tablet

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S.no	Name of chemical	Role of chemical
1	Ashwagandha	Rejuvenates Mind & Body
2	Lactose	Diluent, Binder
3	Magnesium Stearate	Lubricant
4	Tragacanth	Binder
5	Crospovidone	Disintegrant
6	talc	Glidant

Table no 2.1 list of chemicals

2.2 List of Glassware

These are the glassware which are used in below formulation to asses formulating herbal tablet

S.no	Glassware
1	Beaker
2	Funnel
3	Measuring cylinder
4	Glass road
5	Mortar Pestle
6	Pipette
7	Watch Glass

Table no 2.2 list of glassware

Drug and excipients profile

Ashwagandha (*Withania somnifera*): commonly known as Indian ginseng or winter cherry, is a powerful adaptogenic herb widely used in Ayurvedic medicine. It is known for its stress-relieving, rejuvenating, and immune-boosting properties. Ashwagandha contains bioactive compounds such as withanolides, alkaloids, and saponins, which contribute to its medicinal benefits. Traditionally, it has been used to enhance vitality, improve cognitive function, and reduce anxiety and fatigue. Research also highlights its potential in lowering cortisol levels, improving sleep

quality, and enhancing physical performance. Additionally, ashwagandha has anti- inflammatory, antioxidant, and neuroprotective properties, making it effective for conditions like arthritis, neurodegenerative diseases, and hormonal imbalances. It is commonly available in the form of powders, capsules, and tinctures, and is often included in wellness supplements.

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Drug profile

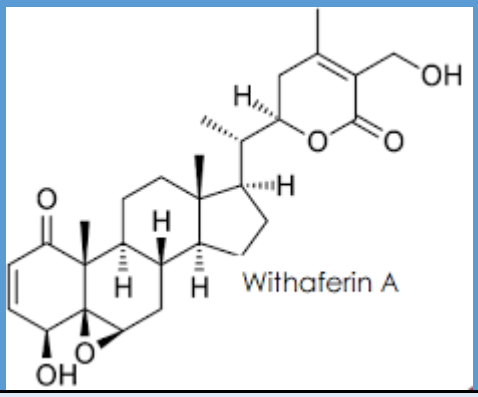
Structure	
Molecular formula	**C28H38O6**
Molecular Weight	**470.6 g/mol**
Family	**Solanaceae**
Uses	**Antistress, Depression, Joint pain.**
Solubility	**Soluble in water**
Appearance	**Whitish cream fine powder**

Table no 2.3 Drug profile

Excipients profile

	Lactose	**Magnesium Stearate**	**Tragacanth**	**Crospovidone**	**Talc**
Appearanc e	White crystalline powder	Light white powder	White to yellowis h white	White to creamy white powder	White powder
Solubility	Soluble in water & ethanol	Practically insoluble in ethanol & water	Practically insoluble in ethanol & water	Insoluble in water	Insoluble in water
% Used in Tablets	60-70	4-5	2-6	2-5	5-30
Category	Diluent	Lubricant	Binder	Disintegrant	Glidant

Table no 2.4 Excipients profile

1. Lactose

- Type: Filler/Diluent
- Chemical Name: β-D-galactopyranosyl-(1→4)-D-glucose

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- Molecular Formula: $C_{12}H_{22}O_{11}$
- Description: White to off-white crystalline powder.
- Solubility: Soluble in water; practically insoluble in alcohol.
- Function: Commonly used as a filler in tablet and capsule formulations. It enhances powder flow, improves tablet hardness, and ensures uniform weight.
- Grades Available:
  - Anhydrous Lactose: Better compressibility.
  - Lactose Monohydrate: Preferred for wet granulation.
- Incompatibilities: Can undergo the Maillard reaction with amine-containing drugs, resulting in discoloration or instability.

2. Magnesium Stearate

- Type: Lubricant
- Chemical Name: Magnesium octadecanoate
- Molecular Formula: $Mg(C_{17}H_{35}COO)_2$
- Description: Fine, white, odorless powder with a greasy texture.
- Solubility: Practically insoluble in water and ethanol.
- Function: Used to reduce friction between particles and tablet press surfaces, improving tablet ejection. It also minimizes powder adhesion during manufacturing.
- Optimal Use Level: 0.25%–2% w/w
- Incompatibilities:

Excessive use can retard tablet disintegration.
May react with acidic drugs, reducing their stability.

3. Tragacanth

- Type: Binder, Thickener, Suspending Agent
- Chemical Name: Natural polysaccharide gum obtained from *Astragalus* species.
- Molecular Formula: Complex polysaccharide structure.
- Description: Off-white to pale yellow, odorless, fibrous powder.
- Solubility: Swells in water to form a viscous colloidal solution; insoluble in alcohol.
- Function:

Used as a natural binder in tablet granulation.
Provides viscosity and stability in suspensions and emulsions.

- Optimal Use Level: 1%–5% w/w
- Incompatibilities: May degrade in alkaline conditions or with strong acids.

4. Crospovidone

- Type: Superdisintegrant
- Chemical Name: Cross-linked polyvinylpyrrolidone (PVP)
- Molecular Formula: $(C_6H_9NO)_n$
- Description: White to off-white, free-flowing, hygroscopic powder.
- Solubility: Practically insoluble in water but swells rapidly in aqueous environments.
- Function: Enhances tablet disintegration and improves bioavailability.
- Optimal Use Level: 2%–5% w/w
- Key Feature: Effective even at low concentrations and suitable for direct compression or wet granulation.
- Incompatibilities: Stable in most conditions; no major interactions reported

5. Talc

- Type: Glidant, Anti-caking agent
- Chemical Name: Hydrated magnesium silicate
- Molecular Formula: $Mg_3Si_4O_{10}(OH)_2$
- Description: Fine, white to grayish-white, odorless powder with a soapy texture.
- Solubility: Insoluble in water, alcohol, and acids.
- Function: Improves powder flow during tablet compression, minimizes friction, and prevents sticking

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in machinery.

- Optimal Use Level: 1%–5% w/w
- Incompatibilities:

Inert but requires proper purity control to avoid asbestos contamination.
Excessive use may reduce tablet dissolution rates.

Materials and Methods

2.5.1 Collection of Materials

The required materials for the present investigation were collected from the local markets of the Marothiya .

2.5.2 Preparation of Powder

The dried roots of ashwagandha root were grinded in disc mill. The obtained powder is then allowed to sieve from rotary sieve shaker containing sieves of different mesh no. viz. 30, 60 and 100.

2.5.3 Preparation of ethanolic, acetonic and aqueous extracts of ARP (Ashwagandha Root Powder)

The powdered Ashwagandha root samples (50 g/250 mL) were extracted successively with methanol, acetone and water using soxhlet apparatus at 55-85^{0}C for 8-10 h in order to extract the polar and non-polar compounds (Elgorashi and Staden, 2004).

2.6 Preformulation studies

2.6.1Organoleptic properties

- **Appearance**: Light brown to dark brown powder with a slightly fibrous texture. The roots are usually long, slender, and cylindrical.
- **Odor:** Characteristic earthy, slightly pungent, and musty aroma.
- **Taste:** Bitter, astringent, and slightly pungent.
- **Touch/Texture:** Root powder feels coarse or fibrous with a somewhat dry texture.

2.6.2 Phytochemical screening

1. **Test for Alkaloid Wagner's test:** About ten mg of extract was taken and few drops of Wagner's reagent (Dissolve 2 g of iodine and 6g of KI in 100 cm3 of water) was added and the formation of a reddishbrown precipitate indicates the presence of alkaloids.
2. **Test for Flavonoid Lead acetate test:** Ten mg of extract was taken and few drops of 10% lead acetate solution was added. Appearance of yellow colour precipitate indicates the presence of flavonoids.
3. **Test for Tannin Ferric Chloride Test:** To 5 ml of the sample, a few drops of 0.1% ferric chloride were added. The presence of a brownish green or blue black colour indicated that the material possessed tannins.
4. **Test for Saponin Foam test:** 0.5 mg of extract was diluted with 20 ml distilled water and shaken well in a graduated cylinder for 15 min. The formation of foam to a length of 1 cm indicated the presence of saponins.
5. **Test for Carbohydrates Fehling's test:** Five ml of Fehling's solution was added to 0.5
6. mg of extract and boiled in a water bath. The formation of yellow or red precipitate indicates the presence
7. **Test for Glycosides Glycoside test:** 0.5 mg of extract was dissolved in 1 ml of water and then aqueous NaOH solution was added. Formation of yellow colour indicates the presence of glycosides

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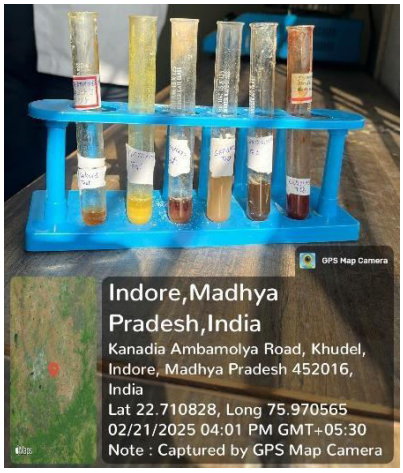
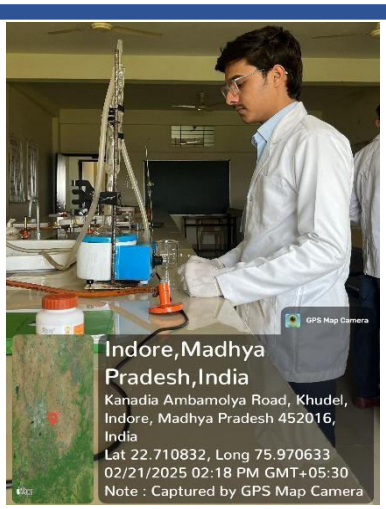


Fig no2.6.1 :- phytochemical screening



Figno2.6.2:-Extractionofpowder

2.7 Flow property of powder

Angle of repose: Angle of repose: The funnel method was used to calculate the angle of repose. The carefully weighed mixture was poured into a funnel. The funnel's height has been modified so that the tip barely brushes the top of the heap or head of blend. The mixture of drug excipients was permitted to freely flow down the funnel and onto the surface. The powder cone's diameter was measured. the following equation was used to get the angle of repose: $\tan \theta = h/r$ $\theta = \tan^{-1} h/r$

Where h is the height of the newly generated powder heap and r is its radius. A weighed amount of the mixture was poured into a graduated cylinder, and the volume and apparent bulk density were measured.

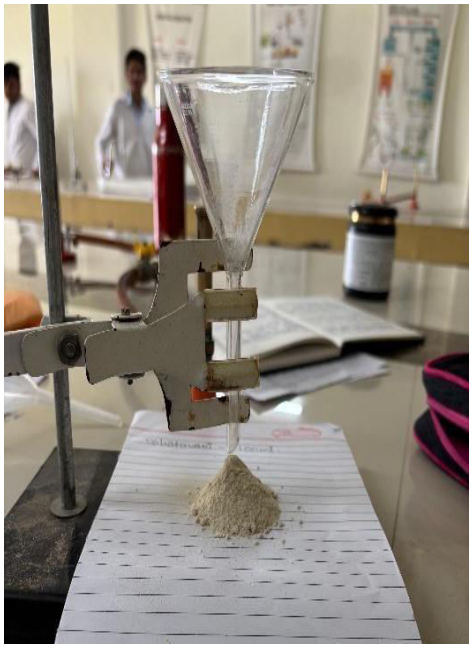


Fig.no2.7.1: -Angle of repose

1. Bulk Density: The apparent bulk density was calculated by pouring a predetermined amount of the mix into a graduated cylinder, weighing it, and then measuring the volume. BD = Weight of the powder / volume of the packing.

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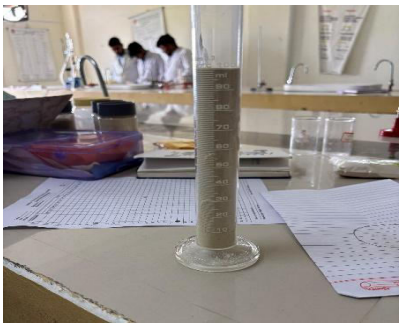

Fig no 2.7.2: - Bulk density

2. Tapped Density: Tapped density was calculated by setting a graduated cylinder with a known mass of the drug excipient mixture on top of it. The cylinder was allowed to land on a hard surface as a result of its own weight. The tapping was kept up until there was no longer any loudness change

TD = Weight of the powder / volume of the tapped packing.

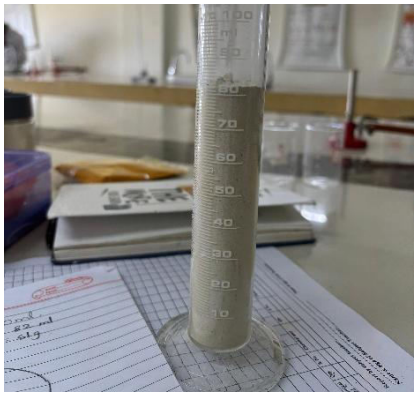

Fig no 2.7.3: - tapped density

1. Compressibility Index: Carr's compressibility index was used to calculate the blends' compressibility indices. compressibility index (%) = (TD-BD) x 100 / TD

2. Hausner's Ratio: It measures the drug's flow characteristic. Hausner's Ratio = Tapped density/ Bulk density.

3. Loss on drying at 105°C: 10g of sample was placed in tarred evaporating dish. It was dried at 105˚C for 5 hours in hot air oven and weighed. The drying was continued until difference between two successive weights was not more than 0.01 after cooling in desiccator. Percentage of moisture was calculated with reference to weight of the sample.

Fig no 2. 7.4: - loss on drying

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7. Total Ash: 2g of sample was incinerated in a tared platinum crucible at temperature not exceeding 450˚C until carbon free ash is obtained. Percentage of ash was calculated with reference to weight of the sample.

Fig no 2.7.5: - Ash value

1.8Method of Preparation

Wet granulation method

- Pass all the ingredients through sieve no. 80.
- Mix Ashwagandha, Crospovidone, Tragacanth & Magnesium stearate.
- Prepare separately Lactose solution with water (Q.S).
- Add the solution to the mixture to form a damp coherent mass.
- Pass the coherent mass through sieve no.12 to form granules.
- Dry the granules at 50-600C for 1 hour in hot air oven. 7
- Pass the dried granules through sieve no.16 or 18.
- Add Talc and mix thoroughly.
- Evaluate the preparation for preformulation studies.

Ingredients	Formulations	
	AG1	**AG2**
Ashwagandha	500	500
Lactose	114	114
Magnesium Stearate	6	12
Tragacanth	6	6
Crospovidone	18	12
Talc	6	6
Total	650	650

Table no 2.8.1 Formulation table

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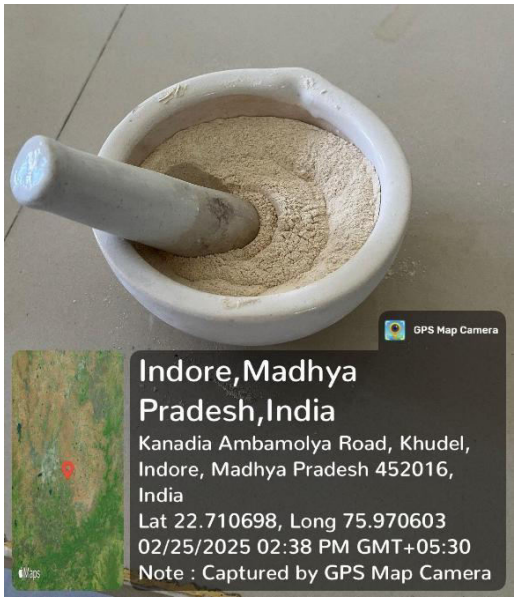

Fig no 2.8.2 Mixing of drug

Fig no2.8.3 granules of ashwagandha

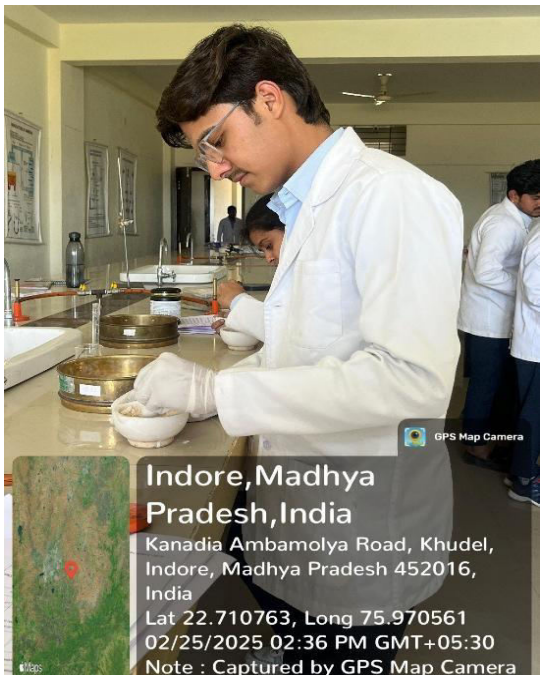

Fig no2.8.4 Dump mass

Fig no2.8.5 Ashwagandha tablet

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2.9 Evaluation parameter

1. Organoleptic Properties

1. Appearance:

- Typically, light brown to beige in color.
- Surface may be smooth, with slight speckling due to herbal powder content.
- Available in round, oval, or oblong shapes.

2. Odor:

- Characteristic earthy, slightly pungent aroma.
- Herbal scent may become prominent upon breaking the tablet.

3. Taste:

- Bitter, astringent, and slightly pungent.
- Some formulations may include coatings to mask the bitterness.

4. Texture:

- Hard with a smooth or slightly rough surface.
- Breaks cleanly when split, with visible herbal particles in cross-section.

5. Color:

- Natural beige to brownish hue, influenced by the presence of ashwagandha root powder and other excipients.

6. Tablet thickness: The single dimensional variable connected to the compression process of tablets is the thickness of the tablet. Typically, a micrometre is used to measure it. In addition to controlling for patient approval and simplifying tablet packing, the thickness should be within 5% of a defined value.

7. Hardness: To withstand mechanical handling during production, packaging, and shipping, tablets need to have a specific level of strength or hardness and resistance to friability. The strength of a tablet's crushing is typically measured by hardness.

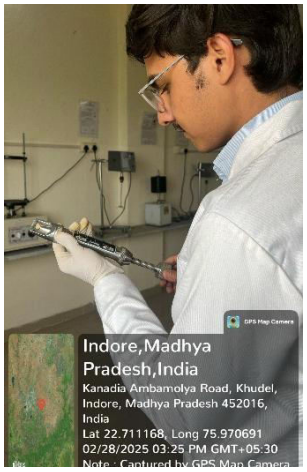

Fig no 2.9.1: - Hardness

Fig no2.9.2: -Hardness

6. Friability: A tablet's friability can be assessed in a lab setting using a Roche friabilator. This consists of a plastic chamber that rotates at 25 revolutions per minute, dropping the tablets into the friabilator through a distance of six inches, and then operating for 100 revolutions. The tablets are weighed again. Tablet compression that loses between 0.5 and 1.0 percent of the tablet weight is acceptable. Friability = Initial weight - Final weight / Initial weight ×100.

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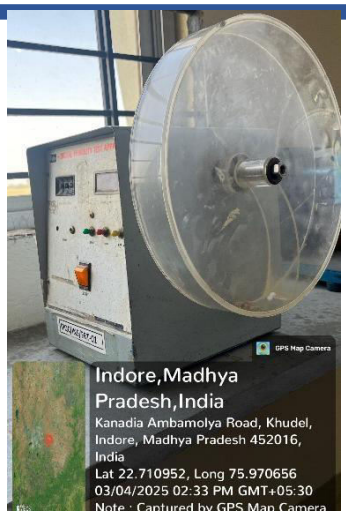

Figno2.9.3: -Friability

Weight Variation Test (U.S.P.): Take 20 tablets, each to be weighed separately. Calculate the average weight before comparing it to the weight of each tablet. If no more than two tablets fall outside the allowed percentage range and no tablet deviates by more than twice the allowed range, the tablet passes the USP test.

Disintegration Test (U.S.P.):

1. The U.S.P. disintegration test apparatus consists of six 3cm long glass tubes that are open at the top and 10 mesh screens at the bottom.
2. One tablet is inserted in each tube, and the basket rack is placed in a 1L beaker of water, simulated gastric fluid, or simulated intestinal fluid at 370C such that the tablet remains 2.5 cm below the liquid surface.
3. On their upward movement and not more than 2.5 cm from the bottom of the beaker on their downward movement.
4. At a frequency of 28 to 32 cycles per minute, move the basket containing the tablets up and down over a distance of 5 to 6 cm.
5. Placing perforated plastic discs on each tablet will stop it from floating.
6. For the test to pass, the tablet must disintegrate and all particles must pass through the 10-mesh screen in the allotted amount of time. If any residue is left, it must have a soft bulk

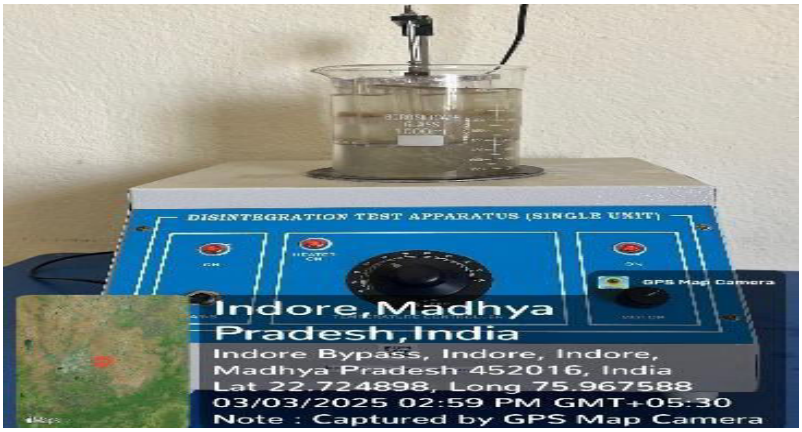

Fig no 1.9.4: - Disintegration Test

7. **Dissolution test (U.S.P)**

- Fill the dissolution vessels with the selected medium and bring it to 37 ± 0.5°C.
- Place one tablet in each vessel. For USP Type I (Basket), secure the tablet in the basket.

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- Begin the rotation (50–75 rpm as required).
- Withdraw 10 mL of the sample at predetermined intervals (e.g., 5, 10, 15, 30, 45, and 60 minutes).
- Filter the sample to remove undissolved particles (e.g., using a 0.45 µm filter).
- Immediately replace the withdrawn volume with fresh dissolution medium (pre- warmed to 37°C) to maintain constant volume.
- Analyze the filtered sample using UV-Visible Spectrophotometry or HPLC.
- Measure absorbance at the API's specific wavelength.

Fig no 2.9.5: - Dissolution Test

III. RESULT AND DISCUSSION

3.1Result

The active ingredient tested in this paper exhibit the considerable properties as mentioned below.

1 Organoleptic Properties:

As per the method given in 4.1.1 the following result obtain

Property	Description
Appearance	Light brown to beige, with possible visible herbal particles. Surface may be smooth or slightly rough.
Color	Natural brownish or earthy tone (due to ashwagandha root powder).
Odor	Characteristic earthy, slightly pungent, and musty aroma.
Taste	Bitter, astringent, and slightly pungent (common for herbal formulations).
Texture	Hard and firm; may feel slightly coarse if uncoated.
Shape	Typically round, oval, or oblong, depending on the manufacturer.

Table no 3.1.1 organoleptic properties

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2 Qualitative screening of Phytochemical Constituents of ashwagandha root Powder

Preliminary qualitative phytocheical analysis was carried out to identify the secondary metabolites present in the ashwagandha root powder extracts of acetone, etahanol and aqueous. The following results had been made

Sr. No.	Phytochemical Constituents	Extracts			Name of the Test
		Ethanol	Acetone	Aqueous	
1	Alkaloid	+	+	+	Wagner's Test
2	Flavonoid	+	+	-	Lead acetate test
3	Tannin	+	+	+	Ferric Chloride Test
4	Saponin	+	-	+	Foam test
6	Carbohydrate	+	+	+	Fehling's test
7	Glycoside	+	+	+	Glycoside test

Table no3.1.2 Phytochemical screening

3 Physical properties of Ashwagandha root Powder

As per the method given in 4.5 .the following result are obtained

Sr. No.	Parameters	Mean value
1	True Density (g/ml)	0.55
2	Bulk Density(g/ml)	0.41
3	Angle of Repose (^{o})	27.80
4	Carr Index (%)	25.45
5	Hausner Ratio	1.34
6	Moisture	7.2
7	Ash	4.2

Table no 2.1.3 flow properties

4Evaluation of Tablets

As per the method given in 4.7.the following result are obtain

Formulatio ns	Hardness (kg/cm^2)	Friability (%)	Weight variation Test (±STD)	Disintegration Time (MIN)	Wetting Time (MIN)
AG1	3.0	0.3	5	8	5
AG2	3.1	0.7	5	7	4

Table no 3.1.4 Evaluation result

Discussion

"Developing of Herbal Tablet for Alleviating Symptoms of Myasthenia Gravis" presents a comprehensive and well-structured approach to combining herbal medicine with pharmaceutical practices. The introduction effectively outlines Myasthenia Gravis (MG) as a complex autoimmune neuromuscular disorder, explaining its pathophysiology, types, and symptoms. The discussion on antibody involvement, particularly AChR, MuSK, and LRP4, along with the mention of seronegative MG (SNMG), highlights the diagnostic challenges faced in clinical practice. The emphasis on the increasing prevalence of MG and the need for alternative treatment approaches sets the stage for the integration of herbal formulations like Ashwagandha.

The document places significant focus on Ashwagandha (*Withania somnifera*) due to its adaptogenic, anti-inflammatory, and neuroprotective properties. These characteristics align well with the therapeutic needs of MG patients, particularly in

improving muscle strength, reducing fatigue, and enhancing immunity. The inclusion of recommended dosages, precautions, and optimal combinations (e.g., Ashwagandha + Shatavari) reflects a thoughtful and practical application of herbal medicine. Additionally, the detailed explanation of Ashwagandha's bioactive compounds such as withanolides, alkaloids, and saponins further strengthens the scientific basis for its use.

IV.SUMMARY AND CONCLUSION

4.1SUMMARY

"Development of Herbal Tablet for Alleviating Symptoms of Myasthenia Gravis" presents a comprehensive exploration of Myasthenia Gravis (MG) and proposes an herbal-based formulation using Ashwagandha as a potential supportive treatment. MG, a complex autoimmune neuromuscular disorder, is characterized by muscle weakness, fatigue, and impaired nerve-muscle communication. While conventional treatments such as acetylcholinesterase inhibitors, immunosuppressants, and plasmapheresis are effective, they often come with limitations like side effects, resistance, or incomplete symptom relief. To address these concerns, the study emphasizes the potential of Ashwagandha (*Withania somnifera*) for its adaptogenic, anti-inflammatory, and neuroprotective properties. Ashwagandha's ability to improve muscle strength, reduce fatigue, and modulate immune responses makes it a promising complementary therapy for MG management. The formulation process involved combining Ashwagandha with excipients such as Lactose (filler), Magnesium Stearate (lubricant), Tragacanth (binder), Crospovidone (disintegrant), and Talc (glidant). Comprehensive preformulation studies ensured the selection of stable, effective ingredients, while the prepared tablet underwent standard evaluation tests, including hardness, friability, weight variation, content uniformity, dissolution, and disintegration to meet pharmaceutical quality standards.

The findings highlight that the developed Ashwagandha tablet formulation offers potential benefits in enhancing muscle strength, reducing fatigue, and supporting neuromuscular health in MG patients. By leveraging Ashwagandha's well-documented pharmacological actions, this formulation provides a natural, supportive alternative to conventional MG treatments.

4.2 CONCLUSION

In conclusion, the study successfully demonstrates that an Ashwagandha-based herbal tablet can serve as a promising complementary therapy for managing Myasthenia Gravis. However, future studies involving clinical trials, bioavailability analysis, and long-term stability assessments are recommended to validate its efficacy, ensure safety, and optimize dosing strategies for improved patient outcomes.

The prepared tablets underwent rigorous evaluation for essential pharmaceutical parameters such as hardness, friability, weight variation, disintegration, and dissolution. Results indicated that the developed tablet formulation met standard quality requirements, demonstrating efficient disintegration and dissolution profiles for optimal drug release. Additionally, the inclusion of Ashwagandha, known for its adaptogenic, antioxidant, and neuroprotective properties, further reinforces the potential benefits in managing MG symptoms.

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