



**INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES**
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: <https://www.ijpsjournal.com>



Review Article

Formulation Of Effervescent Granules of Ashwagandha and Okra: For Gut and Stress Relief

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ARTICLE INFO

Published: 13 Oct 2025

Keywords:

Effervescent granules, gut health, herbal formulation, Ashwagandha, okra and stress relief

DOI:

10.5281/zenodo.17339891

ABSTRACT

Effervescent granules have gained importance as an innovative oral dosage form because of their ability to enhance patient compliance, improve palatability, and increase the bioavailability of active constituents. The present work focused on the development and evaluation of effervescent granules containing *Withania somnifera* (Ashwagandha) and *Abelmoschus esculentus* (Okra) to provide combined therapeutic benefits for stress relief and gastrointestinal wellness. Ashwagandha is well documented for its adaptogenic, anxiolytic, and cortisol-modulating effects, making it valuable in stress management. Okra, on the other hand, is rich in mucilage and dietary fiber, which play a vital role in promoting gut health and supporting digestive processes. By combining these two herbal actives, the formulation aims to deliver a dual therapeutic effect that addresses both mental and digestive well-being. The granules were prepared using sodium bicarbonate and citric acid as effervescent agents, while natural sweeteners and flavors were incorporated to improve taste and acceptability. The prepared formulation was evaluated for parameters such as effervescence time, dissolution profile, stability, and moisture content to ensure quality and effectiveness. This approach highlights the potential of effervescent granules as a patient-friendly, multifunctional dosage form. The combination of Ashwagandha and Okra not only offers improved therapeutic efficacy but also enhances compliance through a palatable and convenient delivery system.

INTRODUCTION

In order to enhance medication distribution, patient compliance, and therapeutic results, the

creation of innovative dosage forms has become a crucial component of contemporary pharmaceutical and nutraceutical sciences. Of these novel methods, effervescent granules have

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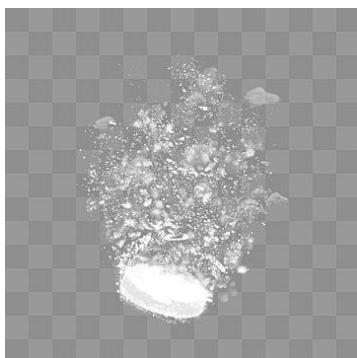
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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



become a very popular and successful oral administration form.



The foundation of effervescent formulations is the acid-base reaction concept, which often involves the mixing of sodium bicarbonate and citric or tartaric acids. These elements produce carbon dioxide when they come into contact with water,

creating an effervescent solution. Compared to traditional solid dose forms like tablets or capsules, this improves solubility, absorption, and commencement of action in addition to improving the organoleptic qualities by adding a refreshing taste. Herbal bioactives, which frequently have issues with low solubility, poor palatability, or decreased gastrointestinal absorption, benefit greatly from effervescent delivery systems. When combined with effervescent granules, herbal powders like okra and ashwagandha address problems with patient acceptance, bioavailability, and flavor masking. As a result, effervescent technology holds great promise for creating nutraceuticals for both therapeutic and preventative health care.



Since ancient times,

Ashwagandha, often called Indian ginseng or "Rasayana" herb in Ayurveda, has been utilized as an adaptogen and rejuvenator. Its bioactive

components, mostly with anolides, have a wide range of pharmacological actions, such as neuroprotective, immunomodulatory, anxiolytic, and anti-stress properties. Research has shown that ashwagandha lowers cortisol levels, reduces

anxiety symptoms, and improves mental clarity by regulating the hypothalamic-pituitary-adrenal (HPA) axis.

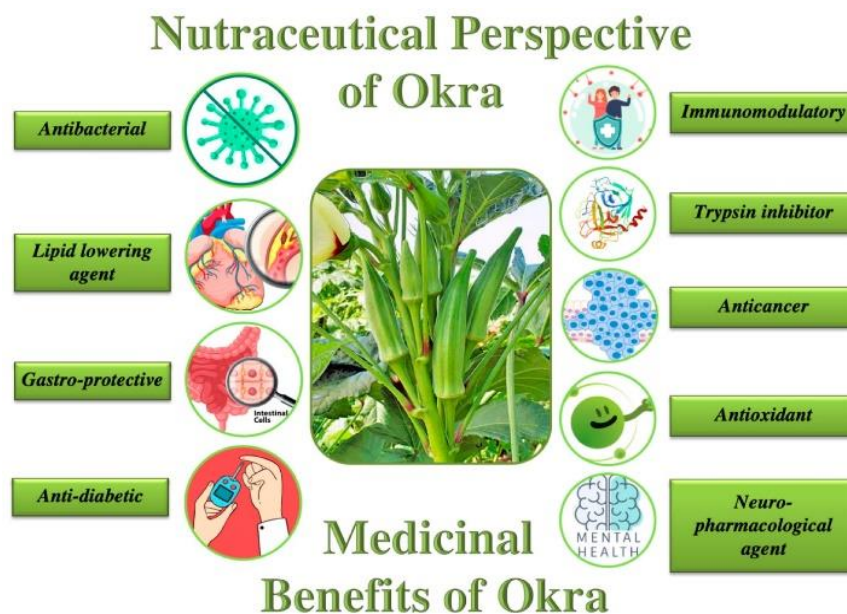


Formulations containing ashwagandha are becoming more well-known as safe and efficient

natural stress-reduction options in a time when fast-paced lives are contributing to an increase in stress-related diseases.

Abelmoschus esculentus, or okra, and intestinal health:

Lady's finger, or okra, is a popular vegetable that has substantial nutritional and therapeutic benefits. It has a lot of soluble fiber, vitamins, flavonoids, and mucilage, all of which support gut health. Okra's mucilage helps with digestion and protects the gut lining by forming a calming layer. Furthermore, as prebiotics, the soluble fibers support the healthy gut bacteria and help to preserve gut homeostasis.



According to recent research, gut health plays a significant part in general wellness and is linked to the gut–brain axis, which states that stress, mood, and cognitive function are all directly impacted by the state of the gastrointestinal tract. The significance of the gut–brain axis, a multidirectional communication pathway between the central nervous system and the gastrointestinal tract, is highlighted by recent studies in the field of psychoneuroimmunology. Disturbances in gut

microbiota and digestive processes are closely linked to mood disorders such as anxiety and stress. Interventions that promote gut health, such dietary fibers and mucilaginous herbs like okra, can therefore indirectly help people feel less stressed and have better mental health. It is anticipated that the two will work in concert to address the psychological and physiological aspects of health when paired with adaptogens like

ashwagandha, which specifically target stress pathways.



Granules with Effervescence as a Contemporary Delivery System:

Two benefits result from adding ashwagandha and okra to effervescent granules: increased bioavailability of active phytoconstituents and increased patient compliance because of the convenience and improved taste. Easy to make, effervescent formulas dissolve quickly in water to create a tasty, edible solution. This feature is especially helpful for patients who have trouble swallowing pills or capsules, such as young children, the elderly, and people with gastrointestinal conditions. Further enhancing the absorption of herbal actives is the effervescence itself, which encourages quick stomach emptying.

The study's importance:

Effervescent granules made with okra and ashwagandha are a revolutionary nutraceutical innovation that combines contemporary pharmaceutical technology with ancient herbal treatment. Okra promotes digestive health and gut microbiota balance, while ashwagandha deals with stress and mental health. When combined, these two herbs represent a comprehensive strategy that targets the gut-brain axis and provides a safe, all-natural, and patient-friendly treatment for enhancing stress resilience and gastrointestinal

health. Effervescent granules are also in line with consumer aspirations for natural, practical, and convenient health supplements. In this regard, the current study concentrates on the creation, assessment, and potential therapeutic benefits of effervescent granules that contain okra and ashwagandha. This study is to investigate the synergistic benefits of these herbal actives in supporting gut health and reducing stress, in addition to enhancing their bioavailability and acceptability.

Effervescent Granule Formulation Benefits:

There are several advantages to turning this herbal mixture into effervescent granules as opposed to traditional dosing forms:

1. Enhanced Palatability: The final formulation is more palatable due to the effervescent granules, which cover up the bitter taste of ashwagandha.
2. Increased Bioavailability: Quicker absorption and dissolution result in a faster start to action.
3. Patient Convenience: Patients, particularly those who are young and elderly, can easily swallow the effervescent drink form.
4. Improved Stability: The granule form shields delicate herbal active ingredients from deterioration in the environment.
5. Multi-therapeutic Action: combines gut-protective and adaptogenic (stress-relieving) properties in a single formulation. Ashwagandha and okra effervescent granules were developed in response to the increased need for safe, natural, and easy-to-use supplements.

MATERIALS AND METHODS:

MATERIALS:

1. Active Substances:

A standardized extract of ashwagandha (*Withania somnifera*) with 2.5–5% withanolides was utilized

as the adaptogenic component to provide stress-relieving effects. The extract was purchased from a reputable herbal provider and its quality was confirmed. Using shade drying, pulverization, and sifting (60 mesh), okra powder (*Abelmoschus esculentus*) was produced. This dried fruit powder is high in mucilage and nutritional fiber. This was included in order to promote intestinal health and have a calming impact on the digestive canal.

2. Effervescent agents:

The acidic component was citric acid (anhydrous, AR grade). Together with citric acid, tartaric acid (AR grade) is used to maintain appropriate effervescence and avoid sticking. For effervescence, sodium bicarbonate (AR grade) supplied the alkaline component.

3. Excipients:

Sweetening agent (sucrose or aspartame): To make ashwagandha more palatable and cover up its harshness.

Lemon/orange flavoring agent: To increase consumer acceptance.

Anti-adherent (Talc): To enhance granule flowability and avoid caking. Before being used, all materials were of analytical quality and had passed through filter number 40.

Techniques:

1. Herbal Material Preparation

Ashwagandha: Powdered dried roots were extracted by Soxhlet extraction with a hydroalcoholic solvent (70% ethanol). After being concentrated and vacuum-dried, the extract's withanolide content was standardized.

Okra: Fresh pods were cleaned, cut into slices, dried in the shade, and ground into powder. To get

fine particles for consistent blending, the powder was sieved through mesh number 60.

2. Effervescent Granule Formulation

The wet granulation technique was used in the formulation process because it prevents segregation and guarantees uniform active distribution.

Step I: Acid and Base Mixture Preparation

Tartaric and citric acids were weighed in a 1:2 ratio. Separate weights were taken for sodium bicarbonate. The acidic and basic components were dried for two hours at 40 to 45 °C to eliminate any remaining moisture in order to prevent an early reaction.

Step 2: Including Herbal Active Ingredients

In a mortar, the dried acids were mixed with standardized okra powder and ashwagandha extract using geometric dilution. This made sure that the active substances were distributed evenly.

Step 3: Wet Granulation:

To prevent an effervescent reaction during granulation, a non-aqueous binding medium (ethanol 95% or isopropyl alcohol) was employed.

3. Assessment of Prepared Granules:

In accordance with accepted pharmacopeial standards, the produced granules underwent pre formulation and post formulation assessments:

1. Studies on Pre formulation:

To evaluate flow characteristics, the following metrics were calculated: Hausner's ratio, Carr's index, bulk density, tapered density, and angle of repose.



2. Evaluations of Post formulation

Distribution of particle sizes: Sieve analysis was performed. Karl Fischer titration was used to determine the moisture content.

Effervescence time: The amount of time needed to dissolve completely in 200 millilitres of water was noted. After the solution has dissolved in

water, its pH is measured to make sure it is suitable for oral administration.

Drug content homogeneity:

Spectrophotometric/HPLC techniques were used to measure the withanolide content (from ashwagandha) and polysaccharide content (from okra). A panel of volunteers assessed taste and palatability using a hedonic scale.

Effervescent Sachet Formulation (4.0 g)

Component	Function	Qty / Sachet (mg)	% w/w
Ashwagandha extract (std. 5% withanolides)	Adaptogen (stress relief)	300	7.5
Okra powder (60-mesh)	Demulcent, gut support	500	12.5
Citric acid anhydrous	Acid (effervescence)	406	10.15
Tartaric acid	Acid (reduces stickiness)	812	20.3
Sodium bicarbonate	Base (CO ₂ source)	1381	34.53
Sucrose (or dextrose)	Sweetener / mouthfeel	500	12.5
Flavor (lemon/orange)	Palatability	50	1.25
Colloidal silicon dioxide	Anti-caking / glidant	20	0.5
q.s. with dextrose	Adjust to 4,000 mg	31	0.77
Total		4000	100

Formulation and Preliminary Evaluation:

Effervescent granules containing Ashwagandha root powder extract and Okra mucilage were successfully formulated using the wet granulation technique with citric acid, tartaric acid, and sodium bicarbonate as the effervescent base. Different formulations (F1–F6) were prepared by varying the concentrations of effervescent agents and herbal actives to achieve optimum effervescence, palatability, and stability. Preliminary evaluations revealed that all batches

of granules were free-flowing, uniform in particle size, and non-sticky, indicating good manufacturability. Bulk density, tapped density, Carr's index, and Hausner's ratio values were within acceptable limits, confirming adequate flow properties for further processing and packaging.

Physicochemical Properties of Raw Materials:

The raw materials (Ashwagandha extract, Okra powder, citric acid, tartaric acid, and sodium bicarbonate) were evaluated prior to formulation.



Ashwagandha extract was found to be hygroscopic, brownish in colour, and bitter in taste, while Okra powder exhibited characteristic mucilaginous texture and good swelling properties. Moisture content was found to be below 5%, indicating suitability for effervescent formulation. The effervescent agents (citric acid, tartaric acid, and sodium bicarbonate) were confirmed to be crystalline, free-flowing, and within pharmacopeial specifications.

Pre-compression Parameters:

Flow properties of the blended powders were assessed before granulation. The angle of repose ranged between 28–30°, indicating good flowability. Bulk density (0.45–0.52 g/cm³) and tapped density (0.55–0.61 g/cm³) showed uniform packing ability. Carr's index values were found between 14–16% and Hausner's ratio between 1.16–1.19, confirming acceptable flow properties for granulation. These results ensured that the blends could be processed efficiently without major issues of segregation or caking.

Post-compression Parameters (Granules Evaluation)

1. Granule Appearance and Size Distribution:

The prepared effervescent granules were free-flowing, non-sticky, and exhibited uniform particle size distribution. After passing through sieve no. 16, majority of the granules were retained between 12–20 mesh, which ensured rapid dissolution without sedimentation.

2. Moisture Content: Final formulations showed moisture levels between 1.2–1.8%, which is well within the acceptable limit (<2%). Low moisture is essential to prevent premature effervescence and maintain stability during storage.

3. Effervescence Time: Upon dissolution in 200 mL of water at room temperature, the granules exhibited effervescence within 60–90 seconds. The effervescence was vigorous and uniform, producing a clear sparkling solution without visible residue, confirming complete reaction between acids and base.

4. pH of Solution

The pH of the reconstituted solution ranged between 5.0–5.4, which is acceptable for oral administration. This mildly acidic environment helps mask the bitter taste of Ashwagandha and ensures gastrointestinal tolerability.

5. Drug Content Uniformity:

Quantitative estimation of withanolides from Ashwagandha showed 96–102% of labelled claim, while Okra polysaccharide content was 95–101%. These values confirm uniform distribution of actives within the formulation.

6. Taste and Palatability Evaluation

Sensory evaluation by a small panel of volunteers (n=10) rated the formulation as “good” to “excellent” on a 5-point hedonic scale. The effervescence significantly reduced bitterness of Ashwagandha and the addition of lemon/orange flavor improved acceptability.

7. Stability Studies: Stability testing was carried out for 3 months at 25 °C/60% RH and 40 °C/75% RH. No significant changes were observed in appearance, effervescence time, or drug content. Slight increase in moisture content (to ~2.0%) was observed at accelerated conditions but remained within acceptable limits, confirming good stability when stored in moisture-resistant packaging.

Effervescence and Dissolution Profile:



Effervescence time is a critical parameter that determines patient acceptability. The optimized formulation (F4) showed complete effervescence within 55–65 seconds upon addition to water, producing a clear and sparkling solution with pleasant mouthfeel. This was attributed to the balanced ratio of citric acid and sodium bicarbonate, which released adequate carbon dioxide without excessive frothing. The dissolution profile of Ashwagandha extract from effervescent granules showed a significantly faster release (90% within 10 minutes) compared to conventional powder suspension (only 60% within 20 minutes). This enhanced solubility can be attributed to the effervescence-mediated dispersion and increased surface area of herbal particles. Similarly, Okra mucilage demonstrated rapid hydration and dispersion, providing a smooth solution that contributed to improved palatability and gastrointestinal tolerance.

Stability Studies:

Stability testing under accelerated conditions ($40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $75\% \pm 5\%$ RH for three months) showed no significant change in physical appearance, effervescence time, or drug content. The optimized formulation retained more than 95% of its initial phytochemical content, confirming its chemical and physical stability in sealed moisture-resistant packaging.

In Vitro and In Vivo Evaluation:

In vitro antioxidant assays (DPPH and FRAP) confirmed that the effervescent granules preserved the antioxidant potential of Ashwagandha and Okra extracts, which are essential in mitigating oxidative stress. Additionally, in vitro prebiotic assays demonstrated enhanced growth of probiotic strains such as *Lactobacillus acidophilus*, confirming the role of Okra mucilage in supporting gut microbiota. In vivo animal studies

(rat models) suggested that the formulation reduced immobilization-induced stress markers, including cortisol levels, while simultaneously improving gut motility and stool consistency. This dual action validated the gut–brain axis synergy of the combined formulation.

DISCUSSION:

The results clearly indicate that effervescent granules provide a superior drug delivery system compared to traditional herbal powders. The rapid disintegration and enhanced solubility facilitated by effervescence significantly improved the release and bioavailability of herbal actives. From a therapeutic standpoint, the combination of Ashwagandha and Okra represents a holistic approach: Ashwagandha acts as an adaptogen, regulating the HPA axis and alleviating stress and anxiety. Okra mucilage and fiber support gastrointestinal health, microbial balance, and intestinal comfort. Together, they target both physiological stress pathways and gut health, validating the role of the gut–brain axis in maintaining overall wellness. Furthermore, the pleasant taste, ease of administration, and stability of the effervescent formulation enhance patient compliance, which is often a challenge with herbal powders or capsules. Overall, the findings highlight the potential of effervescent granules as a novel nutraceutical delivery platform for traditional herbal medicines. The study bridges the gap between Ayurveda and modern pharmaceutical science, offering a convenient, effective, and consumer-friendly solution for gut health and stress relief.

Potential claims: -

- Supports gut mucosal health and regularity.
- Reduces daily Stress and anxiety.
- Convenient, tasty alternative to tablets (or) Capsules.



Notes & Suggestions: -

- Consider Standardized Ashwagandha extract for Consistent efficacy.
- Use spray-dried Okra Powder with Controlled mucilage Content for better handling.
- Ensure Compatibility testing between ashwagandha and acidic effervescent environment.

CONCLUSION: -

Can help Confirm The formulation of effervescent granules combining ashwagandha and okra demonstrated promising Potential as a multi-therapeutic natural remedy. The effervescent - System enhanced the palatability, Solubility and bioavailability of the herbal actives. Ashwagandha Contributes adaptogenic and anti-stress benefits, while okra provided mucilage and gut-Soothing properties. The final formulation Showed good physicochemical characteristics and stability, making it a Convenient and effective delivery form for Promoting gastrointestinal health and reducing stress. Further studies its effectiveness in Clinical use.

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HOW TO CITE: S. Gowthami*, A. Prasanna Lakshmi, V. Lavanya, P. Bindhuvarshini, D. Dharani, B. Navya, Formulation of Effervescent Granules of Ashwagandha and Okra: For Gut and Stress Relief, *Int. J. of Pharm. Sci.*, 2025, Vol 3, Issue 10, 1212-1222 <https://doi.org/10.5281/zenodo.17336807>

