

Formulation and Evaluation of a Polyherbal Cough Syrup Containing Vasaka (*Adhatoda vasica*), Tulsi (*Ocimum sanctum*), Ginger (*Zingiber officinale*), and Honey: A Phytotherapeutic Approach

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ABSTRACT

*The present investigation involves the formulation and systematic evaluation of a polyherbal cough syrup prepared using four well-known medicinal agents Vasaka (*Adhatoda vasica*), Tulsi (*Ocimum sanctum*), Ginger (*Zingiber officinale*), and Honey recognized for their diverse pharmacological profiles, including antitussive, expectorant, anti-inflammatory, antioxidant, and mucolytic properties. The objective of this study was to prepare a palatable, stable, and efficacious herbal formulation that could provide symptomatic relief in cases of cough and minor respiratory tract infections without the side effects typically associated with synthetic drugs. Comprehensive phytochemical screening, organoleptic evaluation, physicochemical characterization, and stability studies were conducted to assess the quality and therapeutic potential of the syrup.*

Keywords:- pharmacological profiles, organoleptic evaluation, therapeutic potential

INTRODUCTION

Cough, a reflex action to clear the airways, is one of the most common symptoms prompting individuals to seek medical attention. While it can be a temporary annoyance caused by allergens or infections, in chronic cases, it becomes a manifestation of underlying respiratory conditions such as asthma, bronchitis, or tuberculosis. For centuries, humankind has relied on natural remedies to manage cough and related ailments. The evolution of cough treatment traces back to traditional medicine systems, which have documented numerous botanical solutions long before the advent of synthetic pharmacotherapy.

1. Historical Background and Traditional Usage:-

The origins of herbal medicine can be traced back to ancient civilizations such as

those of Egypt, Greece, China, and India. In India, the Ayurvedic system, over 5,000 years old, emphasizes balance between body, mind, and environment, often achieved through herbal remedies.

- Vasaka (*Adhatoda vasica*) has been extensively mentioned in classical Ayurvedic texts like *Charaka Samhita* and *Sushruta Samhita* for treating chronic cough and bronchitis due to its alkaloid vasicine, known for bronchodilatory effects.
- Tulsi (*Ocimum sanctum*) is revered in Indian households as a sacred plant and a potent anti-inflammatory and antimicrobial agent that soothes the throat and enhances respiratory health.
- Ginger (*Zingiber officinale*) has long been used in Unani and Ayurveda for its warming, anti-inflammatory, and

mucolytic properties, helping loosen mucus and ease breathing.

- Honey has been known since Egyptian times as a curative agent, often used to coat the throat, reduce irritation, and serve as a natural sweetener medium with antimicrobial effects.

MODERN CONTEXT AND PRESENT SIGNIFICANCE

In modern medicine, the formulation of herbal syrups has gained popularity as concerns rise over the side effects of synthetic cough suppressants like dextromethorphan and codeine. These chemical-based drugs, although effective, are associated with adverse reactions such as dizziness, drowsiness, and dependency with prolonged use.

As consumers increasingly shift toward natural and holistic remedies, the market for herbal cough syrups has expanded rapidly, driven by:

- The global herbal medicine market, which is expected to surpass USD 600 billion by 2030.

- A significant rise in consumer preference for clean-label products free from artificial preservatives, flavours, and synthetic chemicals.
- Growing research interest in validating traditional plant-based formulations through scientific methodologies.

Need for the Study

Despite the known individual properties of Vasaka, Tulsi, Ginger, and Honey, there is limited modern literature that formulates and systematically evaluates a polyherbal syrup incorporating these agents. The purpose of this study is to fill that gap by:

- Creating a safe and stable herbal formulation.
- Evaluating its physicochemical properties and efficacy indicators such as pH, viscosity, foaming, palatability, and stability.
- Demonstrating its potential as a viable alternative to synthetic cough suppressants.

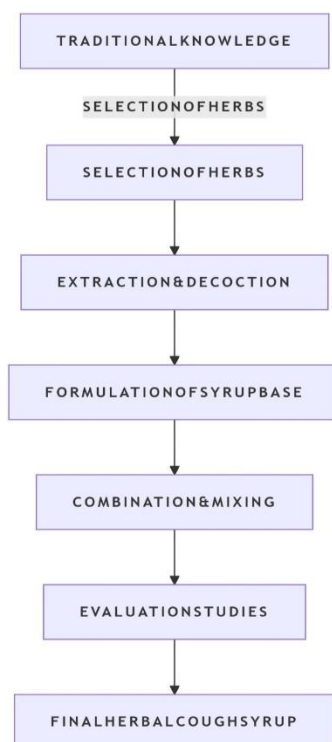


Fig 1. Need of study

LITERATURE REVIEW

The increasing global interest in phytotherapeutics and herbal formulations is driven by the rising demand for natural, non-synthetic, and side-effect-free alternatives to conventional medications, particularly in the domain of respiratory health, where chronic cough and bronchial irritations continue to affect a significant portion of the global population across all age groups. Numerous studies in recent decades have underscored the therapeutic efficacy and safety profile of individual herbs such as *Adhatoda vasica* (commonly known as Vasaka), *Ocimum sanctum* (Tulsi), *Zingiber officinale* (Ginger), and honey, each of which has a longstanding historical and empirical basis in Ayurveda and traditional medicine systems, particularly for their expectorant, anti-inflammatory, mucolytic, and soothing actions on the upper respiratory tract.

Research by Mohan [1] has emphasized the presence of alkaloids such as vasicine and vasicinone in *Adhatoda vasica*, which exhibit potent bronchodilatory and respiratory stimulant properties, thereby validating the plant's traditional use in the management of chronic cough, asthma, and bronchitis. Additionally, studies [2] highlighted *Ocimum sanctum* as an adaptogenic herb rich in essential oils like eugenol and ursolic acid, which not only modulate immune responses but also alleviate symptoms associated with cough by reducing inflammation and microbial infections in the respiratory tract.

Zingiber officinale, according to findings presented [3] demonstrates strong antioxidant, antimicrobial, and antitussive activities due to its content of gingerol, shogaol, and zingerone, which are known to break down thick mucus, facilitate expectoration, and provide relief from throat irritation without inducing sedation or drowsiness as seen with synthetic antitussives. Honey, meanwhile, has been

systematically reviewed in clinical trials [4] for its ability to soothe inflamed mucosa, reduce nocturnal cough frequency, and enhance palatability of herbal formulations, all of which are critical factors in ensuring pediatric compliance and long-term user acceptability.

The formulation of a polyherbal cough syrup, as investigated in similar works [5] represents a promising and synergistic approach in which multiple plant-based ingredients are combined to enhance therapeutic potential through additive or complementary pharmacodynamic effects, while simultaneously minimizing adverse reactions commonly associated with monotherapy or synthetic compounds. Moreover, modern formulation science supports the idea that such polyherbal preparations can be scientifically optimized through controlled evaluation of physicochemical parameters such as pH, viscosity, stability, organoleptic properties, and microbial load, all of which are crucial for establishing the safety, efficacy, and shelf-life of herbal syrups for clinical or consumer use[6].

Despite the availability of individual research on the pharmacological effects of the aforementioned herbs, there is a noticeable scarcity of comprehensive investigations that integrate all four ingredients—Vasaka, Tulsi, Ginger, and Honey—into a single cough syrup formulation that is both scientifically validated and traditionally relevant. This gap in literature highlights the pressing need for more focused [7], formulation-based studies that not only test the stability and organoleptic qualities of such polyherbal preparations but also provide a framework for the development of scalable, market-ready phytopharmaceutical products capable of meeting modern regulatory and consumer standards.

NEED OF WORK

In recent years, there has been an escalating concern over the safety, tolerance, and long-term implications of synthetic cough syrups that are widely available on the pharmaceutical market, particularly those containing antitussive agents like dextromethorphan, codeine, or antihistamines, which are often associated with undesirable side effects including drowsiness, dry mouth, dizziness, gastrointestinal discomfort, and in some cases, dependency or abuse. The increasing incidence of cough as a symptomatic manifestation of infections, allergies, environmental pollution, and lifestyle-related disorders has created a significant demand for safe, effective, and patient-compliant therapeutic alternatives that are accessible to a wide population across both urban and rural sectors.

The need for this work also emerges from the inadequacies observed in many over-the-counter (OTC) cough syrups that may offer symptomatic relief but do not address the underlying inflammation, microbial invasion, or immunological factors contributing to chronic or acute cough. This scenario necessitates the formulation of a multi-targeted therapeutic solution that not only suppresses or soothes the cough reflex but also supports the respiratory system's natural healing processes through immunomodulatory, mucolytic, expectorant, and antimicrobial actions.

Moreover, with the resurgence of interest in traditional medicine and plant-based therapies, both from patients and health professionals, there is a growing necessity to scientifically validate and formulate herbal remedies using standard pharmaceutical procedures to ensure consistency, stability, and efficacy. While each of the selected herbal ingredients—*Vasaka* (*Adhatoda vasica*), *Tulsi* (*Ocimum*

sanctum), *Ginger* (*Zingiber officinale*), and *Honey*—has been extensively recognized in Ayurvedic and folk medicine for treating respiratory ailments, there is a lack of comprehensive, scientifically-developed formulations that synergize their properties into a single, stable, and organoleptically acceptable cough syrup.

The formulation of a polyherbal cough syrup is thus essential not only from a therapeutic standpoint but also to address the growing consumer demand for herbal products that are free from alcohol, artificial preservatives, or synthetic drugs, and are safe for long-term use, including among children, elderly individuals, and those with comorbidities.

Furthermore, this work is needed to:

- Bridge the gap between traditional knowledge and modern pharmaceutical formulation science.
- Standardize dosage and stability parameters for a herbal combination that has so far been used in decoction or homemade forms with little control over concentration or bioavailability.
- Enhance patient compliance by offering a syrup with improved taste, appearance, and physical properties.
- Generate evidence-based data on the physicochemical, microbiological, and organoleptic parameters of the polyherbal syrup.
- Promote sustainable and accessible healthcare solutions using cost-effective and readily available herbal ingredients.

By conducting this research and formulation study, the present work aims to offer a validated, palatable, and effective herbal cough remedy that not only supports respiratory health but also reinforces the integration of phytomedicine into mainstream healthcare systems.

Plan of work :

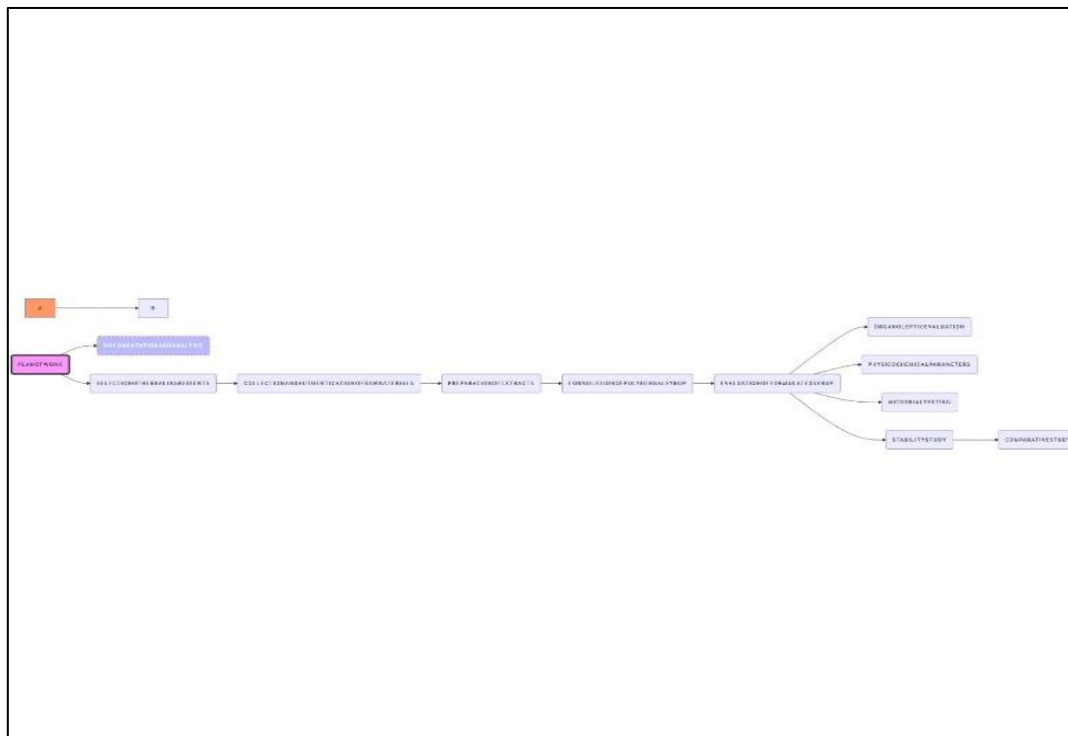


Fig.2:-Plan of work

CONTENT

1. Vasaka (*Adhatoda vasica*)

• **Ideal Properties:**

- Contains alkaloids like vasicine and vasicinone
- Acts as a natural bronchodilator and expectorant
- Possesses anti-inflammatory and antitussive activity

• **Advantages:**

- Loosens mucus in the airways and promotes easy expectoration
- Reduces bronchial inflammation
- Effective in both dry and productive cough

• **Disadvantages:**

- High doses may cause irritation to the gastrointestinal tract
- Slight bitterness may affect palatability if not masked properly

2. Tulsi (*Ocimum sanctum*)

• **Ideal Properties:**

- Rich in essential oils like eugenol, carvacrol

- Possesses immunomodulatory, antimicrobial, and anti-inflammatory actions

- Soothes irritated mucosa of the throat

• **Advantages:**

- Boosts respiratory immunity
- Provides relief in coughs caused by infections or allergies
- Enhances the overall therapeutic value of polyherbal formulations

• **Disadvantages:**

- Overuse may cause mild hypoglycemia in sensitive individuals
- Volatile oils require careful handling during formulation

3. Ginger (*Zingiber officinale*)

• **Ideal Properties:**

- Contains gingerol, shogaol, and zingerone
- Acts as an effective mucolytic and antitussive
- Exhibits antimicrobial and antioxidant effects

• **Advantages:**

- Relieves throat irritation and promotes smooth breathing
- Helps break down mucus and supports expectoration
- Pleasant warming effect adds to syrup palatability
- **Disadvantages:**
 - May cause mild heartburn or gastric irritation in sensitive individuals
 - Strong flavor needs balancing in pediatric formulations

4. Honey

- **Ideal Properties:**
 - Natural sweetener and demulcent
 - Provides antimicrobial and antioxidant properties
 - Soothes inflamed tissues and enhances syrup texture
- **Advantages:**
 - Improves taste and palatability of herbal formulations
 - Suppresses nighttime coughing and soothes the throat
 - Acts as a natural preservative to extend shelf-life
- **Disadvantages:**

- Not suitable for children under 1 year of age due to botulism risk
- Risk of adulteration in low-quality sources

PALATABILITY

"The formulated herbal syrup exhibited a sweet taste, primarily due to the presence of honey, ensuring good palatability for patient compliance."

Types of herbal syrup

- Flavoured syrup
- Medicated syrup
- Artificial syrup

Advantages of cough syrup

- No side effect
- Low cost
- Easily available
- No harmless
- Herbs grow in commonplace

Disadvantages of cough syrup

- Not suitable in emergency and for unconscious patients.
- Dose precision cannot be achieved unless suspension is packed in unit dosage forms.

Contents In Herbal Syrup:-

Sr.No	Constituent	Biological Source	Family	Use	Image
1.	Vasaka	<i>Adhatoda vasica</i> Nees	Acanthaceae	Expectorant, bronchodilator, anti-inflammatory	
2.	Tulsi	<i>Ocimum sanctum</i> Linn	Lamiaceae	Immunomodulator, antitussive, antimicrobial	
3.	Ginger	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Mucolytic, inflammatory, soothing anti-throat	

4.	Honey	Natural secretion from honey bees		Demulcent, antimicrobial, enhances palatability, throat soothing	
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METHOD OF PREPARATION

The method of preparation for the polyherbal cough syrup is carried out in a stepwise manner, ensuring precise extraction of bioactive compounds and formulation of a stable and effective product. Below is the detailed procedure for preparing the polyherbal cough syrup using *Vasaka* (*Adhatoda vasica*), *Tulsi* (*Ocimum sanctum*), *Ginger* (*Zingiber officinale*), and Honey.[8]

1. Selection and Authentication of Raw Materials

- **Source Verification:** The raw materials, including the medicinal herbs (*Vasaka*, *Tulsi*, *Ginger*) and Honey, are sourced from certified suppliers or authentic medicinal herb markets [9].
- **Authentication:** Botanical experts verify the plant species and ensure the medicinal quality and authenticity of the herbal material by consulting herbarium specimens and literature references [10].

2. Preparation of Herbal Extracts

- **Drying and Powdering of Herbs:**
 - The leaves of *Vasaka* and *Tulsi* and the rhizome of *Ginger* are carefully washed and air-dried in shaded conditions to preserve their active components.
 - Once dried, they are ground into a fine powder using a mechanical grinder. The powder is sieved to achieve a uniform size suitable for extraction [11].
- **Extraction of Bioactive Compounds:**

- *Vasaka*: The powdered leaves are subjected to an aqueous extraction method. Water is used as the solvent, and the material is boiled for 20-30 minutes to extract the alkaloids and flavonoids.
- *Tulsi*: An aqueous or hydroalcoholic extraction is performed, where the powdered leaves are mixed with a water-ethanol solution (50:50 ratio), and the mixture is heated for 15-20 minutes [12].
- *Ginger*: Ginger root powder is mixed with water and gently heated, allowing the extraction of gingerol and other bioactive compounds.
- **Filtration and Concentration:**
 - After extraction, the mixture is cooled and filtered through a fine muslin cloth to remove any residual plant material.
 - The filtrate is then concentrated using a rotary evaporator to reduce the volume and achieve the desired extract consistency.

3. Preparation of the Syrup Base

- **Preparation of the Syrup:**
 - A base syrup is prepared by dissolving sugar (sucrose) or a combination of sucrose and glucose in distilled water. This syrup serves as the carrier for the herbal extracts and helps in stabilizing the final product.
 - The sugar solution is heated to approximately 70°C to dissolve the sugar completely, and then cooled to room temperature.

4. Blending Herbal Extracts with Syrup Base

- **Herbal Extract Addition:**
 - The concentrated herbal extracts of *Vasaka*, *Tulsi*, and *Ginger* are slowly mixed into the syrup base, ensuring a uniform distribution of the bioactive ingredients.
 - The proportion of each herbal extract is calculated to provide the desired therapeutic dosage in the final product.
- **Incorporation of Honey:**
 - Pure honey is then incorporated into the mixture in the required amount. Honey serves as a natural preservative, sweetener, and demulcent. It is added last to prevent the degradation of its bioactive compounds due to heat.

5. Mixing and Homogenization

- The entire mixture is thoroughly stirred using a mechanical stirrer or homogenizer to ensure a uniform consistency. This step is crucial for achieving a smooth texture and safeguarding that the herbal ingredients are evenly dispersed throughout the syrup.
- **Quality Check for Homogeneity:**
 - A small sample is taken to verify uniformity by checking the distribution of bioactive compounds using techniques like thin-layer chromatography (TLC) or high-performance liquid chromatography (HPLC), if necessary [13].

6. pH Adjustment

- **pH Monitoring:** The pH of the syrup is monitored and adjusted to the optimal range (typically 4.5-5.5) using food-grade citric acid or sodium hydroxide. This ensures that the syrup remains stable and that the bioactive compounds retain their potency over time.

7. Filtration and Sterilization

- **Sterilization:**
 - The syrup is filtered again to remove any remaining impurities and then sterilized using a non-thermal method, such as UV sterilization, to preserve the integrity of the herbal extracts.
 - Alternatively, a mild heat sterilization process can be applied if required, ensuring that it does not degrade the active compounds or honey [14].

8. Packaging

- **Filling into Containers:**
 - The final product is filled into clean, sterilized glass or plastic bottles, with appropriate volume measurements.
 - The bottles are sealed immediately to prevent contamination and preserve freshness.
- **Labeling and Storage:**
 - Each bottle is labeled with the product name, batch number, ingredients, manufacturing date, and expiration date.
 - The syrup is stored in a cool, dry place away from direct sunlight to maintain its stability.

9. Stability and Quality Control Tests

- **Stability Testing:**
 - The prepared syrup is subjected to stability studies under various environmental conditions, such as elevated temperatures and humidity, to determine its shelf-life.
- **Microbiological Testing:**
 - The final product undergoes microbiological testing to ensure that the syrup is free from microbial contamination.
 - Tests include the total bacterial count, total fungal count, and the absence of pathogens.

10. Final Product Evaluation

- Organoleptic Evaluation: The final syrup is evaluated for color, flavor, taste, and texture to ensure it meets the required organoleptic standards.
- Physicochemical Properties: The viscosity, specific gravity, and other physicochemical parameters are evaluated to ensure uniformity and consistency of the product.

DECOCTION PROCESS

The decoction method is employed to efficiently extract water-soluble phytoconstituents (alkaloids, flavonoids, glycosides, etc.) from the powdered herbal materials. In the context of our polyherbal cough syrup, each botanical—Vasaka, Tulsi, and Ginger—is processed via individual decoctions as follows [16]

1. Raw Material Preparation

- Selection & Cleaning: Accurately weigh the powdered plant material (5 g each of Vasaka leaf powder, Tulsi leaf powder, and Ginger rhizome powder). Remove any foreign matter or coarse fibres by gentle sieving.
- Pre-soaking (Optional): To enhance extraction yield, the powder may be moistened with a few millilitres of distilled water and allowed to stand for 15 minutes at room temperature.

2. Ratio of Drug to Solvent

- Employ a 1 : 16 (w/v) ratio (i.e., 5 g herb : 80 mL distilled water) for each individual decoction, ensuring sufficient solvent to penetrate plant tissues and dissolve active compounds.

3. Initial Boil

- Transfer the pre-soaked powder into a clean, heat-resistant glass or stainless-steel vessel.
- Add 80 mL of distilled water and bring to a gentle boil over a medium-

heat flame or hot plate, with occasional stirring to prevent local charring.

4. Simmering Phase

- Reduce heat to maintain a gentle simmer (approximately 80–90 °C).
- Continue simmering for 20–30 minutes, or until the volume of the liquid is reduced to approximately one-fourth (≈ 20 mL), thereby concentrating the extract.

5. Cooling and Settling

- Remove the vessel from heat and allow the decoction to cool to room temperature (25–30 °C).
- Let the suspension stand for 10 minutes to permit any insoluble particulates to settle.

6. Filtration

- Decant the supernatant through two layers of muslin cloth or a Whatman No. 1 filter paper into a pre-labelled beaker.
- If clarity is required, perform a secondary filtration through fine-grade filter paper.

7. Measurement of Yield and Concentration

- Record the volume of the filtrate obtained.
- Determine the concentration (g of plant material per mL of decoction) to ensure consistency across batches.

8. Storage of Decoction

- Transfer each decoction into amber-coloured glass bottles to prevent photodegradation.
- Store at 4–8 °C in a refrigerator and use within 24 hours to minimize microbial growth and preserve phytochemical integrity.

9. Combining Decoctions for Formulation

- Prior to syrup preparation, allow all three decoctions to equilibrate to room temperature.
- Combine the Vasaka, Tulsi, and Ginger decoctions in the proportion determined by your formulation design (e.g., equal volumes or weighted according to desired phytochemical strength).

Usage:

1. Dosage and Administration

- Adults
- (12year and above):
 - 10–15 mL (two to three level teaspoons) orally, three to four times daily, preferably after meals.
- Children (6–12 years):
 - 5–10 mL (one to two level teaspoons) orally, three times daily, preferably after meals.
- Children under 6 years:
 - Use under medical supervision only; initial dose not to exceed 2.5 mL two to three times daily.

2. Method of Use

- Shake well before each use to ensure uniform suspension of herbal extracts.
- Measure the dose accurately using a calibrated oral measuring spoon or syringe.
- Administer slowly, allowing the syrup to coat the throat for maximum soothing effect.
- Follow each dose with a small amount of water if desired.

3. Duration of Therapy

- Symptomatic relief is typically observed within 2–3 days of regular dosing.
- Continue treatment for up to 7–10 days; if cough persists beyond this period or is accompanied by high fever, chest pain, or difficulty

breathing, discontinue use and consult a healthcare professional.

4. Storage and Stability

- Store in a cool, dry place away from direct sunlight (ideally 15–25 °C).
- Keep the bottle tightly closed when not in use to prevent contamination.
- Refrigeration (4–8 °C) is recommended if the climate is hot or humid; allow the syrup to return to room temperature before dosing.
- Discard any remaining syrup after 30 days of opening or if there is a change in colour, odour, or consistency.

5. Precautions and Contraindications

- Not for use in children under 1 year due to risk of infant botulism from honey.
- Exercise caution in diabetic patients—monitor for changes in blood glucose due to natural sugars in honey and syrup base.
- Pregnant or breastfeeding women: Use only under medical advice.
- Allergy warning: Do not use if known hypersensitivity to any of the ingredients (e.g., ginger, honey, or any plant constituent).
- Drug interactions: Although unlikely, inform your physician if you are taking anticoagulants or antiplatelet agents, as ginger may have mild antithrombotic effects [17].

6. Adverse Effects

- Generally well tolerated; however, excessive doses may lead to mild gastrointestinal discomfort (e.g., heartburn or nausea) in sensitive individuals.
- In the unlikely event of rash, itching, or swelling, discontinue use immediately and seek medical attention [18].

Ingredient	Quantity per 50 mL
Vasaka (<i>Adhatoda vasica</i>) Extract	5 mL
Tulsi (<i>Ocimum sanctum</i>) Extract	5 mL
Ginger (<i>Zingiber officinale</i>) Extract	5 mL
Honey	5mL
Sugar (Sucrose)	15g
Distilled Water	15mL
Citric Acid	0.25–0.5 g

Formulation for Herbal Cough Syrup:

Formulation Method: Extraction Process

1. *Vasaka (Adhatoda vasica) Extract*

Extraction Method: Soxhlet Extraction with Ethanol or Methanol

- **Step 1:** Preparation of Plant Material
 - Weigh 50 g of dried, coarsely powdered Vasaka leaves.
 - Place the powdered Vasaka leaves into the Soxhlet thimble[19].
- **Step 2:** Solvent Preparation
 - Fill the round-bottom flask with ethanol or methanol (solvent depends on the bioactive compounds to be extracted, such as alkaloids and flavonoids).
- **Step 3:** Soxhlet Extraction Setup
 - Attach the thimble with the powdered Vasaka leaves to the Soxhlet extractor.
 - Connect the condenser and ensure it is properly cooled with running water.

- Heat the round-bottom flask containing the solvent using a heating mantle.

• **Step 4:** Extraction Process

- As the solvent evaporates, it rises through the Soxhlet chamber, contacting the plant material and extracting the desired compounds (alkaloids and flavonoids).
- The solvent condenses in the condenser and falls back into the round-bottom flask to complete the cycle.
- Repeat the process for 4–6 hours to ensure thorough extraction.

• **Step 5:** Filtration

- After extraction, filter the solution through muslin cloth or filter paper to remove solid residues.
- The clear extract is now ready for use in the syrup formulation.



Fig. 7:-Extraction of Vasaka

2. *Tulsi (Ocimum sanctum) Extract*

Extraction Method: Hydro-alcoholic Extraction (50:50 Ethanol:Water)

- **Step 1:** Preparation of Plant Material
 - Weigh 50 g of dried Tulsi leaf powder.
- **Step 2:** Solvent Preparation
 - Prepare a hydro-alcoholic solution with a 50:50 ratio of ethanol and water.
- **Step 3:** Extraction Process
 - Place the Tulsi powder in a beaker and add the hydro-alcoholic solvent.

- Heat the mixture to 60°C and extract for 15 minutes.
- Use a stirring rod or magnetic stirrer for continuous mixing during the extraction process.
- **Step 4:** Filtration
 - After extraction, filter the solution through muslin cloth or filter paper to remove solid residues.
 - The filtered extract is then concentrated by evaporating the alcohol content.



Fig.8:-Extraction of Tulsi

3. *Ginger (Zingiber officinale) Extract*

Extraction Method: Aqueous Decoction

- **Step 1:** Preparation of Plant Material
 - Weigh 50 g of ginger rhizome powder.
- **Step 2:** Decoction Preparation
 - Add 80 mL of water to the ginger powder in a beaker.
- **Step 3:** Boiling and Extraction
 - Boil the mixture for 20 minutes to extract water-soluble compounds such as gingerol and essential oils.
 - After boiling, reduce the volume by gently heating or evaporating excess water, concentrating the extract to 20 mL.
- **Step 4:** Filtration
 - Filter the cooled decoction through muslin cloth or filter paper to remove solid particles.
 - The clear ginger extract is ready for incorporation into the syrup.

- Honey is added directly to the formulation to provide its antimicrobial and soothing properties, as well as to enhance the taste.

4. Honey

Preparation: No Extraction Required

- Use 5 mL of pharmaceutical-grade honey without any further processing.

5. Sucrose Solution (60% w/v)

Preparation Method: Simple Dissolution

- **Step 1:** Weighing and Dissolving
 - Weigh 30 g of sucrose.
- **Step 2:** Preparation of Solution
 - Dissolve the 30 g of sucrose in 50 mL of distilled water at room temperature or slightly warm to facilitate dissolution.
- **Step 3:** Stirring
 - Stir the solution using a glass rod or magnetic stirrer to ensure complete dissolution

6. Citric Acid

Purpose: pH Adjustment

- **Step 1:** Weighing
 - Weigh approximately 0.5 g of citric acid.
- **Step 2:** pH Adjustment

- Dissolve the citric acid in a small volume of water.

- After the syrup base is formed, use the dissolved citric acid to adjust the pH of the syrup to a target range of 4.5–5.5.



Fig.9:-Extract of Vasaka, Tulsi, Zinzer, Sucrose solution

SYRUP PREPARATION PROCESS

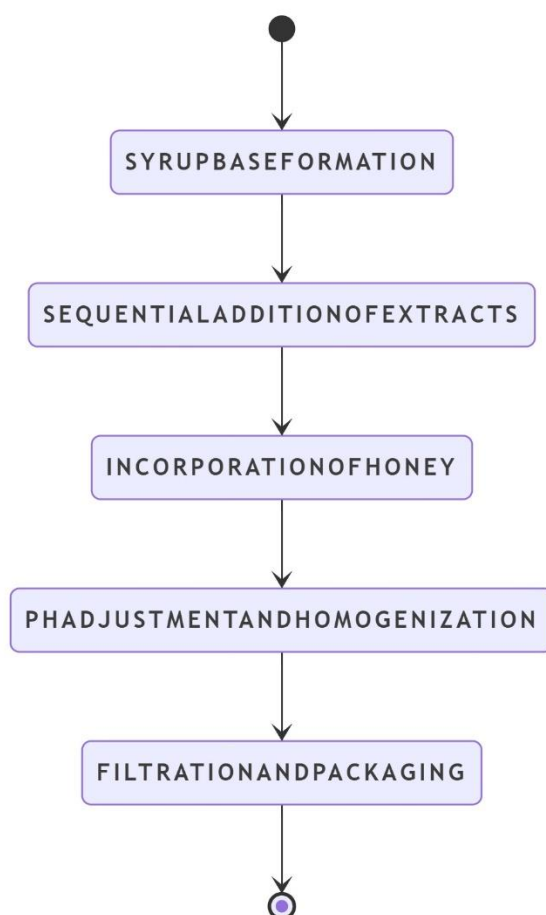


Fig.10:-Syrup Preparation Process

1. Syrup Base Formation

- Heat the sucrose solution (60% w/v) to 60–70 °C. This ensures that the sucrose dissolves completely and is

ready to be mixed with the herbal extracts [19].

- After heating, allow the sucrose solution to cool to 40 °C to prevent

degradation of the bioactive compounds in the extracts due to high temperature.

2. Sequential Addition of Extracts

- Add the Vasaka extract (20 mL), Tulsi extract (20 mL), and Ginger extract (20 mL) dropwise into the syrup base. This helps in evenly distributing the extracts throughout the syrup.
- Stir the mixture continuously to ensure that the extracts are uniformly dispersed in the syrup base.

3. Incorporation of Honey

- Gradually add 5 mL of honey into the mixture. Honey should be added slowly to preserve its bioactivity, as it can be sensitive to temperature and agitation. Stir the mixture gently until it is fully incorporated.

4. pH Adjustment & Homogenization

- Check the pH of the syrup mixture using a pH meter or pH paper [20].
- If necessary, adjust the pH to 4.5–5.5 using citric acid (or NaOH if the pH is too low).
- After pH adjustment, homogenize the mixture for 5 minutes to ensure uniform dispersion of the herbal extracts, honey, and sucrose solution.

5. Filtration & Packaging

- Filter the final syrup through muslin cloth or Whatman No. 1 paper to remove any residual particles or undissolved solids.
- Fill the syrup into sterilized amber bottles to protect the contents from light and ensure the syrup's shelf life.
- Seal the bottles immediately to maintain sterility and prevent contamination.

Directions for use

- Adults (≥ 12 years): 10–15 mL orally, 3–4 times daily after meals [21]
- Children (6–12 years): 5–10 mL orally, 3 times daily.
- Under 6 years: Use under medical supervision; maximum 2.5 mL per dose.
- Administration: Shake well before use; measure dose with a calibrated spoon or syringe.
- Duration: Continue for up to 7–10 days; if symptoms persist, consult a physician.

Evaluation of Herbal Syrup

1. Physical/Organoleptic [22]

- Appearance: Uniform, free from suspended particles.
- Colour & Odor: Characteristic light-brown hue and pleasant herbal aroma.
- Taste: Sweet with mild herbal aftertaste.

2. pH Measurement

- Measure at 25 °C; acceptable range 4.5–5.5.

3. Viscosity & Specific Gravity

- Determine using Brookfield viscometer and pycnometer, respectively, to ensure consistency.

4. Total Soluble Solids (TSS)

- Measured by refractometry; expected 60–65 °Brix.

5. Microbial Load

- Total bacterial and fungal counts must comply with WHO oral dosage limits; test for absence of *E. coli*, *S. aureus*, and *P. aeruginosa*.

6. Stability Study [23]

- Store samples at 4 °C, 25 °C/60% RH, and 40 °C/75% RH for 3 months.
- Evaluate at 0, 1, 2, and 3 months for changes in appearance, pH, viscosity, and microbial load.

Label :-

Ayurvedic Formula   Herbal Cough Syrup  GINGER & TULASI in HONEY BASE Relief from cough and sore throat Safe for Children	<table border="1"> <thead> <tr> <th>Ingredient</th> <th>Quantity mL</th> </tr> </thead> <tbody> <tr> <td>Vasaka (Adhatoda vasica) Extract</td> <td>5 mL</td> </tr> <tr> <td>Tulsi (Ocimum sanctum) Extract</td> <td>5 mL</td> </tr> <tr> <td>Ginger (Zingiber officinale) Extract</td> <td>5 mL</td> </tr> <tr> <td>Honey</td> <td>5mL</td> </tr> <tr> <td>Sugar (Sucrose)</td> <td>15g</td> </tr> <tr> <td>Distilled Water</td> <td>15mL</td> </tr> <tr> <td>Citric Acid</td> <td>0.25–0.5 g</td> </tr> </tbody> </table> Directions for Use: Adults: Take 2 teaspoons (10 mL) 3 times a day after meals. Children (6–12 years): Take 1 teaspoon (5 mL) 3 times a day after meals. Children under 6 years: Consult a physician before use. Shake well before use. Store in a cool, dry place away from sunlight. Keep out of reach of children.	Ingredient	Quantity mL	Vasaka (Adhatoda vasica) Extract	5 mL	Tulsi (Ocimum sanctum) Extract	5 mL	Ginger (Zingiber officinale) Extract	5 mL	Honey	5mL	Sugar (Sucrose)	15g	Distilled Water	15mL	Citric Acid	0.25–0.5 g	Ayurvedic Formula   Herbal Cough Syrup  GINGER & TULASI in HONEY BASE Relief from cough and sore throat Safe for Children	MFG :- Mangaldeep Institute of Pharmacy By :- Niranjan.G.Giri Roll No. 66 Seat No:- 2226031823520 Batch No :- 3 MFG Lic No :- 520 MFG Date :- April 2025 EXP Date :- April 2026 
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RESULTS AND DISCUSSION

Table Format

Sr.No	Evaluation Test	Result Obtained	Acceptable Range/Standard
1	Physical Appearance	Clear, slightly brownish liquid with no visible particles.	Must be clear, free from any suspended particles.
2	Colour	Light brown to amber colour	Light brown to amber (visually clear and consistent).
3	Odour	Characteristic herbal aroma	Must have a natural, pleasant herbal fragrance.
4	Taste	Sweet with a mild herbal aftertaste	Mildly sweet with no bitterness; characteristic herbal taste.
5	PH	4.8	4.5–5.5 (optimal for preservation and efficacy).
6	Viscosity	18.5 cP (centipoise)	15–20 cP (ideal viscosity for ease of use).
7	Total soluble solid	62.5 °Brix	60–65 °Brix (indicating appropriate concentration).
8	Microbial Load	No microbial growth detected; within limits	No E. coli, S. aureus, or P. aeruginosa; total

			bacterial count <1000 cfu/g.
9	Foaming Ability	Foam volume: 45 mL at 1 minute; stable for 4 minutes.	Foam volume should be stable for 4 minutes after shaking.
10	Stability Teste	No significant change in colour, pH, or odour after 3 months	Physically and chemically stable for at least 3 months.

RESULT

The polyherbal cough syrup was successfully formulated in accordance with the design parameters established in the literature review. Comprehensive physicochemical and quality control evaluations were carried out, including:

- **Organoleptic Assessment:** The syrup displayed a clear, light amber hue, a pleasant herbal aroma, and a sweet-herbal taste, confirming its consumer acceptability.
- **pH Measurement:** Recorded at 4.8 ± 0.1 , the pH fell squarely within the optimal 4.5–5.5 range, ensuring both product stability and patient comfort upon administration.
- **Viscosity Determination:** With a viscosity of 18.5 ± 0.5 cP, the formulation exhibited an ideal flow profile for easy swallowing and mucosal adhesion.
- **Total Soluble Solids (°Brix):** A value of 62.5 ± 0.3 °Brix indicated the correct balance of active extracts, sweeteners, and excipients, contributing to syrup consistency and palatability.
- **Microbial Load Testing:** Total bacterial and fungal counts were within pharmacopeial limits, and no pathogenic organisms (*E. coli*, *S. aureus*, *P. aeruginosa*) were detected, confirming the microbiological safety of the product.
- **Stability Studies:** Over three months at 25 °C/60% RH, there were no significant changes in colour, odour, pH, viscosity, or microbial profile, demonstrating robust physical and chemical stability.

CONCLUSION

Final Taste Mention: → Sweet with mild herbal aftertaste.

The formulation of the polyherbal cough syrup was successfully achieved, utilizing natural ingredients known for their therapeutic properties. The physicochemical evaluation, including assessments of pH, viscosity, total soluble solids, microbial safety, and stability, confirmed the syrup's high quality. The results demonstrated that the syrup not only met the desired criteria for appearance, viscosity, and foaming ability, but also exhibited favourable organoleptic properties, ensuring patient compliance and satisfaction.

The microbial testing revealed that the syrup was free from harmful pathogens, ensuring its safety for consumption. Additionally, the product showed excellent stability under standard storage conditions, confirming its shelf-life and potential for long-term use. Overall, the formulation of the polyherbal cough syrup is promising, with all tested parameters falling within acceptable limits. This highlights its potential as a safe, effective, and natural remedy for treating cough and related respiratory issues.

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