



# FORMULATION AND EVALUATION OF HERBAL INHALANT GEL CONTAINING THYME OIL

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## ABSTRACT

Formulation and evaluation of a herbal inhalant gel containing thyme oil, aimed at providing a natural alternative for respiratory and skin applications. Thyme oil, renowned for its antimicrobial properties due to thymol and carvacrol, serves as a key ingredient. Thyme plant shows beneficial activity for body. Thyme oil in an inhalant gel provides antimicrobial, spasmolytic, and expectorant benefits, while also allowing for a natural, stable, and well-tolerated delivery system. The formulation process involves extraction of thyme oil from dried thyme leaves followed by incorporation into aloe vera gel. Pharmacological investigations reveal the potential bronchodilation, anti-inflammatory, and antimicrobial effects of thyme oil, supporting its therapeutic value in respiratory conditions. Evaluation tests encompass physical characteristics assessment, pH measurement, homogeneity analysis, spreadability test, and viscosity measurement. This comprehensive approach offers insights into the development of an effective herbal inhalant gel with thyme oil, promising for respiratory and skin health.

**KEYWORDS:** -thyme plant, gel formulation, respiratory disease treatment

## INTRODUCTION

The formulation and evaluation of a herbal inhalant gel containing thyme oil involves creating a delivery system with potential antimicrobial properties. Thyme essential oil, rich in thymol and carvacrol, is key for its effects on microorganisms like *Candida albicans*.

The gel's texture is optimized using central composite design, with colloidal silica and paraffin oil influencing firmness, cohesiveness, and consistency.<sup>(3)</sup>

Thyme oil's properties, such as being spasmolytic, expectorant, and antimicrobial, make it valuable for cough relief and cold symptoms.<sup>(2)</sup>

This herbal gel offers a natural alternative for respiratory and skin application.<sup>(1)</sup>

**the key benefits of using thyme oil in inhalant gels are:**

**Spasmolytic, expectorant, and antimicrobial effects:** Thyme oil has properties that can help relieve cough and cold symptoms, as it is spasmolytic (relaxes muscles), expectorant (promotes mucus clearance), and antimicrobial.<sup>(2)(12)</sup>

**Antimicrobial properties:** Thyme essential oil, rich in thymol and carvacrol, has significant antimicrobial activity against microorganisms like *Candida albicans*. This makes it valuable for respiratory and skin applications.<sup>(13)</sup>

**Natural alternative:** The herbal inhalant gel offers a natural alternative to synthetic medications for respiratory and skin conditions.<sup>(14)</sup>

**Optimized texture and stability:** The gel formulation can be optimized using ingredients like colloidal silica and paraffin oil to achieve desirable texture, firmness, cohesiveness, and stability.<sup>(3)(15)</sup>

**Hypothesis:** - In earlier studies, thyme plant shows beneficial activity for body. Thyme oil in an inhalant gel provides antimicrobial, spasmolytic, and expectorant benefits, while also allowing for a natural, stable, and well-tolerated delivery system.<sup>(16)</sup>

## Materials

### 1. Herbal ingredients:

- thyme leaves (extract)



**2. Chemical ingredients:**

- a. Carbapol 940
- b. Triethanolamine
- c. Sodium benzoate
- d. Distilled water

**Plant Description**

Thyme is a tiny perennial shrub, with a semi evergreen groundcover that seldom grows quite 40 cm tall it's each horizontal and upright habits. The stems become woody with age. Thyme leaves are terribly little, usually 2.5 to 5 mm long and vary significantly in form and hair covering, depending on the variety, with every species having a rather completely different scent. <sup>(4)</sup>

*Thymus vulgaris* leaves are oval to rectangular in form and somewhat fleshy aerial components are used for volatile oil production, principally by steam distillation. The contemporary and dried herb market uses it for cookery functions. Thyme grows well during a temperate to heat, dry, sunny climate, and wherever the plants don't seem to be shaded. It desires full sun to grow to its best potential. Thyme doesn't like excessive wet as a result of its condition it will get rot diseases. Thyme prefers lightweight, well drained soils with a pH of 5.0 to 8.0. Thyme species do best in coarse, rough soils that may be unsuitable for several alternative plants. <sup>(5)</sup>



**Fig.1. Thyme plant**

**Taxonomical classification <sup>(10)</sup>**

<b>Kingdom</b>	Plantae
<b>Phylum</b>	Tracheophyta
<b>Class</b>	Magnoliopsida
<b>Order</b>	Lamiales
<b>Family</b>	Labiatae
<b>Scientific name</b>	<i>Thymus vulgaris</i>
<b>Common name</b>	<b>English</b> – common thyme, garden thyme <b>Hindi</b> – ban ajwain
<b>synonyms</b>	<i>Origanum thymus</i> Kuntze <i>Thymus collinus</i> Salisb.

**Chemical constituents and uses**

<b>Chemical constituent</b>	<b>Biological activities(uses)</b>	<b>Reference</b>
Thymol <sup>(6)</sup>	Antiseptic, antibacterial, antifungal and antioxidant properties	(Aeschbach et al., 1994; Cosentino et al., 1999; Venturini et al., 2012).
Linalool <sup>(7)</sup>	Antiviral effect, anti-inflammatory, antioxidant, anti-anaphylactic activities	Elisabetsky et al., 1995; Usta et al., 2009; Bagetta et al., 2010; Coelho et al., 2011).
Eugenol <sup>(8)</sup>	Neuro-protective, anticancer, antibacterial, and anti-anaphylactic activities	Laekeman et al., 1990; Atsusane, 1991. Wie et al., 1997; Jadhav et al., 2004
Carvacrol <sup>(9)</sup>	Antimicrobial, anti-thrombotic, anti-inflammatory, acetyl cholinesterase inhibitory properties	Enomoto et al., 2001; Sosa et al., 2005; Jukic et al., 2007

**Formula**

Sr.no	Ingredient	quantity	category
1	Thyme oil	1-2 ml (5-6 drop)	Expectorant
2	Carbapol	1 gm	Gelling agent
3	Sodium benzoate	0.3 gm	Preservative
4	Triethanolamine	0.5 gm	pH stabilizer
5	water	q. s	Vehicle

**Procedure of formulation****A) extraction**

1. Take dried thyme leaves.
2. Triturate thyme leaves with mortar pestle.
3. 1000 gm. of thyme leaves used in extraction with 3000 ml of 95% ethanol in ratio 1:3.
4. Collect the essential oil extracted at the volumetric flask by separation of ethanol and essential oil.
5. Store essential oil in amber bottle and away from sunlight.<sup>(11)</sup>

**B) Formulation**

1. Thyme Oil Preparation  
Measure out 2 grams of thyme oil and set it aside for later incorporation into the gel.
2. Carbopol Gel Preparation  
Sprinkle Carbopol: Slowly sprinkle 1 gram of Carbopol into approximately 20 grams of purified water while stirring continuously to prevent clumping.  
Hydration: Allow the mixture to hydrate for at least 30 minutes until it forms a clear gel.
3. Neutralizing Carbopol Gel  
Add TEA: Drop triethanolamine (TEA) into the Carbopol gel gradually while stirring until the pH reaches around 6.5-7.0. Use a pH meter or strips for accurate monitoring.  
Importance of Neutralization: Neutralizing Carbopol is crucial for achieving the desired gel consistency.
4. Incorporating Thyme Oil  
Add Thyme Oil: Slowly add the 2 grams of thyme oil to the neutralized Carbopol gel.  
Stirring: Gently stir to ensure even distribution of the thyme oil throughout the gel.
5. Adding Sodium Benzoate  
Dissolve Sodium Benzoate: Dissolve 0.3 grams of sodium benzoate in a small amount of purified water.  
Incorporate: Add the sodium benzoate solution to the thyme oil-infused gel and stir well for uniform dispersion.<sup>(17)</sup>
6. Checking and Adjusting pH  
Use a pH meter or strips to check the final pH of the gel, aiming for 6.5-7.0. Adjust, if necessary, by adding more TEA (to increase pH) or citric acid (to decrease pH).
7. Final Adjustment and Packaging:  
Consistency Check: Assess the consistency and texture of the gel. Adjust thickness by adding small amounts of purified water if needed.
8. Packaging:  
Once satisfied with texture and pH, transfer the herbal inhalant gel into clean, airtight containers or tubes suitable for storage and application.<sup>(18)</sup>

**Pharmacology**

**Bronchodilation:** Thyme oil has been shown to relax bronchial muscles, leading to bronchodilation and improved airflow. This can help alleviate symptoms of asthma and COPD.

**Anti-inflammatory effects:** Thyme oil can reduce inflammatory markers like IL-1 $\beta$  and IL-8, and downregulate NF- $\kappa$ B signalling, thereby exerting anti-inflammatory actions in the respiratory tract.<sup>(19)(20)</sup>

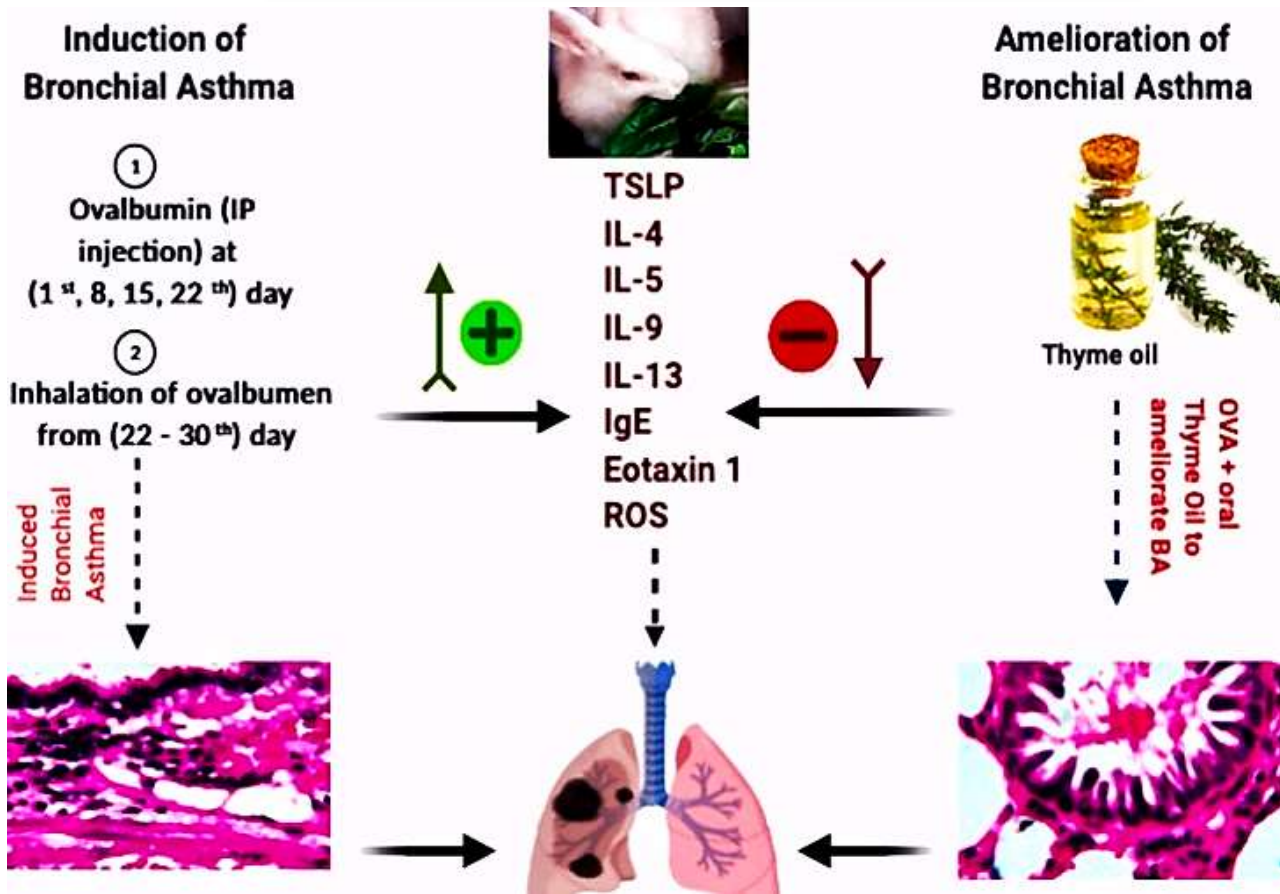


Fig.2. MOA

**Antimicrobial activity:** Thyme oil exhibits potent antimicrobial properties, including against multidrug-resistant strains, which can help combat respiratory infections that may exacerbate asthma and COPD.<sup>(21)(22)</sup>

**Mucociliary clearance enhancement:** Thyme oil can increase cilia beating frequency and modulate calcium and cAMP signalling, improving mucociliary clearance in the airways.<sup>(19)</sup>

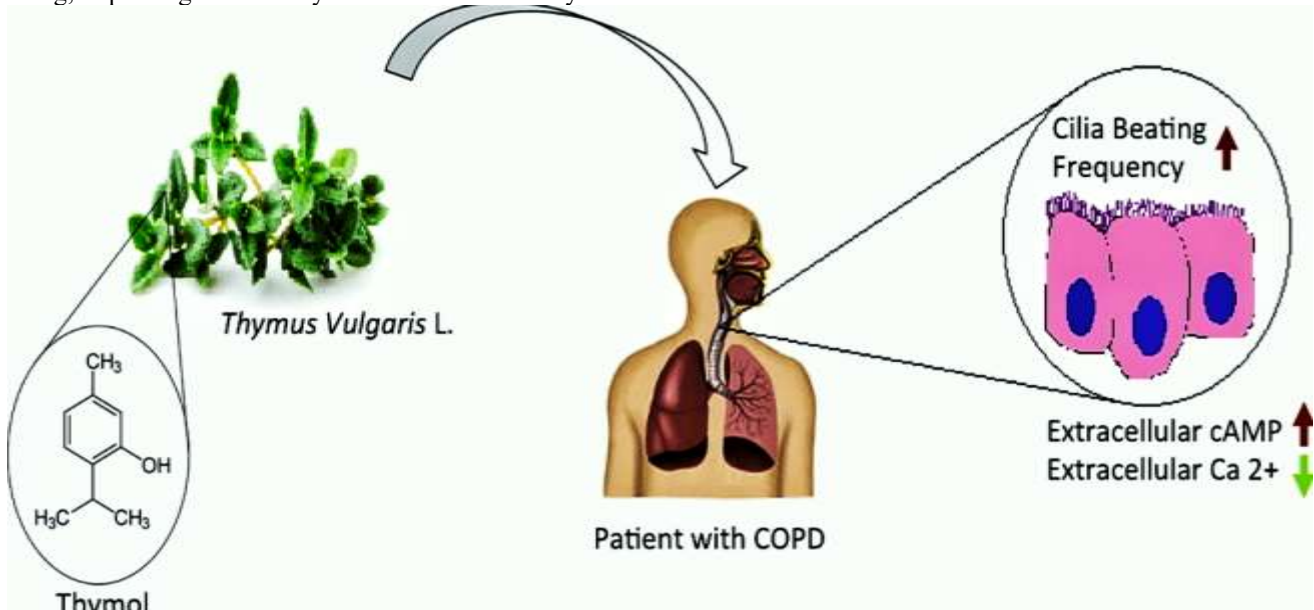


Fig.3. MOA (mucociliary)

**Antiviral effects:** Thyme oil and its active compounds have demonstrated antiviral activity against respiratory viruses like influenza and SARS-CoV-2.<sup>(21)</sup>



**Evaluation test<sup>(23)</sup>:-****External appearance of the gel**

**A. Physical evaluation:** Visual checks on physical characteristics, such as colour, smell and consistency, were performed.

**B. Colour:** A visual inspection was conducted to determine the formulation's colour.

**C. Consistency:** Consistency was evaluated by applying the formulation onto the skin.

**D. Odor:** The formulation's Odor was tested by smelling the Odor of the mixture of the gel with water. Table reveals the physical evaluation of the gel formulation.

**Measurement of pH**

Using a digital pH meter, the pH of the formulation of the herbal gel was assessed. A precise 2.5 g of gel was weighed, dissolved in 25 mL purified water, and kept in storage for 2 h. The pH of the formulation was then measured by fully submerging the glass electrode 3 times in the gel system, and the average values of pH were calculated.



**Fig.4. Digital pH Meter**

**Homogeneity**

All generated gels were checked visually for homogeneity after being placed in a container to assess the appearance and the presence of aggregates. They were examined for the presence of aggregates and how they appeared.<sup>(23)</sup>



**Fig.5. Homogeneity**

**Spreadability**

Based on the gel's slip and drag properties, spreadability was determined using wooden equipment. On these ground slides, more gel (approximately 2 g) was added to the experiment. Another glass slide oriented with a fixed direction was then given the gel and then sandwiched between these slides. Weight of 1 kg was fixed on the top of the slide for 5 min to eject air and to offer an even film of the gel linking the slides. Surplus of the gel was scrapped off from the boundaries. The apex plate was then subjected to drag of 50 g. A shorter interval indicates better spreadability.

Spreadability was calculated using the following formula:

$$S = (M \times L) / T$$

Where S is spreadability; M is weight in the pan; L is length moved by the glass slide; and T is time in seconds taken to separate the slide completely each other. <sup>(24)</sup>

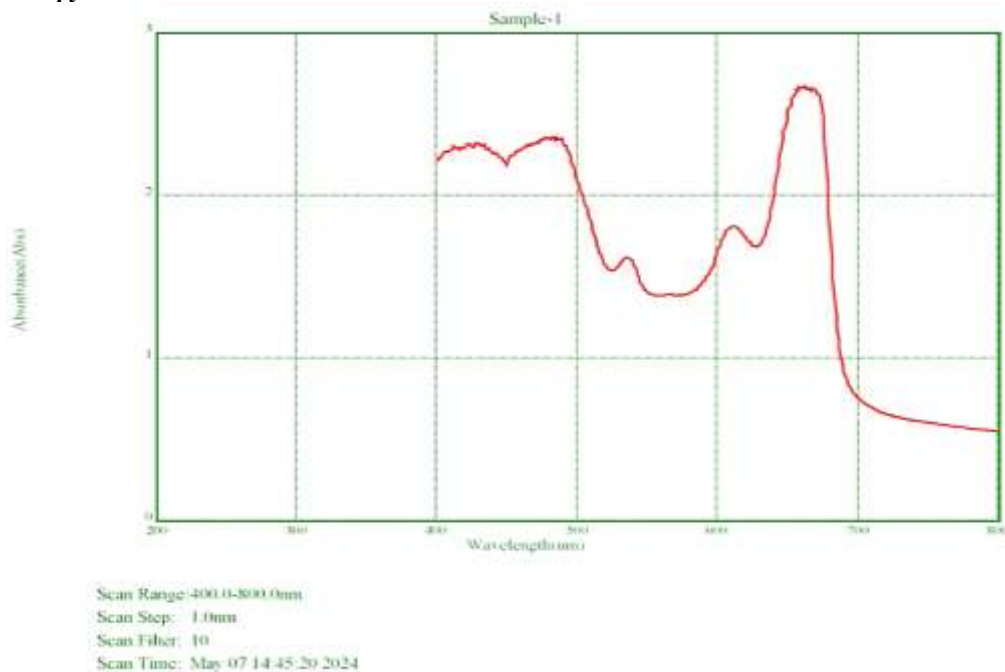
### Viscosity

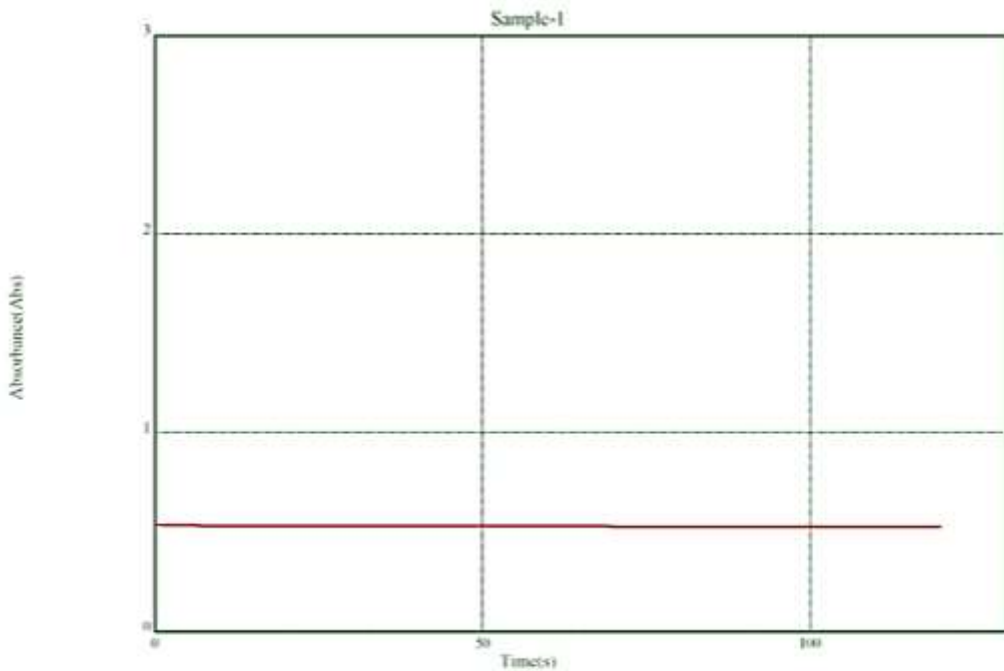
The Brookfield viscometer was used to measure the viscosity of the created gel at a temperature of 25°C. The dial reading for each speed was recorded as the gels were rotated at 0.3, 0.6, and 1.5 rotations per minute. The gels' viscosity was then determined by multiplying the dial reading by a value listed in the Brookfield viscometer catalogues.



Fig.6. Viscosity

### UV- Visible spectroscopy





Wavelength: 700.0nm  
 Total Time: 120s  
 Scan Step: 1.0s  
 Operator: UV Spectrophotometer  
 Scan Time: May 07 14:46:49 2024

**Sample 1**

0.0s	0.5297	34.0s	0.5269	68.0s	0.5242	102.0s	0.5225
1.0s	0.5296	35.0s	0.5269	69.0s	0.5242	103.0s	0.5225
2.0s	0.5295	36.0s	0.5268	70.0s	0.5241	104.0s	0.5226
3.0s	0.5293	37.0s	0.5269	71.0s	0.5240	105.0s	0.5224
4.0s	0.5292	38.0s	0.5269	72.0s	0.5236	106.0s	0.5224
5.0s	0.5290	39.0s	0.5270	73.0s	0.5237	107.0s	0.5223
6.0s	0.5289	40.0s	0.5269	74.0s	0.5236	108.0s	0.5224
7.0s	0.5289	41.0s	0.5267	75.0s	0.5236	109.0s	0.5222
8.0s	0.5288	42.0s	0.5267	76.0s	0.5234	110.0s	0.5222
9.0s	0.5287	43.0s	0.5267	77.0s	0.5234	111.0s	0.5220
10.0s	0.5285	44.0s	0.5266	78.0s	0.5233	112.0s	0.5220
11.0s	0.5283	45.0s	0.5265	79.0s	0.5232	113.0s	0.5218
12.0s	0.5281	46.0s	0.5264	80.0s	0.5233	114.0s	0.5218
13.0s	0.5280	47.0s	0.5264	81.0s	0.5231	115.0s	0.5216
14.0s	0.5278	48.0s	0.5262	82.0s	0.5230	116.0s	0.5215
15.0s	0.5277	49.0s	0.5262	83.0s	0.5230	117.0s	0.5214
16.0s	0.5278	50.0s	0.5262	84.0s	0.5229	118.0s	0.5213
17.0s	0.5277	51.0s	0.5260	85.0s	0.5229	119.0s	0.5213
18.0s	0.5278	52.0s	0.5260	86.0s	0.5229	120.0s	0.5213
19.0s	0.5276	53.0s	0.5258	87.0s	0.5228		
20.0s	0.5275	54.0s	0.5256	88.0s	0.5229		
21.0s	0.5276	55.0s	0.5256	89.0s	0.5229		
22.0s	0.5275	56.0s	0.5254	90.0s	0.5229		
23.0s	0.5276	57.0s	0.5254	91.0s	0.5226		
24.0s	0.5275	58.0s	0.5252	92.0s	0.5228		
25.0s	0.5276	59.0s	0.5252	93.0s	0.5228		
26.0s	0.5275	60.0s	0.5250	94.0s	0.5228		
27.0s	0.5275	61.0s	0.5248	95.0s	0.5228		
28.0s	0.5275	62.0s	0.5248	96.0s	0.5227		
29.0s	0.5274	63.0s	0.5247	97.0s	0.5228		
30.0s	0.5273	64.0s	0.5247	98.0s	0.5224		
31.0s	0.5273	65.0s	0.5246	99.0s	0.5223		
32.0s	0.5272	66.0s	0.5244	100.0s	0.5225		
33.0s	0.5270	67.0s	0.5244	101.0s	0.5225		



**Observation and Result****A). physical parameters**

Sr.no	Physical parameter	
1	Colour	Transparent
2	Odour	Aromatic
3	Consistency	Good

**B) pH determination:** slightly alkaline (6.99)**C) Homogeneity:** good**D) Spreadability:**  $5.5 \pm 0.5$  cm**E) Viscosity:** 4500 cps**F) Uv-Visible spectroscopy:** 400-600 nm**CONCLUSION**

The formulation and evaluation of the herbal inhalant gel containing thyme oil present a promising natural alternative for respiratory and skin applications. Thyme oil, rich in thymol and carvacrol, offers significant antimicrobial, spasmolytic, and expectorant properties, making it beneficial for alleviating cough, cold symptoms, and respiratory conditions. Through a meticulous formulation process and optimization of texture and stability, the gel ensures a consistent and effective delivery system. The inclusion of key ingredients like Carbapol, Sodium benzoate, and Triethanolamine, along with careful consideration of pH levels, contributes to the gel's quality and efficacy. Furthermore, the pharmacological properties of thyme oil, including bronchodilation, anti-inflammatory effects, antimicrobial activity, and mucociliary clearance enhancement, underscore its therapeutic potential in managing respiratory ailments.

The comprehensive evaluation tests, encompassing physical characteristics, pH measurement, homogeneity, spreadability, and viscosity assessment, provide valuable insights into the gel's performance and quality assurance.

Overall, the herbal inhalant gel containing thyme oil emerges as a promising formulation, offering a natural, stable, and well-tolerated solution for respiratory and skin conditions, backed by its potent therapeutic properties and rigorous evaluation.

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