



# Formulation and Evaluation of Herbal Gel by using Lemongrass oil

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**Abstract :-** The aim of this research is to formulate and evaluate a herbal gel that contains extract from the leaves of Cymbopogon citratus and extract of tulsi leaves . Carbapol 940, propylene glycol, methyl and propyl parabens, Cymbopogon citratus leaf extract, and the necessary quantity of distilled water were used to formulat gel ,later Tri-ethanolamine was added drop by drop to maintain the skin pH (6.8–7).

Cymbopogon citratus oil was prepared using a solvent extraction method for extraction of essential oils. After extraction, topical gel was formulated for the treatment of acne .

Then three different measured amounts of Cymbopogon citratus oil was incorporated into the gel and labeled as F1,F2 and F3 and evaluated for physical parameters.

**Keywords :-** , Gel,Antiacne ,lemongrass oil, tulsi leaves extract,carbapol 934,Formulation , Evaluation

## INTRODUCTION :-

The word "gel" comes from the word "gelatin," while the words "gel" and "jelly" have their roots in the Latin words gelu, which means "frost," and gel an, which means "freeze" or "congeal." This source illustrates the basic concept of a liquid setting to a solid-like substance that is elastic and retains some liquid properties but does not flow.

Gels are defined as semi rigid systems in which the movement of the dispersing medium is restricted by an interlacing three-dimensional network of particles or solvated supermolecules of the dispersed phase. The USP defines gels (sometimes called jellies) as semisolid systems containing either suspensions made up of small inorganic particles, or large organic molecules diffused by a liquid.

Gels that have a network of tiny, distinct particles inside their mass are categorized as two-phase systems. When a two-phase system has a dispersed phase with relatively large particle sizes, the gel mass is referred to as a magma. Organic supermolecules are evenly spread throughout a liquid to generate single-phase gels; the liquid and the dispersed supermolecules do not appear to have any boundaries.

Topical gels are semi-solid, homogeneous preparations that are applied topically to treat and prevent skin ailments. Gels' hydrophilic properties allowed the medication or active ingredient to be delivered fast. Two components make up a gel: a three-dimensional, cross-linked material with enough liquid in it to form a sufficiently rigid network to trap the liquid continuous phase. Inorganic and organic macromolecules work together to form the gel's structural network.

## PROPERTIES OF GELS. :-

**Pharmaceutical gels are designed with specific properties to ensure their efficacy and safety in various applications. Here are some ideal properties of pharmaceutical gels:**

1. **Viscosity:** To guarantee ease of application and adhesion to the target site, gels should have the proper viscosity. Depending on the intended use (topical treatment, oral administration, etc.), this viscosity may change.
2. **Uniformity :** To provide steady dosage delivery, the gel's active components should be distributed uniformly throughout its matrix.

3. **Stability** : Throughout the gel's shelf life, stability is essential to preserving its efficacy and integrity. This involves resistance to chemical deterioration (such as oxidation and hydrolysis) as well as physical changes (such as phase separation and crystallization).
4. **Bioadhesion** : The ability of topical gels to adhere to biological surfaces (such as skin and mucosa) might improve drug absorption by extending residence duration.
5. **Non-toxicity** : To reduce adverse effects on tissues and organs, gels should be non-toxic and compatible with biological systems
6. **Non-irritating** : To ensure patient comfort and compliance, gels should ideally not cause irritation
7. **Ease of application** : The gel need to be uniformly distributed over the application site and simple to apply
8. **Compatibility** : To preserve the stability and effectiveness of the formulation, compatibility with other excipients and ingredients is essential.
9. **Solubility** : To attain the appropriate therapeutic concentrations, the gel must successfully suspend or solubilize the active medicinal ingredient(s).
10. **Transparency/Opacity** : Gels may need to be opaque (to protect light-sensitive chemicals) or transparent (for aesthetic reasons), depending on the application.
11. **Ease of removal** : It is preferable for topical gels to be easy to remove after application, if applicable.
12. **Taste and odor** : To increase patient acceptance and compliance, gels meant for oral administration should have tolerable taste and odor profiles.

**All of these characteristics ensure that pharmaceutical gels are safe, effective, and suitable for their intended use in healthcare and medical applications.**

#### **ADVANTAGES OF GEL :-**

##### **Pharmaceutical gels offer several advantages :-**

1. **\*\*Ease of Application\*\***: Gels offer specific treatment without the need for invasive treatments; they are simple to apply to the skin or mucous membranes.
2. **\*\*controlled Drug Release\*\***: This allows for the gradual, regulated release of medications, which is advantageous for long-lasting therapeutic benefits.
3. **\*\*Improved Bioavailability\*\***: Compared to other dosage forms, gels can improve the absorption of medications through the skin or mucous membranes.
4. **\*\*Reduced Systemic Side Effects\*\***: By directing the drug's distribution to the affected location, localized application helps reduce systemic side effects.
5. **\*\*Versatility\*\***: Gels are adaptable for a variety of therapeutic applications because they can hold a broad spectrum of medicines, including both hydrophilic and lipophilic compounds.
6. **\*\*Patient Compliance\*\***: Because of their non-invasive application and user-friendliness, they frequently increase patients' adherence to recommended treatments.
7. **\*\*Aesthetic Appeal\*\***: Gels are visually pleasant to patients because they are usually transparent or translucent and leave no residue behind.
8. **\*\*Moisturizing Effect\*\***: Certain gels have the ability to moisturize, which is advantageous for specific skin issues.

**Pharmaceutical gels are a recommended dose form in ophthalmology, dermatology, and other medical specialties that need localized drug delivery because of these benefits.**

#### **Method of gel preparation :-**

1. **Fusion Technique**
2. **Cold Method**
3. **Dispersion Approach**

##### **1.Fusion Technique :-**

The fusion technique used for preparation of gel typically refers to the process of melting ingredients together to form a homogeneous mixture that solidifies upon cooling. This technique is commonly used in the preparation of gels for various applications such as in cosmetics, pharmaceuticals, and even in certain types of food products.

## Here's a basic outline of how the fusion technique is applied in gel preparation:

An overview of the fusion technique's basic application in gel preparation is given below:

1. **Selection of Ingredients**: Water, gelling agents (such as agar, gelatin, or gellan gum), and additional additions like colorants, perfumes, or preservatives are typically combined to make gels.

2. **Heating**: The ingredients are combined and heated to a temperature at which each ingredient is liquid. This temperature is usually above the gelling agent's melting point, though it might vary based on the particular chemicals utilized.

3. **Mixing and Homogenization**: To guarantee complete mixing of all ingredients, the mixture is agitated or swirled while it is heating. This aids in distributing the gelling agent and other ingredients uniformly.

4. **Cooling and Gel Formation**: After the mixture is well combined, it is allowed to cool. The gelling ingredient starts to solidify and create a gel structure as it cools. The gel's texture and consistency can be adjusted by adjusting the cooling process.

5. **final adjustments**: Depending on the particular needs of the gel product, last modifications like pH balancing or adding more ingredients may be carried out after gel formation.

By using this fusion approach, the gelling ingredient is dispersed equally throughout the mixture and the gel has a consistent texture and appearance. It is an essential step in the creation of different kinds of gels that are utilized in consumer and industrial settings.

## 2. Cold Method :-

When preparing gels using the cold method, a gelling ingredient is usually dissolved in a cold liquid and left to set in the refrigerator or at room temperature. Here is a general rundown of how it can be accomplished:

1. **Ingredients**: Gather the liquid (water, juice, broth, etc.) that you wish to use as the base of your gel as well as your gelling agent (gelatin, agar-agar, pectin, etc.).

2. **Mixing**: Gently whisk the chilled liquid while uniformly dispersing the gelling agent. This guarantees equal distribution and lessens the chance of clumping.

3. **Hydration**: Give the mixture a few minutes to settle so that the liquid gelling agent can hydrate.

4. **Heating (optional)**: To fully dissolve some gelling agents (like gelatin), a little heating may be helpful; nevertheless, boiling should be avoided to maintain the gelling qualities.

5. **Setting**: Transfer the mixture into molds or containers, and then refrigerate (or let stand at room temperature, based on your gelling agent's recommendations) until it solidifies completely.

6. **Final touches**: gel is now ready to be served or unmolded in accordance with your recipe after it has set. This technique is especially helpful for delicate preparations when quick setting is required or high heat may destroy flavors.

## 3. Dispersion Approach :-

The dispersion approach method is a technique used in the preparation of gels, particularly hydrogels, which are cross-linked polymer networks capable of holding large amounts of water. Here's how the dispersion approach method typically works:

1. **Polymer Dissolution**: Firstly, the polymer (such as polyvinyl alcohol, polyacrylamide, etc.) is dissolved in a suitable solvent. This solvent could be water or another compatible solvent depending on the polymer's solubility.

2. **Cross-linking Agent**: A cross-linking agent is then added to the polymer solution. This agent forms bridges between polymer chains, creating a network structure that gives the gel its strength and integrity. Common cross-linking agents include glutaraldehyde, formaldehyde, or various other bifunctional or multifunctional compounds.

3. **Dispersion and Mixing**: After adding the cross-linking agent, the polymer solution is dispersed or mixed thoroughly to ensure uniform distribution of the cross-linking agent throughout the polymer solution. This step is crucial to achieving consistent gel properties.

4. **Gelation**: The cross-linking reaction is allowed to proceed, leading to gelation. During this process, polymer chains become interconnected through the cross-linking agent, forming a three-dimensional network that traps water molecules within its structure.

5. **Purification and Processing**: Once the gelation is complete, the gel may undergo purification steps to remove any unreacted materials or residual solvents, depending on the specific requirements of the application.

6. **Characterization**: Finally, the prepared gel is characterized to ensure it meets desired specifications such as mechanical strength, porosity, biocompatibility (if applicable), and water absorption capacity.

This dispersion approach method is favored for its versatility and ability to produce gels with controlled properties suitable for various applications ranging from biomedical uses (e.g., tissue engineering, drug delivery systems) to industrial applications (e.g., absorbents, sensors).

#### APPLICATION OF GEL :-

Applying gel to your face can serve several purposes depending on the type of gel:

- Moisturizing**: Hydrating gels often help to hydrate and refresh your skin.
- Acne Treatment**: Some gels are effective in treating acne by reducing inflammation and killing bacteria.
- Anti-Aging**: Gels can help to reduce fine lines and wrinkles, promoting a more youthful appearance.
- Cooling and Soothing**: Some gels are particularly known for their soothing properties, which can be beneficial for sunburns or sensitive skin.
- Preventing Breakouts**: Oil-free gels can help control excess oil production, reducing the likelihood of breakouts.

#### ANTIACNE:-

##### ACNE :-

Acne (also known as Acne Vulgaris), is a skin condition that occurs when the hair follicles become clogged with oil and dead skin cells. It is a chronic, inflammatory skin condition that affects teenagers and can persist to adulthood.

The distinct lesions can be classified as inflammatory (papules, pustules, nodules, and cysts) or non-inflammatory (open/black and closed/white comedones), which can result in scar formation and skin pigmentation and require long-term, consistent care. Lesions are usually found on the chest, upper back, neck, and face.

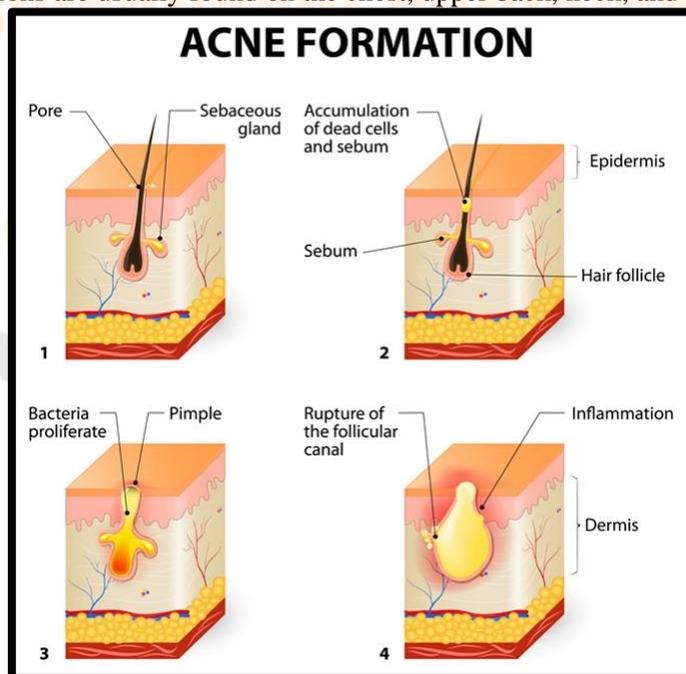


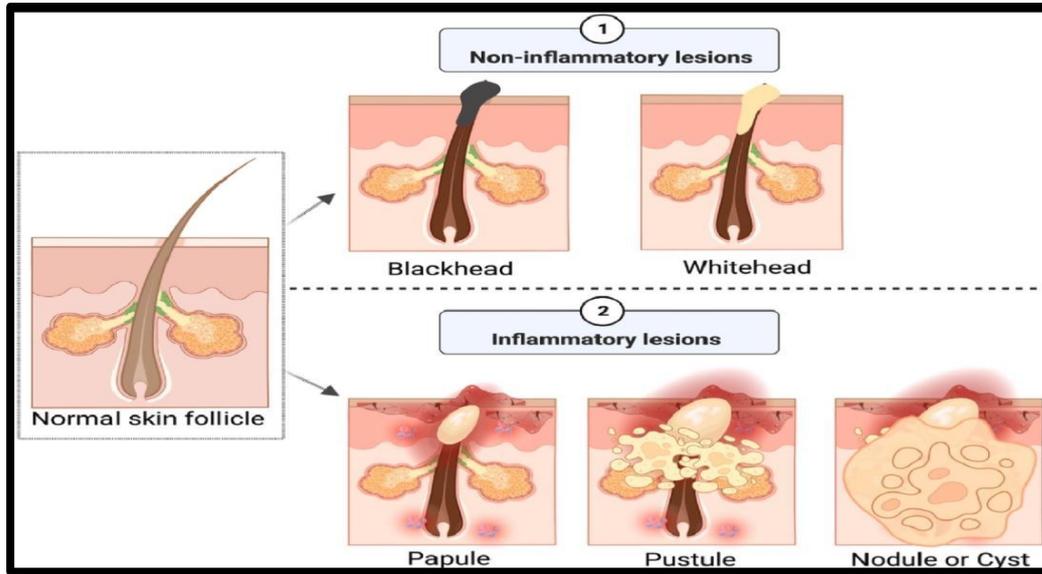
Fig (1) Acne Formation

**TYPES OF ACNE :-**

Acne can take several forms.

They include:

- 1) **Blackheads:** Open bumps on the skin that fill with excess oil and dead skin. They look as if dirt has deposited in the bump, but the dark spots are actually caused by an irregular light reflection off the clogged follicle.
- 2) **Whiteheads:** Bumps that remain closed by oil and dead skin.
- 3) **Papules:** Small red or pink bumps that become inflamed.



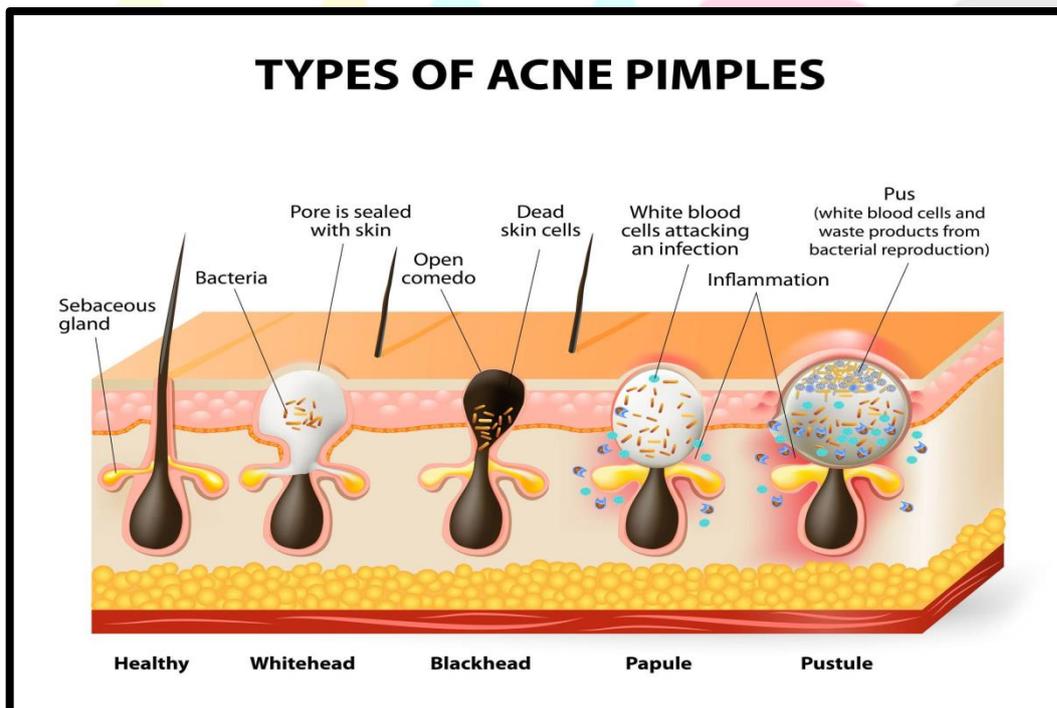
**Fig (2) Types of Acne**

4) **Pustules:** Pimples containing pus. They look like whiteheads surrounded by red rings. They can cause scarring if picked or scratched.

5) **Fungal acne ( pityrosporum folliculitis):** This type occurs when an excess Yeast develops in the hair follicles. They can become itchy and inflamed.

6) **Nodules:** Solid pimples that are deep in the skin. They are large and painful.

7) **Cysts:** Pus-filled pimples. These can cause scars.



**Fig (3) Types of Acne**

**CAUSES :-**

**Doctors believe that one or more of the following can lead to acne:**

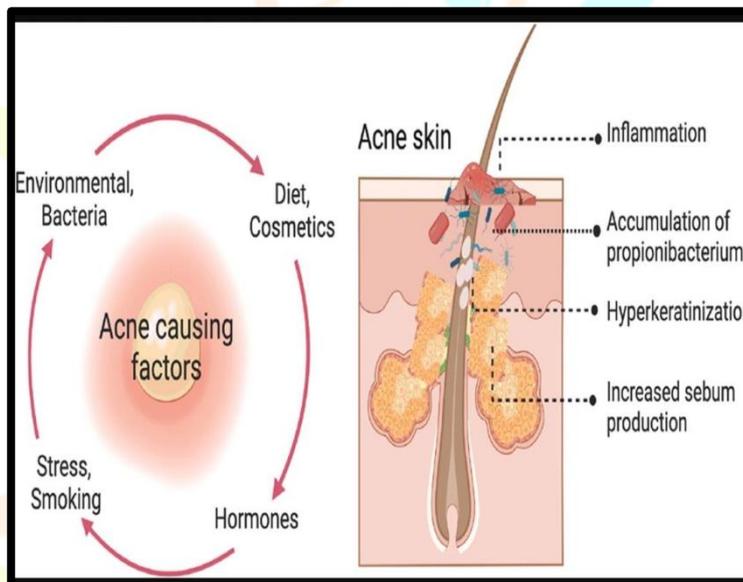
- 1) Too much oil in the pore.
- 2) Buildup of dead skin cells in the pore.
- 3) Growth of bacteria in the pore.

**The following factors may make it more likely for an individual to develop acne:**

- 1) Hormones.
- 2) Family History
- 3) Medications.
- 4) Age

**The following do not cause acne, but may make it worse.**

- 1) Certain foods.
- 2) Stress.
- 3) Pressure from sports helmets, tight clothes, or backpacks.
- 4) Pollution and high humidity.
- 5) Squeezing or picking at pimples
- 6) Scrubbing the skin too hard.



**Fig (4) Causes of Acne**

**Acne can be caused by a combination of factors including:**

1. **\*\*Overproduction of oil\*\***: Sebum, an oily material, is produced by the skin's sebaceous glands. Excessive sebum production can block pores and exacerbate acne.
2. **\*\*Clogged pores\*\***: Comedones (blackheads and whiteheads) are the result of dead skin cells or other debris combining with sebum to clog hair follicles.
3. **\*\*Bacteria\*\***: The skin is home to *Propionibacterium acnes* (*P. acnes*), a bacterium that can grow in closed pores. Inflammation and pimple formation may result from this.
4. **\*\*Hormonal fluctuations\*\***: During puberty, menstruation, pregnancy, and stressful times, hormone fluctuations can lead to an increase in sebum production and exacerbate acne.
5. **\*\*Specific drugs\*\***: Some people's acne may get worse after taking corticosteroids, androgens, or lithium.
6. **\*\*Diet\*\***: Research indicates that dairy products and diets with a high glycemic index may make acne worse in certain individuals, while the exact relationship is debatable.
7. **\*\*Genetics\*\***: People who have a family history of acne may be more likely to develop the ailment.
8. **\*\*Pressure or friction on the skin\*\***: Things like backpacks, helmets, and tight clothing can cause this, aggravating acne.

**Treating several issues at once, such as lowering oil production, stopping bacterial growth, and encouraging skin cell turnover, is frequently necessary for effective acne treatment.**

**PREVENTION :-**

- 1) Wash the face no more than twice each day with warm water and mild soap made especially for acne.
- 2) Do not scrub the skin or burst the pimples, as this may push the infection further down, causing more blocking, swelling, and redness.
- 3) Avoid popping pimples, as this makes scarring likelier.
- 4) A specialist can treat a pimple that requires rapid removal for cosmetic reasons.
- 5) Refrain from touching the face.
- 6) Hold the telephone away from the face when talking, as it is likely to contain sebum and skin residue.
- 7) Wash hands frequently, especially before applying lotions, creams, or makeup.
- 8) Clean spectacles regularly as they collect sebum and skin residue.
- 9) If acne is on the back, shoulders, or chest, try wearing loose clothing to let the skin breathe. Avoid tight garments, such as headbands, caps, and scarves, or wash them regularly if used.
- 10) Choose makeup for sensitive skin and avoid oil-based products. Remove makeup before sleeping.
- 11) Use an electric shaver or sharp safety razors when shaving. Soften the skin and beard with warm soapy water before applying shaving cream.
- 12) Keep hair clean, as it collects sebum and skin residue. Avoid greasy hair products, such as those containing cocoa butter.
- 13) Avoid excessive sun exposure, as it can cause the skin to produce more sebum. Several acne medications increase the risk of sunburn.
- 14) Avoid anxiety and stress, as it can increase production of cortisol and adrenaline, which exacerbate acne.
- 15) Try to keep cool and dry in hot and humid climates, to prevent sweating.

**PATHOGENESIS OF ACNE VULGARIS :-**

Acne vulgaris is thought to have multiple causative elements, which contribute significantly to its traditional etiology. Increased sebum excretion rates, endocrinological factors such as androgens, aberrant keratinization of the follicular infundibulum, bacterial infection growth, and the subsequent inflammation are the causes of chronic acne skin diseases, as previously stated.

**a)Increased in Sebum Production :-**

One of the main reasons acne forms is an increase in sebum production in the hair follicles. Gollnick et al. claim that androgen hormones, particularly testosterone and insulin growth hormone (IGH-1), promote the production and release of sebum [13]. Increased sebum production is clearly correlated with the frequency and severity of acne lesions; therefore, it is an important factor to take into consideration in patients with acne vulgaris.



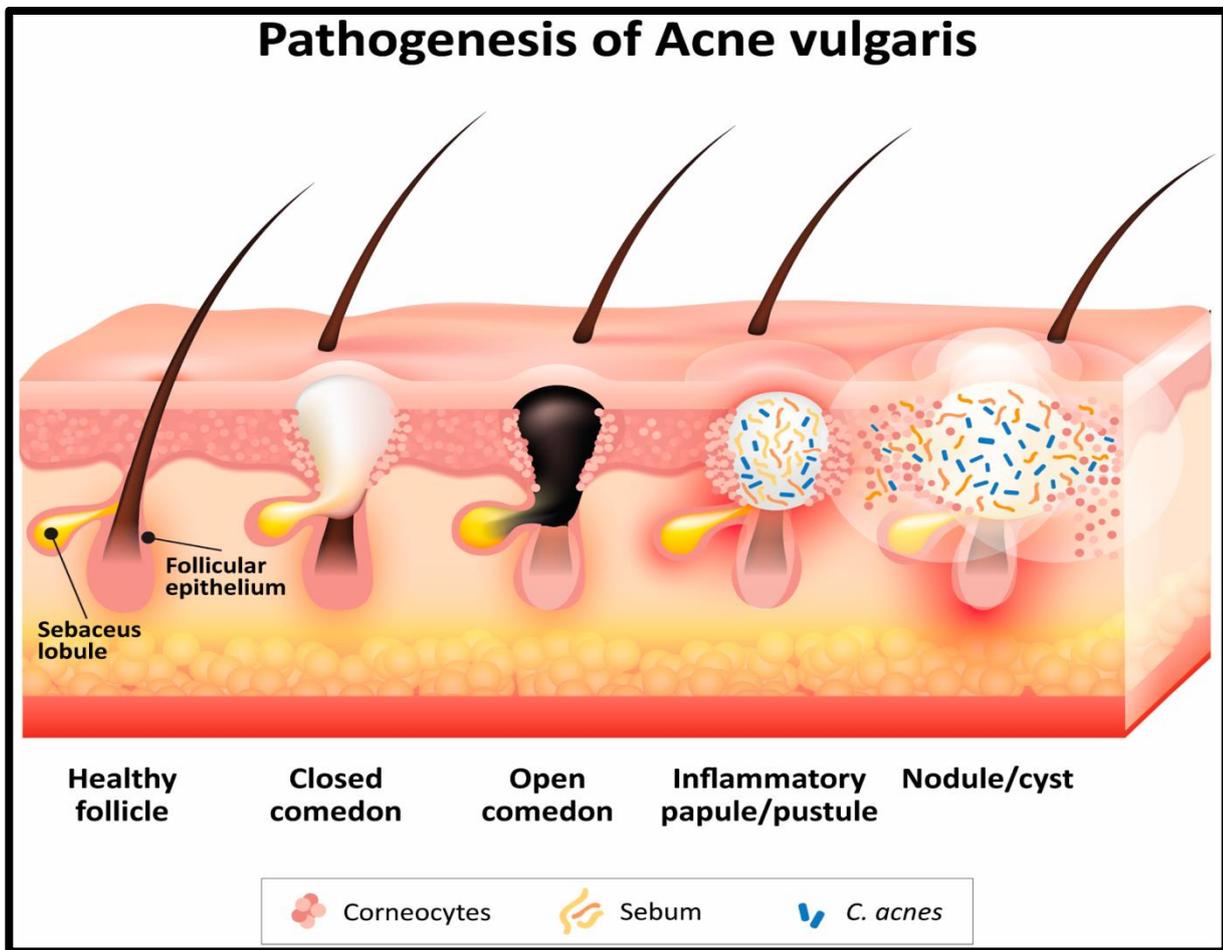


Fig (5) Pathogenesis of Acne

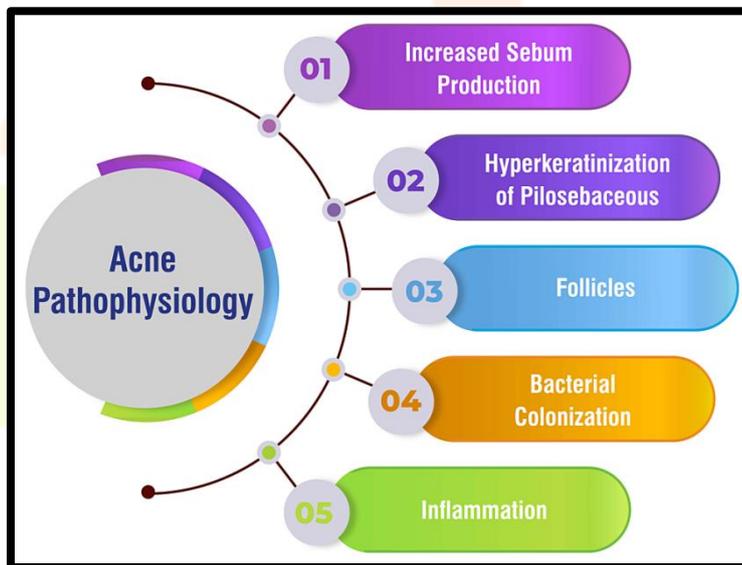


Fig (6) Acne Pathophysiology

**b) Hyperkeratinization abnormalities of the pilosebaceous follicles:**

Single-cell keratinocytes are typically shed by healthy follicles into the lumen, where they are eventually removed. However, hyperproliferative keratinocytes that are not shed into the lumen cause acne patients' pilosebaceous follicles to accumulate irregularly desquamated corneocytes together with lipids and monofilaments

**c) Hyper proliferation of propionibacterium acnes (P. acnes):**

Another agent that causes acne is Propionibacterium, which is involved in the pathophysiology of inflammatory acne. Cutibacterium acnes, originally identified as Propionibacterium acnes, is a gram-positive, lipophilic, anaerobic pathogen that thrives in sebaceous follicles due to their high sebum production and ability to serve as an ideal anaerobic growth medium. P. acnes secretes a lipase enzyme that breaks down sebum triglycerides into fatty acids and glycerol, which can cause skin irritation and comedone production

#### **d) Inflammation acne:-**

In accordance with the previous P. acnes process, the inflammatory process starts as soon as the immune system recognizes P. acnes. Strong inflammatory responses to P. acnes can result in the production of chemotactic agents such as neutrophils, macrophages, and lymphocytes. Furthermore, these disorders result in follicular destruction, rupture, and the dermal layer's release of bacteria, fatty acids, and lipids. The inflammatory lesions caused by these mechanistic processes include ulcers (pustules, nodules, cysts, and papules). Compared to inflammatory lesions, non-inflammatory lesions are smaller and less pus-filled. Reactive oxygen species (ROS), which harm the follicular epithelium and exacerbate acne inflammation, are also produced by neutrophils. This results in a variety of inflammatory acne lesions by forcing the follicular contents into the dermis.

#### **e) DNA Methylation:**

Gene expression can be changed by epigenetic alteration, which is the result of the interaction between genetics and environment under stressful conditions. In the field of dermatology, DNA methylation—one of the well-studied types of epigenetic modification—is receiving more interest due to its role in the mechanisms behind inflammatory, autoimmune, and malignant skin diseases. Research has demonstrated that DNA methylation contributes to the development and course of inflammatory skin conditions, including psoriasis, hidradenitis suppurativa, and atopic dermatitis. The development of acne vulgaris is significantly influenced by epigenetics, which may also provide light on the disease's molecular causes and possible treatment options.

### **EXTRACTION OF ESSENTIAL OIL FROM LEMONGRASS :-**

#### **1.Solvent Extraction Method:**

- Weigh 150 grams of dried lemongrass sample and put in clean flat bottomed flask pour 500ml of n-hexane solvent
- Allow to stand the contents for 36 hours this is done to extract the oil components in lemongrass
- Pour the extract in other 1 liter beaker
- Add 200 ml ethanol to extract essential oil, because oil is soluble in ethanol
- Mix the mixture, transfer to 500 ml separatory funnel
- Allow the separated content to reach equilibrium
- Divided into two layers (depending on their Density is different).
- Collect the lower ethanol extract and upper hexane into two separate 250ml beakers and place them in a 78 °C water bath.
- This is done to remove the ethanol from leaving only natural essential oils
- Production of oil is determined by weighing the extract on electric scale weigh the balance
- The difference between the final weight and the initial weight of the beaker containing the extract and the weight of the empty beaker gives the essential oil .

#### **2.Solvent Extraction Methods:-**

- Pour 140 gm of dried sample from sliced lemongrass sample and 200 ml of ether solvent into the flask
- Stand the content for 18 hours
- Decante the extract into another beaker
- Add 200 ml of ethanol to extract
- Separate the mixture in a separatory funnel.
- Collect the ethanol extract and ether layer into two separate beakers.
- Keep the sample in water bath for 75-80 degree celsius, to remove ethanol
- Determine the oil yield by weighing the extract

### 3. Hydrodistillation Methods:

- Put 140 gm of fresh lemongrass sample and 500ml distilled water into a round- bottomed flask ,the flask is equipped with a rubber stopper and connected to the condenser, and heated.
- Allow water to flow counter currently through the condenser
- Essential oil mixed with water vapor was extracted from the leaves, after reaching the appropriate temperature
- Vapors were condensed and hence separated
- The condensate was collected using a beaker.
- Separate the mixture with separating funnel
- Collect the oil in bottle with stopper and close tightly

### 4. Enfleurage method:

- Mash 140 gm of dried lemongrass using mortar pestle
- Mix 70 ml of light flavored olive oil and lemongrass in a beaker
- Cover with aluminum foil
- Shake for distribution of lemongrass
- Allow to stand for 18 hours at R. T
- Add 140 ml of ethanol to absorb essential oil leaving behind the light-flavored olive oil and the lemongrass residue.
- Keep in water bath at 75-80 0C , to remove ethanol
- The yield of oil was determined

### 1. LEMON GRASS :-

- **Synonyms** – East Indian LemonGrass Indian Melissa
- **Botanical Name** – Cymbopogon flexuosus and Cymbopogon citratus
- **Family** – Gramineae
- **Biological Source** – The lemon grass oil is a volatile oil obtained by steam distillation from the leaves and aerial part of plants cymbopogon flexuosus and Cymbopogon citratus belonging to family Gramineae It includes not less than 75% of aldehydes considered as citral.
  - **Chemical Constituents** - Lemongrass oil is the principal source of citral (68–85%) from which ionone is derived. The oil also contains methyl heptanone, decyl aldehyde, geraniol, linalool, limonene, dipentene, citronellal and  $\beta$ -terpineol, and borneol.
  - **Uses** - The oil is used in perfumery, soaps, and cosmetics and as antimicrobial agent, antibacterial agent antioxidant.

Lemongrass oil, which is frequently used for its antibacterial and astringent properties, can help tone and revitalize the skin.



Fig (7) Lemongrass



Fig (8) Leaves of Lemongrass

### Lemongrass oil has several uses and benefits:

1. **Aromatherapy**: Aromatherapy frequently uses it to encourage stress relief and relaxation.
2. **Insect repellent**: Because lemongrass oil contains citronella, it works well to keep insects away.
3. **antimicrobial properties**: It can aid in the battle against fungi and bacteria thanks to its antibacterial qualities.
4. **Pain relief**: Because of its analgesic qualities, it may be able to lessen pain and inflammation when administered topically
5. **Skin care**: Because of its astringent and antibacterial properties, it is utilized in skincare products to help tone and clean the skin.
6. **Digestive health**: It can help ease stomach problems and improve digestion.
7. **Flavoring**: Lemongrass oil is used in cooking to provide taste to a variety of foods and drinks.
8. **Hair care**: To strengthen hair follicles and treat scalp issues, it can be used in hair products.

### 2.TULSI LEAVES :-

- **Synonym** : *Ocimum tenuiflorum*, commonly known as holy basil
- **Biological source** :Tulsi consists of the fresh and dried leaves of *Ocimum* species like *Ocimum sanctum*L. and *Ocimum basilicum* L. etc.
- **Family** :Lamiaceae.
- **Chemical constituents** :- The Tulsi plant contains numerous active compounds and the major compounds are linalol, eugenol, methyl chavicol, methyl cinnamate, linolen, ocimene, pinene, cineol, anethol, estragole, thymol, citral, and camphor.



Fig (9) Tulsi leaves

- **Uses** :-

**Tulsi's antibacterial and antioxidant qualities can aid in skin cleansing and protection.**

1. **Antimicrobial**: When used topically, tulsi's antibacterial qualities can aid in the prevention of illnesses. It works especially well against viruses, fungus, and bacteria.
2. **Anti-inflammatory**: When used topically, its anti-inflammatory qualities help lessen swelling and irritation.
3. **Antioxidant**: Flavonoids and polyphenols, two types of antioxidants found in tulsi, help shield the skin from oxidative stress brought on by free radicals.
4. **Wound healing**: It accelerates the healing of cuts, wounds, and abrasions by increasing the production of collagen.
5. **Acne treatment**: Tulsi works well to combat acne-causing germs and reduce inflammation associated with acne because of its antibacterial and anti-inflammatory qualities.
6. **Soothing**: It relieves itching, inflammation, and other skin discomforts while having a calming effect on the skin.
7. **Anti-aging**: Tulsi's antioxidants help prevent premature skin aging by lowering the harm that free radicals do to the skin.
8. **Moisturizing**: Because of their hydrating qualities, tulsi extracts are frequently used in creams and moisturizers to help maintain the skin's suppleness and softness.

**In conclusion, tulsi is prized in topical formulations for its capacity to fight bacteria, lessen inflammation, encourage healing, and shield the skin from oxidative damage.**

#### GENERAL INGREDIENTS -

**1. Carbopol** :- Carbopol is used in gel formulations primarily for its unique properties that make it an excellent thickening, stabilizing, and suspending agent. Here are the key reasons why Carbopol is preferred in gels:

1. **Thickening Agent**: Carbopol thickens aqueous solutions to produce gels very well, even at low doses. This property is essential for creating products with the right consistency and viscosity, which improves their application and usability.

2. **Stabilizer**: By keeping particles from settling and guaranteeing that components are distributed uniformly throughout the gel matrix, it helps stabilize emulsions and suspensions. Over time, this stability is crucial to preserving the product's integrity and functionality

3. **Transparency and Clarity**: Carbopol gels are renowned for their transparency and clarity, which is helpful in formulations when a product with a pleasing appearance is required. Because of its clarity, aesthetic additions like colors and glitter can be added without detracting from the overall picture.

4. **Ease of Use**: Because of their smooth texture and lack of stickiness, carbopol gels are simple to work with and apply. This improves the user experience, particularly for pharmaceutical and personal care goods where application ease is crucial.

5. **Versatility**: It can be used in a variety of formulations since it works well with a broad range of components, including both hydrophilic and hydrophobic ones. Its versatility makes it useful in a variety of sectors, including food, medicine, cosmetics, and more.

**Carbopol's ability to thicken, stabilize, enhance clarity, and improve product performance makes it a preferred choice in the formulation of gels**

#### 2. Glycerin :-

Glycerin is commonly used in gel formulations for several reasons:

1. **Humectant**: Glycerin is a potent humectant, attracting moisture from the surrounding air and assisting in its retention in the gel. Because of this characteristic, glycerin-containing gels are excellent skin and hair moisturizers.

2. **Texture and Consistency**: By keeping the gel from drying out or becoming overly brittle, glycerin helps preserve the texture and consistency of the gel. It improves the gel's spreadability and smoothness.

3. **Skin Conditioning**: Glycerin has the capacity to condition skin, leaving it feeling hydrated and silky after use. Because of this, it's a useful component of skincare gels.

**Overall, glycerin plays a crucial role in enhancing the effectiveness and sensory experience of gels, making them more moisturizing, stable, and pleasant to use.**

### 3.Methylparaben :-

**Methylparaben is often used in gels and other cosmetic formulations primarily as a preservative.**

1. **Preservation**: The antimicrobial properties of methylparaben aid in preventing the formation of mold, bacteria, and yeast in cosmetic items, especially gels. By doing this, the product's shelf life is increased and its continued safety for usage is guaranteed.

2. **Stability**: Methylparaben contributes to the stability and integrity of the gel formulation by preventing microbial development. This is particularly critical for aqueous-based gels since they are more susceptible to microbial contamination.

**In conclusion, methylparaben serves a crucial role in gels by ensuring their safety and stability, but its use should be balanced with regulatory guidelines and consumer preferences.**

### 4.Propylene glycol:-

**Propylene glycol is commonly used in gels for several reasons:**

1. **Humectant**: Propylene glycol is good for formulas where hydration is essential such skincare products, as it draws and holds moisture.

2. **Solvent**: It maintains the active chemicals and other components in the gel formulation in a stable and homogeneous dispersion by acting as a solvent for them.

3. **Emollient**: Propylene glycol-containing gels are pleasant to use since they can provide the skin a smooth and silky feel.

4. **Viscosity Modifier**: Propylene glycol is able to modify the gel's viscosity, giving it the proper consistency for a smooth application and the appropriate texture.

5. **Stabilizer**: It prevents the other chemicals in the gel from separating or deteriorating over time by stabilizing them.

**Propylene glycol, in general, is essential for improving the stability, efficacy, and sensory attributes of gels in a variety of industries, such as personal care, cosmetics, and pharmaceuticals.**

### 5.Triethanolamine :-

**Triethanolamine (TEA) is commonly used in gel formulations for several reasons:**

1. **pH Adjustment**: To get the appropriate acidity or alkalinity, the gel formulation's pH is adjusted using TEA. It acts as a buffer, assisting in the product's pH stabilization.

2. **Emulsifying Agent**: TEA can serve as an emulsifying agent in certain gel formulations, assisting in the blending of water and oil components to produce a stable gel consistency.

3. **Viscosity Modifier**: TEA is also an effective thickener and viscosity modifier for gels. It facilitates control over the gel's texture and consistency, which enhances its stability and ease of application.

4. **Solubilizing Agent**: It can help make other ingredients more soluble in water alone, improving the stability and effectiveness of the formulation as a whole.

#### FORMULATION TABLE :-

Ingredients	F1	F2	F3
Lemongrass oil	1.5ml	1 ml	2 ml
Tulsi extract	0.3ml	0.2ml	0.5 ml
Carbapol 934	1 gm	1 gm	1 gm
Methylparaben	0.2gm	0.2 gm	0.2 gm
Glycerin	7.5 ml	7.5 ml	7.5 ml
Propylene glycol	2.5 ml	2.5ml	2.5 ml
Triethanolamine	0.2 ml	0.2 ml	0.2 ml
Distilled water	q. s	q. s	q. s

#### PROCEDURE :-

- Carbapol 934 gels were prepared by adding carbapol 934 in water and kept it for 24 hours, carbapol was homogenized using magnetic stirrer
- Weighed amount of methylparaben was added to water prior to the addition of carbapol 934 in another beaker, the required quantity of propylene glycol was added
- Further lemongrass oil, tulsi extract, this mixture was added to the beaker containing carbapol with stirring.
- The glycerin was also added to the polymer dispersion and stirred continuously till it forms a homogeneous product.
- In order to neutralize the gel at pH 6.7, triethanolamine was later added.
- The volume was made up with distilled water and stirring was done vigorously.

The same method was adopted to formulate three different formulations by taking 1.5 ml , 1 ml and 2 ml of lemongrass oil and labeled as F1, F2and F3.All the prepared gels were then subjected to evaluation tests. The composition of different gel formulations is listed in formulation table

#### EXTRACT :-



**Fig (10) Lemongrass oil**



**Fig (11) Tulsi Extract**



**Fig (12) Extracting lemongrass oil**



**Fig (13) Carbapol Gel**

#### **EVALUATION :-**

##### **Physical Evaluation :-**

**Formulated herbal gel was evaluated by using following physical parameters**

**1.Colour :-**

The color of gel was observed by visual examination i. e pale yellow

**2. Odour :-**

The odour of cream was found to be characteristics

**3.Consistency:-**

The formulation was examined by rubbing gel on hand manually. The gel has a smooth consistency.

**4.Determination of pH :-**

The pH of gel was determined by using pH paper  
The pH of gel was found e within the range of (6-7)  
i. e Neutral to the range of skin pH

**5.Determination of homogeneity:-**

The homogeneity of formulated gels was evaluated visually. The formulations were evaluated for appearance and existence of aggregates.

**6.Determination of Spreadability:-**

The Spreadability of gel was evaluated visually, it was spreadable when applied on the surface of skin .

#### **RESULT :-**

**Physicochemical characteristics for the formulation of gels was examined and results are**

shown below

Parameter	Effect
Colour	Pale yellow
Odour	Aromatic
Consistency	Good
pH	5.8
Homogeneity	Good
Spreadability	Good

Out of the formulated gel preparation F3 gel was good in appearance and showed better antiacne effect than other gel formulations.

The evaluation parameters, which included the gels physical evaluation, PH, spreadability, homogeneity, colour, were displayed in the table under the results.



**Fig (14) Herbal Gel**

### CONCLUSION :-

Based on a review of the literature and ongoing research, we have discovered that the oil extracted from the leaves of the lemongrass plant, *Cymbopogon citrates*, has the potential of showing an anti acne effect . This will undoubtedly pave the way for the future therapeutic use of lemongrass oil and allow it to be used commercially to create topical gels.

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