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## DEVELOPMENT OF AN HERBAL COLD CREAM INCORPORATED WITH LEMON ESSENTIAL OIL FOR SKIN BRIGHTENING

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### INTRODUCTION

#### 1.1 Background of the Study

The skin is the most extensive and complex organ of the human body, serving as the first line of defense against the external environment. Beyond its physiological role in thermoregulation and sensation, the skin's appearance plays a vital role in social interaction and psychological well-being. In the modern era, the quest for "radiant" and "bright" skin has led to a multi-billion dollar global cosmetic industry.

Historically, cosmetics were derived from natural sources—clays, plant oils, and floral waters. However, the industrial revolution shifted the focus toward synthetic ingredients like petrolatum, mineral oils, and chemical lighteners. While effective, these synthetic formulations often carry risks of contact dermatitis, long-term toxicity, and environmental bioaccumulation.

#### The Physiology of Skin Brightening

To understand the development of a brightening cream, one must understand **Melanogenesis**. Melanin is the pigment responsible for skin color, produced by cells called melanocytes. While melanin protects the skin from UV damage, an overproduction (hyperpigmentation) can lead to dark spots, uneven skin tone, and dullness.

Most synthetic brightening agents work by inhibiting **Tyrosinase**, the enzyme responsible for melanin synthesis. Lemon essential oil contains natural bioactive compounds that may assist in this process. Unlike

"bleaching," skin brightening focuses on increasing translucency and restoring the skin's natural glow through exfoliation and antioxidant activity.

### Specific Objectives

- To screen and select compatible herbal ingredients (Beeswax, Liquid Paraffin/Vegetable Oil, Borax) for the cold cream base.
- To extract or procure high-purity Lemon Essential Oil and verify its quality.
- To formulate various batches ( to ) with varying concentrations of Lemon Essential Oil.
- To perform physicochemical evaluations including pH, viscosity, spreadability, and washability.
- To conduct accelerated stability testing to ensure the cream does not undergo phase separation over time.
- To perform a preliminary patch test for skin irritancy.

### Vitamin C (Ascorbic Acid) derivatives:

Though the oil itself is lipid-based, it works synergistically to combat oxidative stress, which is a leading cause of skin darkening.



**Fig 1.1 Lemon Essential Oil**

## AIM AND OBJECTIVE

### **Aim & Objective of Herbal Cold Cream**

The main aim of developing a herbal cold cream is to formulate a safe, effective, and natural skin-care product using herbal ingredients that moisturizes, nourishes, and protects the skin.

#### **Detailed Aims**

##### 1. Moisturizing the skin

To restore and maintain skin moisture and prevent dryness.

##### 2. Nourishing and improving skin health

To provide essential nutrients from herbal extracts (like neem, aloe vera, almond oil).

##### 3. Protection of skin

To form a protective oily layer that reduces water loss and protects from environmental damage.

##### 4. Cooling and soothing effect

To give a cooling sensation and relieve irritation due to evaporation of water in the cream.

##### 5. Use of natural & safe ingredients

#### **Why lemon is used in herbal cold cream**

##### 1. Natural Vitamin C source

- Lemon is rich in vitamin C, which helps in:
- Skin brightening
- Reducing dullness
- Promoting collagen production

##### 2. Skin lightening & glow

Lemon has mild bleaching properties that help:

- Reduce dark spots
- Improve overall skin tone

##### 3. Astringent action

Lemon tightens pores and controls excess oil, making the cream suitable even for slightly oily skin.

##### 4. Antimicrobial properties

It helps in preventing:

- Acne
- Skin infections
- due to its antibacterial nature.

## 5. Exfoliation (removes dead cells)

Contains citric acid (a natural AHA), which helps:

- Remove dead skin cells
- Improve skin texture

### Objectives:

- To harness lemon oil's antioxidant and brightening properties.
- To formulate a balanced water-in-oil cream.
- To assess the cream's effectiveness in moisturizing and brightening skin.
- To ensure stability and safety

### 1. Harness lemon oil's antioxidant and brightening properties:

- Investigate lemon essential oil's ability to reduce hyperpigmentation.
- Measure antioxidant activity to ensure it protects skin from free radicals.

### 2. Formulate a balanced water-in-oil cream:

- Optimize the ratio of water and oil phases for stability.
- Ensure even distribution of lemon oil without destabilizing the emulsion.

### 3. Assess the cream's effectiveness in moisturizing and brightening skin:

- Conduct clinical or user trials to measure hydration levels.
- Use a grading scale or instrumental tests to quantify skin brightness.

### 4. Ensure stability and safety of the formulation:

- Perform stability testing (e.g., temperature, pH, microbial contamination).
- Conduct a skin patch test Evaluate cost-effectiveness by sourcing natural ingredients.

### 5. Use of Natural and Safe Ingredient

To avoid the harmful side effects of synthetic chemicals and promote herbal, skin-friendly cosmetics.

### 6. Cleansing and Beautifying the Skin

To help remove dirt, makeup, and impurities while enhancing the skin's overall appearance.

### 7. Treatment of Minor Skin Problems

To provide antimicrobial, anti-inflammatory, and healing effects for minor skin issues like acne or irritation.

### 8. Harness Lemon Oil's Antioxidant and Brightening Properties

To utilize lemon oil in reducing hyperpigmentation and boosting skin radiance.

## PLAN OF WORK

### **1. Literature Review**

Study skin tanning causes (UV exposure, melanin production).

Review herbal ingredients with anti-tanning and skin-brightening properties.

### **2. Selection of Ingredients**

Choose base ingredients (beeswax, liquid paraffin, borax, water).

Select herbal actives (aloe vera, turmeric, sandalwood, saffron).

Include lemon essential oil for natural bleaching and antioxidant effect.

### **3. Pre-formulation Studies**

Check compatibility of herbal extracts with base cream.

Determine safe concentration of lemon essential oil (to avoid irritation).

### **4. Formulation Development**

Prepare oil phase and aqueous phase separately.

Incorporate herbal extracts and lemon essential oil.

Emulsify to form a smooth cold cream.

### **5. Optimization of Formula**

Adjust proportions for desired consistency, spreadability, and stability.

### **6. Evaluation Tests**

Physical evaluation (color, odor, texture, pH).

Stability testing (temperature variation).

Skin irritation (patch test).

### **7. Efficacy Study (Anti-Tanning Effect)**

Apply cream on tanned skin over a fixed period.

Observe reduction in tan and improvement in skin tone.

### **8. Safety Assessment**

Ensure non-toxic, non-irritant formulation.

Confirm suitability for different skin types.

### **9. Packaging and Storage**

Select suitable containers (air-tight, light-resistant).

label with ingredients and usage instructions

## 10. Prtotype Development:

Mix the herbal extracts, lemon essential oil, and base cream in precise proportions.

Conduct preliminary stability and texture tests.

## 11. Safety and Efficacy Testing:

Perform patch tests to check for skin irritation or allergies.

Conduct small-scale user trials to assess skin brightening results.

## MATERIAL AND METHOD

**Table: Composition of Herbal Cold Cream**

S. No.	Ingredient	Quantity	Category	Function
1	Beeswax	10 g	Oil phase	Emulsifying agent, thickener
2	Liquid paraffin	20 ml	Oil phase	Emollient, provides smooth texture
3	Almond oil	5 ml	Oil phase	Skin nourishing agent
4	Borax	1 g	Aqueous phase	Emulsifier (forms soap with beeswax)
5	Distilled water	30 ml	Aqueous phase	Vehicle/base
6	Aloe vera extract	5 ml	Herbal	Moisturizer, soothing agent
7	Neem extract	2 ml	Herbal	Antimicrobial agent
8	Lemon essential oil	2–3 drops	Active ingredient	Skin brightening, antioxidant

### Principle of Formulation

Cold cream is a water-in-oil (W/O) emulsion, where Oil phase forms the continuous phase Water phase is dispersed within it.

### Working Principle:

- Beeswax reacts with borax to form a soap-type emulsifier.
- which stabilizes the emulsion.
- Oil phase provides moisturization and protection.
- Aqueous phase provides hydration and cooling effect.
- Lemon essential oil acts as an active herbal ingredient for skin brightening

### Method of Preparation

#### Step 1: Preparation of Oil Phase

- Weigh accurately beeswax, liquid paraffin, and almond oil.
- Take them in a clean, dry beaker.
- Heat on a water bath at 70–75°C until beeswax melts completely.
- Ensure uniform mixing of oil component

## Step 2: Preparation of Aqueous Phase

- Dissolve borax in distilled water.
- Heat the solution separately to 70–75°C to match oil phase temperature.
- This ensures proper emulsification.

## Step 3: Emulsification Process

- Slowly add the hot aqueous phase into the oil phase with continuous stirring.
- Stir in one direction to avoid air entrapment.
- Continue stirring until a homogeneous semi-solid cream is formed.

## Step 4: Cooling Stage

- Allow the mixture to cool gradually to around 40°C.
- Continuous stirring is required to maintain consistency.

## Step 5: Addition of Herbal Ingredients

Add the following at lower temperature:

- Aloe vera extract
- Neem extract
- Lemon essential oil

(Added at low temperature to prevent degradation of active compounds)

## Step 6: Addition of Perfume and Final Mixing

- Add rose water or fragrance.
- Mix thoroughly to obtain a uniform product.

## Step 7: Packaging and Storage

- Transfer the cream into airtight containers.
- Label properly with batch details.
- Store in a cool and dry place.

## Evaluation of Herbal Cold Cream

### 1. Physical Appearance

- Color: Should be uniform
- Odor: Pleasant (lemon fragrance)
- Texture: Smooth and creamy
- Phase separation: Absent

### 2. pH Determination

- Measured using pH meter. Ideal pH: 5–6 (skin compatible)

### 3. Spreadability Test

- A small amount of cream is placed between two glass slides.
- The time taken to spread is noted.
- Good cream = spreads easily with minimal force.

### 4. Washability Test

- Apply cream on skin and wash with water.
- Good formulation should be easily washable without residue.

**Table 9: Washability test**

Sr. No	Formulation	Washability
1	F1C	Easily Washable
2	F2C	Easily Washable
3	F3C	Easily Washable
4	F4C	Not Easily Washable
5	F5C	Not Easily Washable

### 5. Viscosity Test

- Measured using viscometer.
- Indicates thickness and consistency of cream.

### 6. Stability Study

- Cream is stored at different conditions:
- Room temperature
- Elevated temperature (40°C)
- Observations
  - Color change
  - Phase separation
  - Odor change

### 7. Skin Irritation Test

- Apply cream on small skin area (patch test).
  - Redness
  - Itching

## PREPARATION OF FUSION METHOD

### Fusion Method: Step-by-Step Laboratory Procedure

The Fusion Method relies on the principle of melting solid components and incorporating an aqueous solution at an identical temperature to ensure a homogenous mixture.

#### ➤ Phase A: The Oil Phase (Non-Polar)

**Selection of Base:** Take 15g of White Beeswax (the structuring agent) and 50ml of Liquid Paraffin (the emollient).

**Melting:** Place these in a clean, dry 250ml glass beaker.

**Heating:** Use a Water Bath to heat the beaker. Heating directly over a flame can char the wax.

**Temperature Control:** Monitor with a laboratory thermometer. Heat until the temperature reaches 75°C. At this point, the mixture should be a clear, uniform liquid.



**Fig 1.1 Oil Phase**

➤ **Phase B: The Aqueous Phase (Polar)**

**Solution Prep:** In a separate 100ml beaker, take 33ml of Rose Water.

**Dissolving Actives:** Add 1g of Borax and 0.1g of Methyl Paraben (preservative).

**Heating:** Heat this beaker on the water bath simultaneously until it also reaches 75°C.



**Fig 1.2 Aqueous Phase**

### ➤ Phase C: Emulsification (The Reaction)

**The "Slow Pour":** While the oil phase is still on the heat (or just removed), slowly pour the Aqueous Phase (B) into the Oil Phase (A).

**Saponification:** The Borax in the water reacts with the free fatty acids in the Beeswax to form a "sodium soap," which acts as the emulsifier that binds the oil and water together.

**Mechanical Stirring:** Stir vigorously and continuously in one direction using a glass rod or a high-speed mixer. This breaks the internal phase into tiny droplets.



Fig 1.3 Emulsification phase

### ➤ Phase D: Cooling and Fragrance Incorporation

**Stirring while Cooling:** Continue stirring as the beaker cools. You will notice the mixture turning opaque and thick.

**Adding Lemon Essential Oil:** Once the temperature drops to 40°C-45°C, add 1ml (approx. 15-20 drops) of Lemon Essential Oil.

Why wait? Adding it at 75°C would cause the volatile brightening compounds (limonene and Vitamin C) to degrade or evaporate.

**Final Setting:** Continue slow stirring until the cream reaches room temperature (25°C). This prevents the "bleeding" of oil.

### Specific Evaluation for Skin Brightening

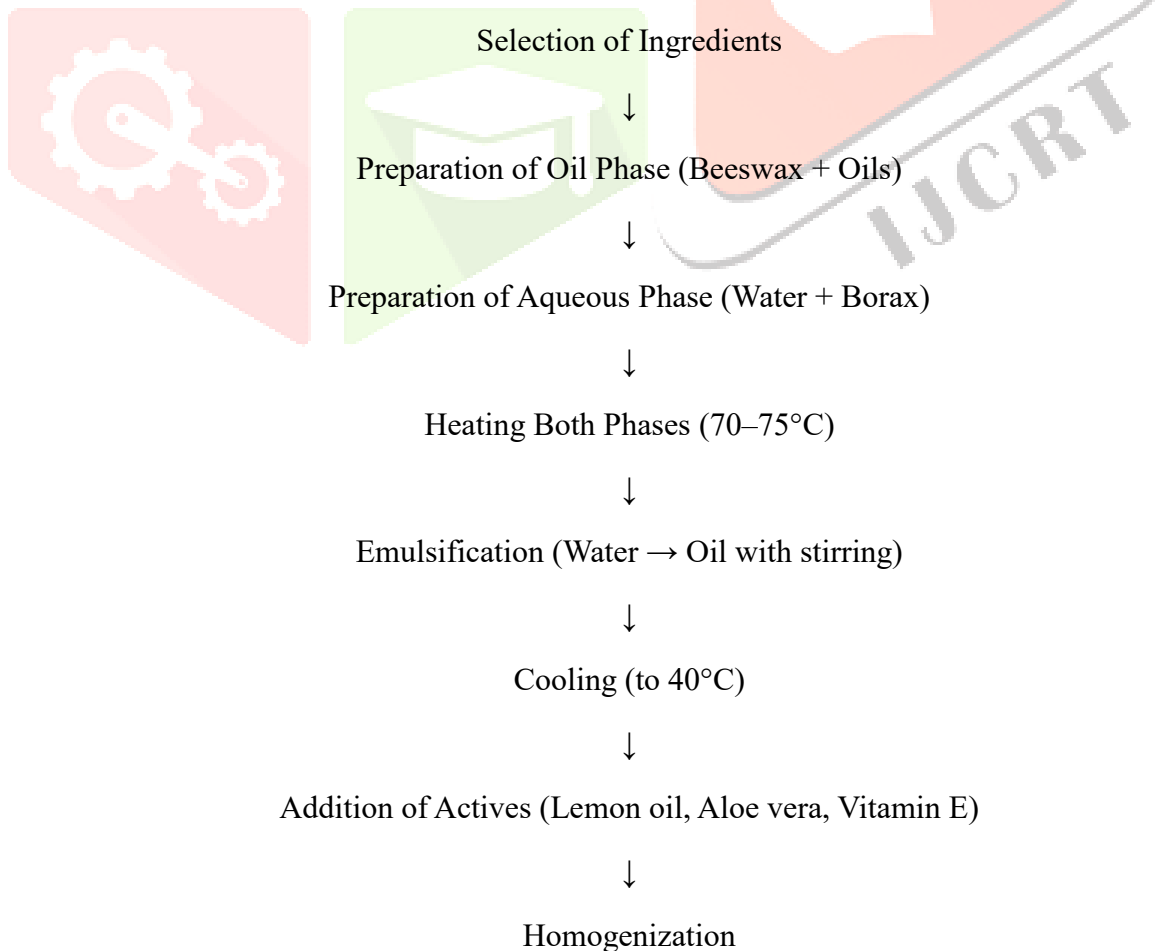
To ensure the "Particularly for Skin Brightening" aspect is met, you must verify the pH Level:\

**Reason:** Lemon oil is acidic. If the pH is too low (below 5), it may irritate the skin. If it is too high, the brightening effect is neutralized. Use a digital pH meter or pH strips to verify.



**Fig 1.4 Controlling and Fragrance Incorporation**

**FLOW CHART**





## Packaging & Storage

### EVALUATION OF HERBAL COLD CREAM

#### PHYSICAL APPEARANCE TEST:

Physical appearance test is used to evaluate the visual characteristics of the formulated cold cream such as color, texture, consistency, homogeneity, and phase separation.

#### Objective:

To examine the overall look and feel of the cream.

To ensure uniformity and absence of any instability (like phase separation or lumps).

#### Procedure:

- Take a small quantity of the prepared herbal cold cream.
- Place it on a clean glass slide or container.
- Observe it under normal light conditions.
- Check the color, texture, and consistency visually and by gentle touch.
- Rub a small amount between fingers to evaluate smoothness and uniformity.

#### Parameters Observed:

- **Color:** Should be uniform (usually pale yellow or off-white due to lemon essential oil).
- **Texture:** Smooth and creamy.
- **Consistency:** Semi-solid and easily spreadable.
- **Homogeneity:** No lumps or coarse particles present.
- **Phase Separation:** No separation of oil and water phases.

**Appearance:** Glossy and appealing.

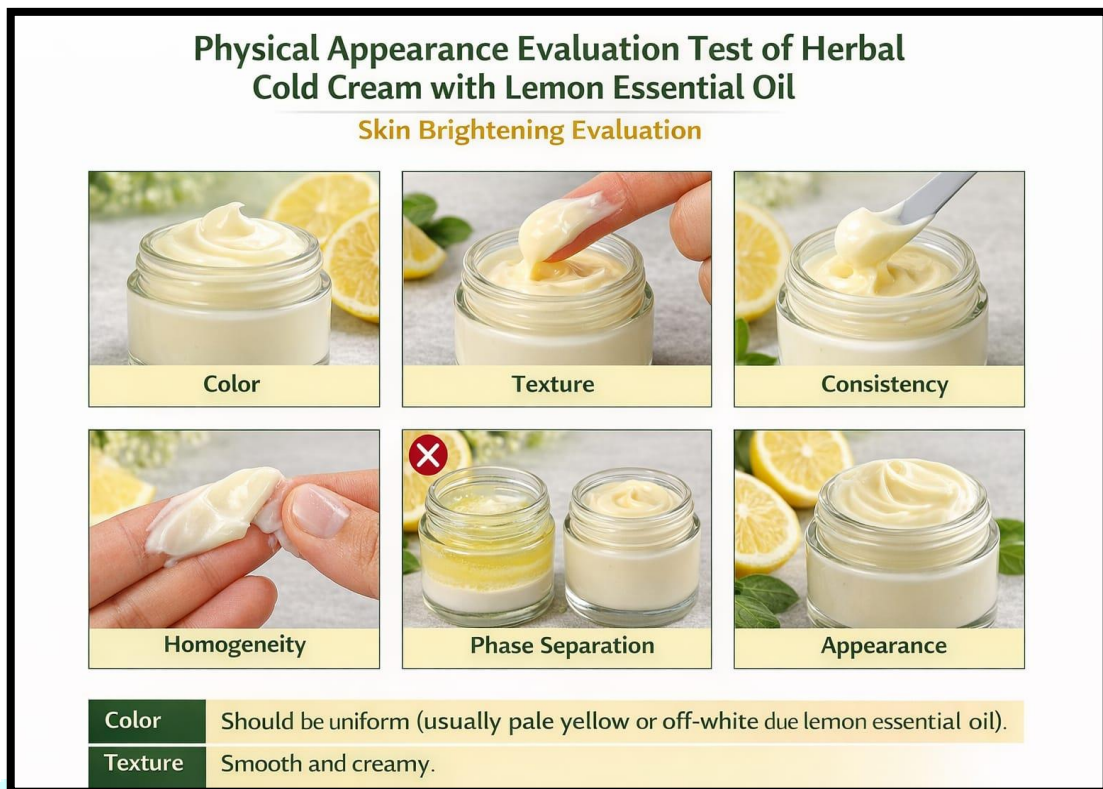
**Observation:** The prepared herbal cold cream showed a uniform pale yellow/off-white color with a smooth and creamy texture. It was homogeneous, free from lumps, and showed no phase separation. The cream was easily spreadable and had a pleasant appearance.

#### Result:

The formulation passed the physical appearance test, indicating good stability and acceptable aesthetic properties.

#### Conclusion:

The herbal cold cream incorporated with lemon essential oil possesses desirable physical characteristics such as smooth texture, uniform color, and good consistency, making it suitable for topical application.



**Fig 1.1 Physical Appearance test**

## 2. PH DETERMINATION:

pH determination is carried out to measure the acidity or alkalinity of the formulated cold cream. It ensures that the product is safe and compatible with skin.

### Objective:

- To determine the pH of the herbal cold cream.
- To ensure that the pH is within the acceptable range for skin (typically 4.5–7).

### Materials Required:

- Glass rod pH meter / pH paper
- Distilled water
- Beaker

### Procedure:

- Take 1 g of the herbal cold cream.
- Dissolve it in 10 mL of distilled water to prepare a uniform dispersion.
- Stir the mixture properly using a glass rod.
- Calibrate the pH meter using standard buffer solutions (pH 4, 7, and 9).
- Dip the electrode of the pH meter into the sample.

### Note the pH value displayed.

(If using pH paper, dip it into the solution and compare the color with the standard chart.)

### Observation:

The pH of the prepared herbal cold cream was found to be in the range of 5.5 – 6.5.

### Result:

The obtained pH is within the normal skin pH range, indicating that the formulation is skin-friendly and non-irritating.



Fig 1.2 PH Determination Test

### 3. SPREADABILITY TEST:

#### Objective:

To determine how easily the prepared herbal cold cream spreads on the skin. Good spreadability ensures uniform application and better skin absorption

#### Principle:

Spreadability is expressed in terms of the time required for two glass slides to slip off from the cream placed between them under a certain load.

Better spreadability = less time required.

#### Materials Required

- Two clean glass slides
- Weighing balance
- Standard weight (e.g., 20–50 g)
- Stopwatch
- Prepared herbal cold cream

#### Procedure:

- Take a small amount of the cold cream and place it on one glass slide.
- Place another glass slide over it to form a thin film of cream between the slides.
- Apply a known weight (e.g., 20 g) on the upper slide for a few minutes to remove air and ensure uniform thickness.
- Remove the weight and tie the upper slide with a string.

- Attach a small weight to the string and allow it to pull the upper slide.
- Start the stopwatch and record the time taken for the upper slide to move a certain distance (or completely slip off).

### Formula

$$S = \frac{M \times L}{T}$$

Where:

S = Spreadability

M = Weight tied to upper slide (g)

L = Length moved by the slide (cm)

T = Time taken (seconds)

### Result Interpretation

High spreadability → Cream spreads easily, good quality

Low spreadability → Cream is too thick or sticky

### Ideal Observation

The herbal cold cream containing lemon essential oil should show good spreadability, indicating smooth texture and ease of application on skin. The spreadability test confirms that the formulated herbal cold cream is suitable for topical use. Proper spreadability enhances patient compliance and ensures effective skin brightening action

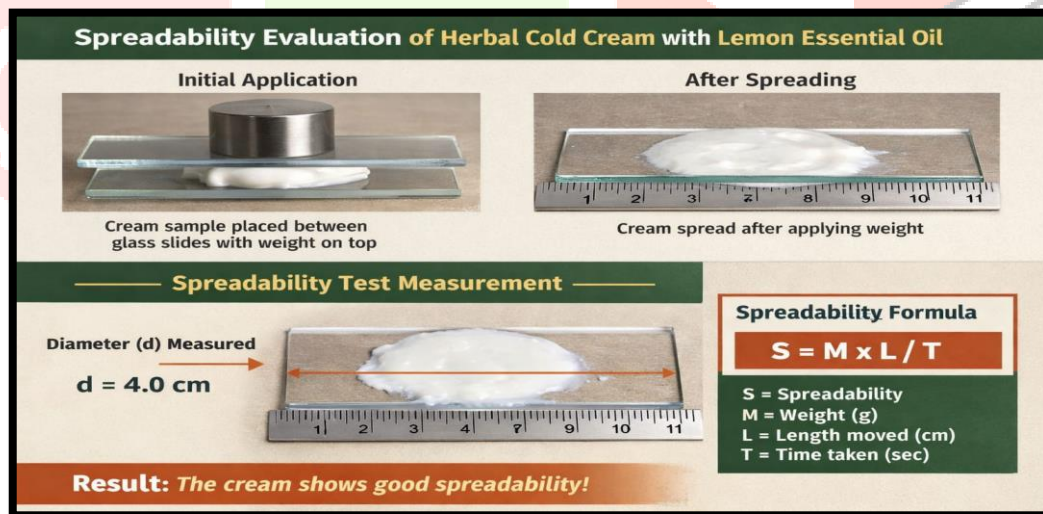


Fig 1.3 Spreadability Evaluation

### 4. WASHABILITY TEST:

#### Objective :

This test determines how easily the cream can be removed from the skin surface with water, which is essential for user convenience and preventing pore clogging.

**Procedure:** Apply a small, measured amount of the cold cream (approx. 0.5g) to a defined area on the back of the hand.

After 10 minutes, wash the area under a steady stream of room-temperature tap water.

### Criteria:

- **Good:** The cream is removed completely without leaving a greasy or sticky residue.
- **Moderate:** Small traces of oil remain, requiring soap for full removal.
- **Poor:** A thick, waxy film persists even after rinsing.

### Observation:

- The cream was easily removed with water.
- No greasy or oily residue remained on the skin.
- Skin felt soft, smooth, and non-sticky after washing.
- Lemon essential oil gave a fresh and clean feeling.

**RESULT:** The formulated herbal cold cream incorporated with lemon essential oil showed good washability, as it was easily removed with water without leaving significant residue or greasiness, providing a clean and smooth skin feel.

Fig 1.4



Washability test

### 5. VISCOSITY TEST:

#### Objective:

To determine the viscosity (thickness and flow behavior) of the formulated herbal cold cream.

**Procedure:**

- The formulated cream was taken in a clean beaker.
- The spindle was immersed properly into the cream sample.
- The viscometer was operated at a fixed speed (e.g., 10 rpm).
- The viscosity reading was noted once the value stabilized.
- Measurements were taken at room temperature.

**Observation:**

- The cream showed smooth and uniform consistency.
- No phase separation was observed.

**Result:** The herbal cold cream exhibited optimum viscosity, indicating:

- Good consistency

Easy spreadability

**Conclusion:**

The viscosity of the formulated cream is ideal for topical application. It ensures:

- Easy application on skin
- Proper retention without being too thick or too runny



**Fig 1.5 Viscosity Test**

**6. STABILITY STUDY:****Objective:**

To evaluate the physical and chemical stability of the formulated herbal cold cream under different storage conditions.

**Procedure:**

- The prepared cream was filled in clean, airtight containers.
- Samples were stored at different conditions:
  - Room temperature (25°C)
  - Refrigerated condition (4°C)

- Elevated temperature ( $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ )
  - The study was carried out for 15–30 days (or longer if required).
  - Samples were evaluated at regular intervals (0, 7, 15, 30 days)

### Result:

The formulation remained stable under different storage conditions without any significant physical or chemical changes.

### Conclusion:

- The herbal cold cream showed good stability, indicating.
- Proper emulsification.

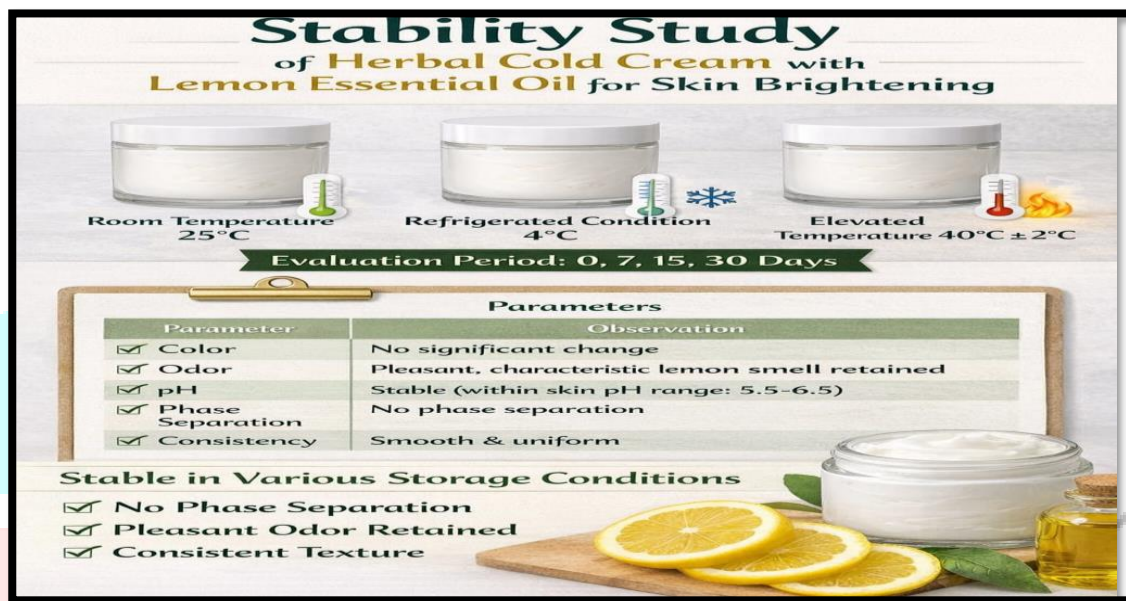


Fig 1.6 Stability Study

## 1. SKIN IRRITATION TEST:

### Objective:

To evaluate the safety of the formulated herbal cold cream and check whether it causes any irritation to the skin.

### Procedure:

- A small amount of the formulated cream was applied on a small area of skin (forearm or behind the ear).
- The area was left undisturbed for 24 hours.
- The applied site was observed at regular intervals (0, 12, and 24 hours).

**Observation:**

Parameter	Observation
Redness	No redness observed
Itching	No itching
Swelling	Absent
sensation	Not observed

**Result:** No signs of irritation or allergic reaction were observed after application.

**Conclusion:** The formulated herbal cold cream is safe for topical application and does not cause skin irritation.

## Skin Irritation Test



**Objective:**

To evaluate the safety of the formulated cream on the skin.

**Procedure:**

- Cream applied on forearm.
- Observed at 0, 12 & 24 hrs.
- Check for Reactions:

**Observations:**

- No Redness
- No Itching
- No Swelling
- No Burning

**0 Hr**



**12 Hrs**



**24 Hrs**



**3. Check for Reactions:**

● Redness  
 ● Itching  
 ● Swelling  
● Burning Sensation

Fig 1.7 Skin Irritation Test

## SUMMARY

The development of a herbal cold cream incorporated with lemon essential oil focuses on creating a natural, safe, and effective skincare formulation that enhances skin brightness while providing deep moisturization and protection.

Cold creams are typically water-in-oil (W/O) emulsions, which form a protective layer on the skin and prevent moisture loss, making them especially beneficial for dry and dull skin.

The use of herbal ingredients in cosmetic formulations has gained popularity due to their minimal side effects and long-term safety. In this formulation, natural components such as beeswax, plant oils, aloe vera, and neem extract are used. Beeswax acts as a thickening and stabilizing agent

The key active ingredient, lemon essential oil, plays a major role in skin brightening. It is rich in vitamin C and natural antioxidants, which help reduce melanin production, lighten dark spots, and improve overall skin tone. It also provides mild exfoliation, removing dead skin cells and promoting a fresh, glowing appearance.

## DISCUSSION

The development of this herbal cold cream highlights the growing importance of natural and plant-based cosmetic formulations. Compared to synthetic creams, herbal formulations are generally safer and have fewer side effects, making them more acceptable for long-term use.

The fusion method used in the preparation is simple, cost-effective, and suitable for laboratory as well as small-scale production. However, maintaining the correct temperature during emulsification is critical, as improper temperature control can lead to phase separation or instability of the cream.

The incorporation of lemon essential oil significantly enhances the functional value of the formulation. Its antioxidant properties help combat free radicals, while its vitamin C content plays a key role in reducing melanin formation, thus contributing to skin brightening.

However, it is important to note that lemon essential oil can sometimes cause skin sensitivity or irritation, especially in higher concentrations or in individuals with sensitive skin. Therefore, proper concentration and patch testing are essential.

The addition of supporting herbal ingredients like aloe vera and neem further improves the formulation. Aloe vera helps in soothing and moisturizing the skin, reducing any potential irritation caused by lemon oil.

Neem adds antimicrobial properties, which help in maintaining skin hygiene and preventing infections.

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