Innovative Herbal Face Serum: Synergistic Approach to Skincare

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Abstract

In the modern cosmetic industry, face serums are widely used due to their rapid action and fast onset of effects. This research aimed to formulate a serum using modern methods and herbal extracts, showcasing a fusion of Ayurveda and contemporary science. The goal was to enhance the serum's activity compared to commercially available products, while minimizing harmful side effects.

This research focuses on the development of a natural, oil/water-based face serum formulated with a synergistic blend of herbal extracts and vitamins known for their skin-enhancing properties. The serum aiming to provide a comprehensive skincare solution. The herbs were selected for their documented benefits, including skin brightening, antioxidant protection, anti-inflammatory effects, and hydration.

Keywords: Face serum, Antioxidants, Evaluation, licorice extract.

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Introduction

Herbal skincare products have gained increasing popularity due to their natural ingredients and skin-enhancing benefits. Our Herbal Face Serum is formulated with a potent blend of botanical extracts, offering a nourishing and rejuvenating experience for all skin types. The key active ingredients-Licorice Root Extract, Vitamin E, and Turmeric Extract-work synergistically to brighten the complexion, reduce pigmentation, and provide deep hydration.[1] A skin care formulation must be able to deliver the powerful agent into the skin to fulfil the intended objective. Face serum is the answer to deliver precious active ingredients into the skin thus eliminating the use of hazardous chemicals in giving instant results. Serum is a concentrated product which is widely used in Cosmetology. The name comes from itself in professional cosmetology. The cosmetic serum is as concentrated in water or oil as any other cream. Serums are defined as concentrated products that contains ten times more organic matter than cream. Therefore, deals with the cosmetic problem quickly and effectively. [1]

All skin types need these ingredients to stay as healthy as possible. Gel preparations and Liquids are best for oily skin and a combination, serum and light lotion is best for normal dry skin, more emollients and the best moisturizing creams for dry to very dry skin. Skin texture is all about the skin type but the smart ingredient for healthy skin is the same for everyone, no matter what product, texture or preference you have. The skin is the largest protective of the body for 24 hours, but sometimes the skin can become dry for many reasons such as UV rays, dirt, cosmetics left overnight can cause irritation or allergies. Skin serum is a skin care product that you can apply to your skin after cleansing but before moisturizing with the intention of bringing the ingredients directly to the skin. Serum is particularly [1]

Well-suited for this task because it is made up of a small molecule that can penetrate deep into the skin and bring about a very high concentration of active ingredients. This makes them a tool to identify specific skin care concerns, such as color, signs of aging. Cosmeceuticals refers to the integration of the cosmetics industry with the pharmaceutical industry. [1]

Herbal face serums typically contain plant-derived extracts, essential oils, and phytochemicals known for their bioactivity. Common botanicals include Aloe barbadensis (aloe vera), Curcuma longa (turmeric), Camellia sinensis (green tea), Rosa Canina (rosehip), and Glycyrrhiza glabra (licorice), each contributing unique phytoconstituentssuch as flavonoids, alkaloids, phenolics, and terpenoids (Kumar et al., 2019). These natural compounds can modulate inflammatory pathways, scavenge free radicals, stimulate collagen synthesis, and promote wound healing, making them highly suitable for dermatological applications. [4,6]

The formulation and commercialization of herbal face serums require adherence to international quality, safety, and efficacy standards. The ISO 16128 guidelines, developed by the International Organization for Standardization, provide a standardized framework for determining the natural origin index of cosmetic ingredients and finished products (ISO, 2016). Furthermore, ISO 22716:2007, which outlines Good Manufacturing Practices (GMP) for cosmetics, is essential to ensure consistent quality, hygiene, and regulatory compliance during the manufacturing process (ISO, 2007).[3]In the European Union, Regulation (EC) No. 1223/2009 establishes comprehensive safety, labeling, and ingredient restrictions for cosmetic products. Similarly, the United States Food and Drug Administration (FDA) enforces the Federal Food, Drug, and Cosmetic Act, which mandates safety, truthful labeling, and prohibition of adulteration in cosmetics.[2]

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Federal Food, Drug, and Cosmetic Act, which mandates safety, truthful labeling, and prohibition of adulteration in cosmetics.[3]

In India and other countries with a strong tradition of herbal medicine, regulatory frameworks such as the AYUSH guidelines provide additional oversight, including quality control parameters and permissible herbal ingredients in Ayurvedic and Unani formulations. Standardization techniques such as High-Performance Liquid Chromatography (HPLC), Gas Chromatography–Mass Spectrometry (GC-MS), and Fourier-transform infrared spectroscopy (FTIR) are commonly employed to evaluate phytochemical content, detect contaminants, and ensure product stability.[5]

Figure 1 serum bottle

This study aims to explore the formulation, standardization, and evaluation of a novel herbal face serum using selected plant-based actives, with emphasis on its physicochemical properties, safety, and dermatological efficacy. By integrating traditional herbal knowledge with modern analytical and regulatory frameworks, the research intends to contribute to the development of scientifically validated, safe, and effective herbal skincare products.[6]

Types of face serum

1. The oil serum

The oil serum is the simplest to make of all the face serums. It often starts with a base of just premium, fast-absorbing carrier oils, also referred to as "dry" oils. In addition to having moisturizing and barrier-repairing characteristics, the premium oils used in the serum also include polyphenols, essential fatty acids, and other substances that may be broken down by the skin.[7].

Figure 2 : oil serum

2. The gel serum

Figure 3 Gel serum

Gel serums provide the skin a "tightening" sensation, giving your consumer the impression that their skin is momentarily lifted or tightened in particular regions of the face. The gel serum provides you the chance to include some fantastic water-based (hydrophilic) plant extracts because this formulation is Water-based.[7]

3. The Water based serum

Water-based serums are comparable to gel serums, although they may contain none or very little gums and thickeners.

Figure 4 :Water based serum

To administer high-performance hydrophilic plant extracts that are trapped against the skin beneath a cream or lotion, you would utilise a water-based face serum. Layering an anti-ageing face mist under an emulsion and then under an oil is the ideal technique to promote higher penetration of water-based compounds into the skin, delivering their high-performance elements slightly deeper into the layers of the skin. The oils will form an occlusive barrier that will promote higher component penetration.[7]

4. The emulsion serum

An emulsion-based face serum is a moisturiser that strengthens the skin's barrier function while also delivering high performance components to the skin. Two "immiscible" phases-phases like oil and water that don't want to mix-are combined in an emulsion. An emulsifier is used to bind water and oil together and retain them in a stable state.

The best chance of delivering high performance actives deeply into the tissues of the skin is through an emulsion. Given the skin's barrier function, it is highly difficult for any cosmetic component to penetrate the dermis, yet an oil and water mixture is best suited to accomplish this remarkable feat.[7]

Figure 5 :Emulsion base serum

5. The pressed balm serum:

A balm serum has a conventional balm basis of butters, waxes, and oils but also includes active substances that are oil-soluble (lipophilic) and may help the skin.

The butters and waxes form an occlusive barrier on the skin that hydrates and nourishes it while allowing the pressed serum's active components to do their job. In a balm serum, dozens of intriguing unique butters and waxes can be combined with thousands of exquisite plant oils.[7]

Figure 6 :Pressed balm serum

Advantages of Herbal Face Serum

Herbal face serums are skincare formulations derived from plant-based ingredients, offering multiple dermatological benefits with minimal side effects.

- **Deep Hydration & Miniaturization**
  Herbal ingredients like aloe Vera jojoba oil, and rose water provide lightweight hydration. [8]

- **Antioxidant & Anti-Aging Action**
  Natural extracts such as green tea, grape seed, and rosehip oil help neutralize free radicals and reduce signs of aging.[9]

- **Brightening & Skin Tone Improvement**
  Turmeric and licorice extract reduce hyperpigmentation and improve radiance.[10]

- **Anti-inflammatory and Soothing Effect**
  Extracts like chamomile, basil, and neem soothe irritated skin and reduce redness.[8]

- **Safe & Natural**
  Free from synthetic chemicals, parabens, and sulfates, making them suitable for sensitive skin types.[10]

Disadvantages of Herbal Face Serums

- Herbal ingredients, such as tea tree oil and lavender, can cause allergic reactions in sensitive individuals, leading to redness, itching, or rashes.[11]

- Lack of Standardization and Regulation

  The herbal cosmetics industry often lacks strict regulatory oversight, leading to variability in product quality and efficacy.[12]

- Potential for Skin sensitivity Certain herbal ingredients, like citrus extracts, can increase the skin's sensitivity to sunlight, leading to a higher risk of sunburn.[11]

- Shorter Shelf Life

  Herbal serums often lack synthetic preservatives, resulting in a shorter shelf life and requiring careful storage to prevent spoilage.[10]

- Higher Cost

  The use of natural ingredients and small-batch production often makes herbal serums more expensive than synthetic alternatives.[10]

- Interactions with Medication

  Certain herbal ingredients may interact with prescription medications, potentially reducing their effectiveness or increasing side effects.[10]

- Limited Scientific Evidence

  Many herbal remedies lack extensive clinical trials to validate their efficacy and safety.[13]

Ideal Quality of Herbal Face Serum

1. Natural and Non-Toxic Ingredients

The serum should be composed of plant-based, chemical-free ingredients that are safe for long-term use.[10]

2. Proper pH Balance (4.5–6.5)

To maintain skin compatibility and prevent irritation.[14]

3. Appropriate Viscosity and Spreadability

Ensures even application and effective absorption without clogging pores.[15]

4. Microbial Stability

The formulation should resist microbial growth over its shelf life.[16]

5. Antioxidant and Anti-inflammatory Activity

Should contain active herbal extracts known to protect against oxidative stress and inflammation (e.g., aloe vera, green tea).[17]

6. Good Aesthetic Appeal

Pleasant odor, non-greasy feel, and appealing appearance.[18]

7. Non-Comedogenic

Should not block pores or cause acne.[19]

Ingredients

Ingredients	Nature source	functions in formulation
Aloe Vera [20]	fresh gel foam aloe vera leaves	Smooth hydrated and conditioning hairs
Licorice extraction [20]	Extract from *Glycyrrhiza glabra*root	Brightens skin tone, reduces hyperpigmentation, anti-inflammatory and antioxidant properties [20]
Vitamin E[20]	Capsule (tocopherol)	Powerful antioxidant, protects against free radical damage, improves skin elasticity [20]
Glycerin	Natural humectant	Acts as a humectant, draws moisture to the skin, keeps skin soft and hydrated
Rosemary Oil [20]	Essential oil from Rosmarinusofficinal is leaves	Antioxidants help tighten skin, reduce puffiness, promote circulation [20]
Guar Gum	Derived from guar beans	Natural thickening agent, improves texture and spreadability of the serum
Geogard	Eco-certified preservative (gluconolactone and sodium benzoate mixture)	Natural preservative protects against microbial contamination.

1. Aloe Vera

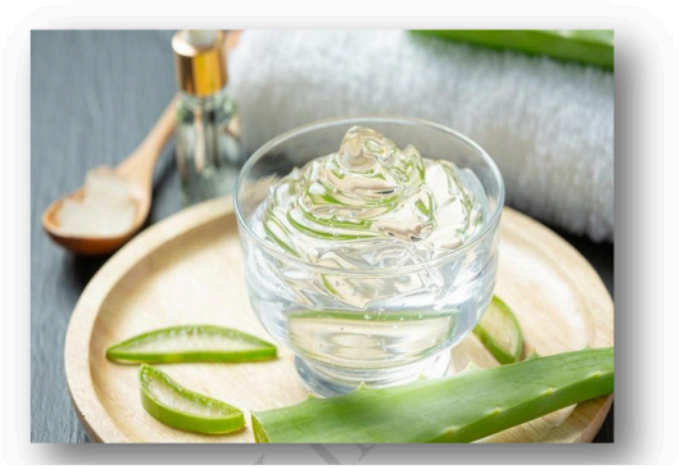


Figure 7 :Aloe Vera gel

Family: Liliaceae

Parts Used: Leaf pulp (gel)

Macroscopic Features: Thick, fleshy green leaves filled with translucent gel; leaves are serrated at the margins.

Microscopic Features: Parenchymatous tissue with mucilage cells and acicular calcium oxalate crystals.[22]

Chemical Constituents: Aloin, aloesin, polysaccharides (glucomannan), enzymes, saponins, vitamins A, C, E.

Pharmacological Actions: Moisturizing, anti-inflammatory, wound healing, antimicrobial.[23]

Uses:-

- It is used to treat skin problems.
- It is used as anti-bacterial and anti-inflammatory agent.
- It is used for hydrating the skin.
- It is used for softening of the skin.

2. Liquorice (2Saponin Glycosides)

Saponin Glycosides

- "Sapo" is Latin name for soap (soap-like)
- Group of organic compounds that form persistent froth when shaken with water even in dilute solution.
- Saponins cause haemolysis of red blood cells.

Figure 8 ： Liquories powder

Classification of saponins:

- ✓ According to the nature of the aglyconesaponins are classified into Steroidal and Triterpenoidal saponins.
- ✓ According to sugar: monodesmoside (one sugar chain), Bidesmoside (two sugar chains).[24

Synonyms:-

Glycyrrhiza; Liquorice root; Glycyrrhizae radix.

Biological Sources:

Liquorice is the dried, peeled or unpeeled, roots, rhizome or stolon ofGlycyrrhiza glabra Linn.

Family:-Leguminosae,

Uses

- Brightening: It helps fade dark

spots and hyperpigmentation by inhibiting the enzyme that causes skin discoloration (tyrosinase).

- Soothing: It has strong anti-inflammatory properties, calming redness and irritation.
- Antioxidant Protection: Licorice is rich in flavonoids that help protect the skin from environmental stressors.
- Oil Control: It can help balance oil production, which is great for acne-prone skin.[24]

Figure 9 : Liquories

3. VitaminE

Vitamin E is a fat-soluble antioxidant. It is abundant in natural plant oils, especially from seeds like sunflower, wheat germ, and almonds. Pharmacognostical evaluation ensures correct identification and quality of the plant source.

Uses

- ✓ Antioxidant: Protects the skin from free radical damage (from sun, pollution, etc.).
- ✓ Moisturizing: Helps to strengthen the skin barrier and retain moisture.
- ✓ Healing: Can promote wound healing and reduce scarring.
- ✓ Anti-aging: May reduce the appearance of fine lines and wrinkles over time.

Figure 10 : vitamin E

Macroscopic Study (Sunflower seeds as source)

- Shape: Oval, flat seeds.
- Color: Black or striped.
- Size: 6–10 mm in length.
- Texture: Smooth outer coat.

Microscopic Study:

Test a thin section of the seed coat: Epidermal cells: Elongated with thick walls. Oil glands visible in Parenchymatous tissue. Chemical Constituents

Main constituents:

- α-tocopherol (major Vitamin E form)
- β-tocopherol
- γ-tocopherol
- δ-tocopherol

4. Rosemary oil

Botanical Name: Rosmarinusofficinalis

Uses:

- ✓ Antioxidant: Helps protect skin from environmental damage.
- ✓ Anti-inflammatory: Reduces puffiness and soothes irritation.
- ✓ Antibacterial: Helps prevent acne-causing bacteria.
- ✓ Improves Circulation: Boosts blood flow, promoting a healthy glow.
- ✓ Astringent Properties: Tightens skin and reduces the appearance of pores.

Figure 11 : Rosemary oil

How it Benefits a Face Serum:

- ❖ Ideal for acne-prone, oily, or dull skin.
- ❖ Helps tone and firm the skin.
- ❖ Promotes youthful appearance by neutralizing free radicals.[24]

5. Glycerine (Glycerol)

Figure 12 :glycerine

Common Name: Glycerine

Chemical Name: Glycerol

Origin:

Usually derived from plant oils (like coconut, soy, or palm) for skincare products.

It's a colorless, odorless, viscous liquid.

Role in Herbal Face Serum:

- ⇨ Acts as a hydration booster.
- ⇨ Helps blend water-based herbal extracts with oil-based ingredients (acts as a mild emulsifier) [26].

Key Skincare Benefits:

- Humectant: Draws moisture from the air into the skin, keeping it hydrated.
- Skin Barrier Support: Helps strengthen the skin's natural barrier to prevent dryness and irritation.
- Smoothness and Softness: Makes the skin soft, supple, and smooth by filling in microscopiccracks.
- Non-Comedogenic: Does not clog pores.
- Wound Healing: Supports minor wound healing and skin regeneration.

Role in Herbal Face Serum:

- Acts as a hydration booster.
- Helps blend water-based herbal extracts with oil-basedingredients (acts as a mild emulsifier).
- Enhances skin absorption of active botanicals.

6. Guar Gum

Scientific Name: Cyamopsistetragonoloba (derived from guar beans)

Type: Natural polysaccharide (plant-based thickening agent)

Figure 13 :Gaur gum

Role in Herbal Face Serum:

- ✓ It is used to thicken watery or runny serums naturally.
- ✓ Provides a silky, light texture without clogging pores.
- ✓ Helps suspend botanical ingredients (like infused herbs or essential oils) evenly.[27]

Key Skincare Benefits:

- Natural Thickener: Gives a smooth, gel-like consistency to serums without harsh chemicals.
- Stabilizer: Helps keep herbal extracts, Glycerine, and oils evenly mixed.
- Skin Conditioning Agent: Forms a soft, moisturizing film on the skin surface.
- Non-irritating: Very gentle and suitable for sensitive skin.
- Enhances Texture: Improves the feel and spreadability of serums.

Role in Herbal Face Serum:

- ➢ Used to thicken watery or runny serums naturally.
- ➢ Provides a silky, light texture without clogging pores.
- ➢ Helps suspend botanical ingredients (like infused herbs or essential oils) evenly.

7. Geogard

Geogard is a trade name for a group of eco-certified, broad-spectrum preservatives used in natural skincare products. It protects herbal serums from bacteria, mold, and yeast.

Common Types:

- Geogard 221 (INCI: Dehydroacetic Acid and Benzyl Alcohol)
- Geogard Ultra (INCI: Gluconolactone and Sodium Benzoate)

Figure 14 :Guogard

Key Benefits for Herbal Serums:

- Broad-spectrum protection: Prevents microbial growth (essential for water-based serums).
- Natural and EcoCert-approved: Accepted in natural, organic cosmetic formulations.
- Compatible with pH 3–7.5: Fits perfectly for most face serums.
- Mild on skin: Does not irritate sensitive or delicate skin.

FORMULATION TABLE:

Ingredients	Amount	Typical use level	Functions
Licorice extract	3ml	1-5%	Skin brightening, anti-inflammatory, soothes irritation
Vitamin E	2ml	0.5-5%	Antioxidant, protects skin, improves shelf life
Aloe Vera Gel	7ml	5-15%	Hydrating, soothing, healing properties for skin
Geogard	0.2ml	0.5-1.5%	Broad-spectrum preservative, protects against microbes
Glycerin	3ml	2-10%	Humectant, draws moisture into the skin
Rose Mary oil	1ml	0.5-1%	Antioxidant, antimicrobial, improves product stability
Gum gaur	0.002gm	0.01-1%	agent
Water	2.4ml	Balance to 100%	Solvent, hydration base

Licorice Extraction Method

1. Clean and dry licorice roots thoroughly.
2. Grind the roots into coarse powder.
3. Measure coconut oil and powdered licorice in a 5:1 or 10:1ratio.
4. Mix the licorice powder into coconut oil.
5. Use the heat infusion method (double boiler, 40–50°C for 2–3 hours) or the cold infusion method (store 2–4 weeks at room temperature).
6. Stir occasionally during infusion.
7. After infusion, filter the oil through muslin cloth or fine strainer.
8. Store the filtered oil in a dark, airtight container.[28]

Figure 15 :Extraction method

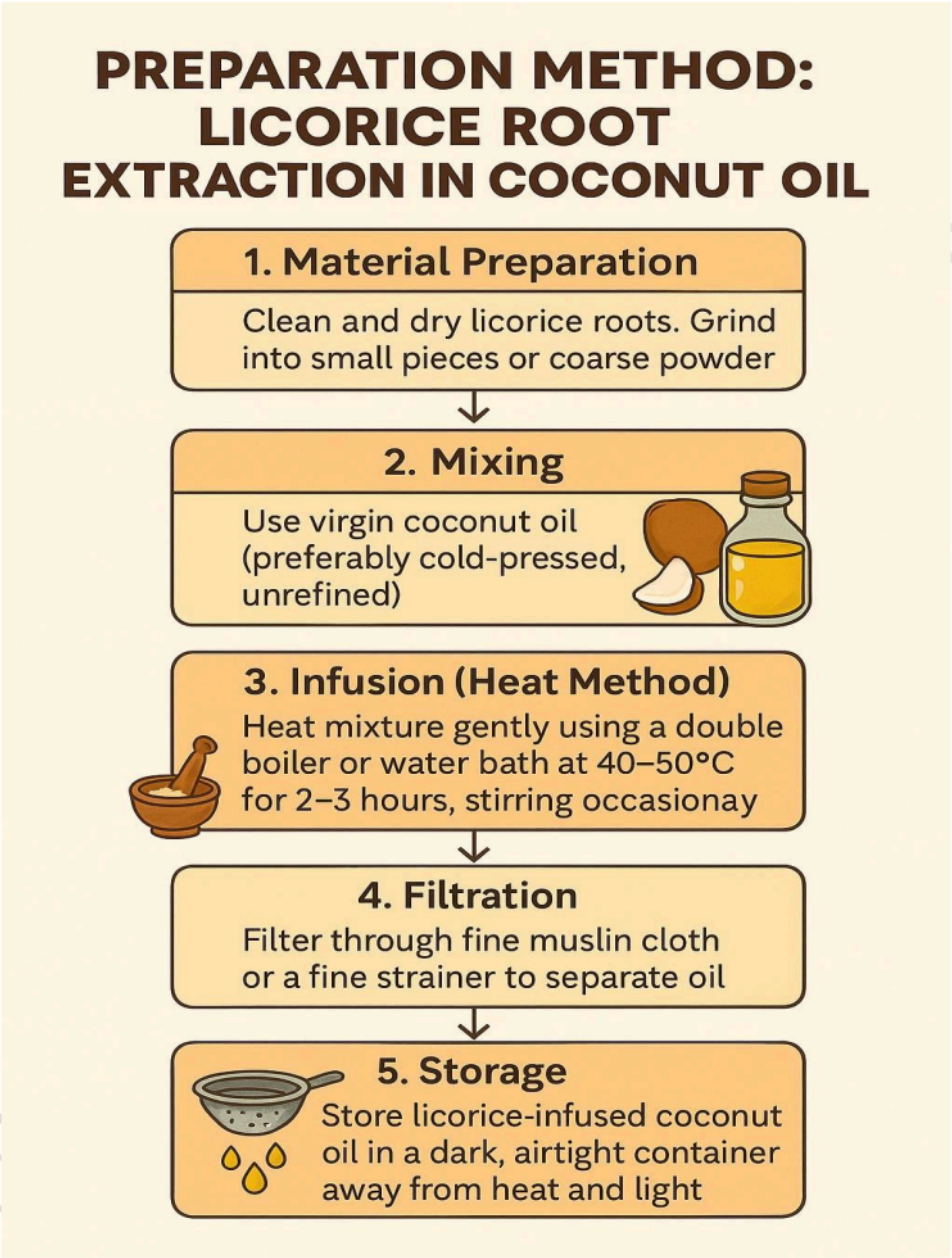


Figure 16 :flow chart of extraction method.

METHOD OF PREPRATION

Phase A – Gel Base Preparation

1. In a sanitized beaker, combine:

Aloe Vera Gel – 10.0 ml

Distilled Water – 2.4 ml

Glycerin – 2.0 ml

2. Sprinkle Guar Gum (0.14 g) into the above mixture slowly while stirring continuously. Stir well with a mini whisk or magnetic stirrer to avoid clumping. Let it sit for 10–15 minutes to allow full hydration.

Optional: Gently heat to 40–45°C to speed up hydration (do not exceed 50°C).

Phase B – Add Actives & Extracts

3. Once the gel base is fully hydrated and smooth, add: Licorice Root Extract – 2.0 ml Mix thoroughly to ensure even distribution.

Phase C – Cool-Down Phase (Under 40°C)

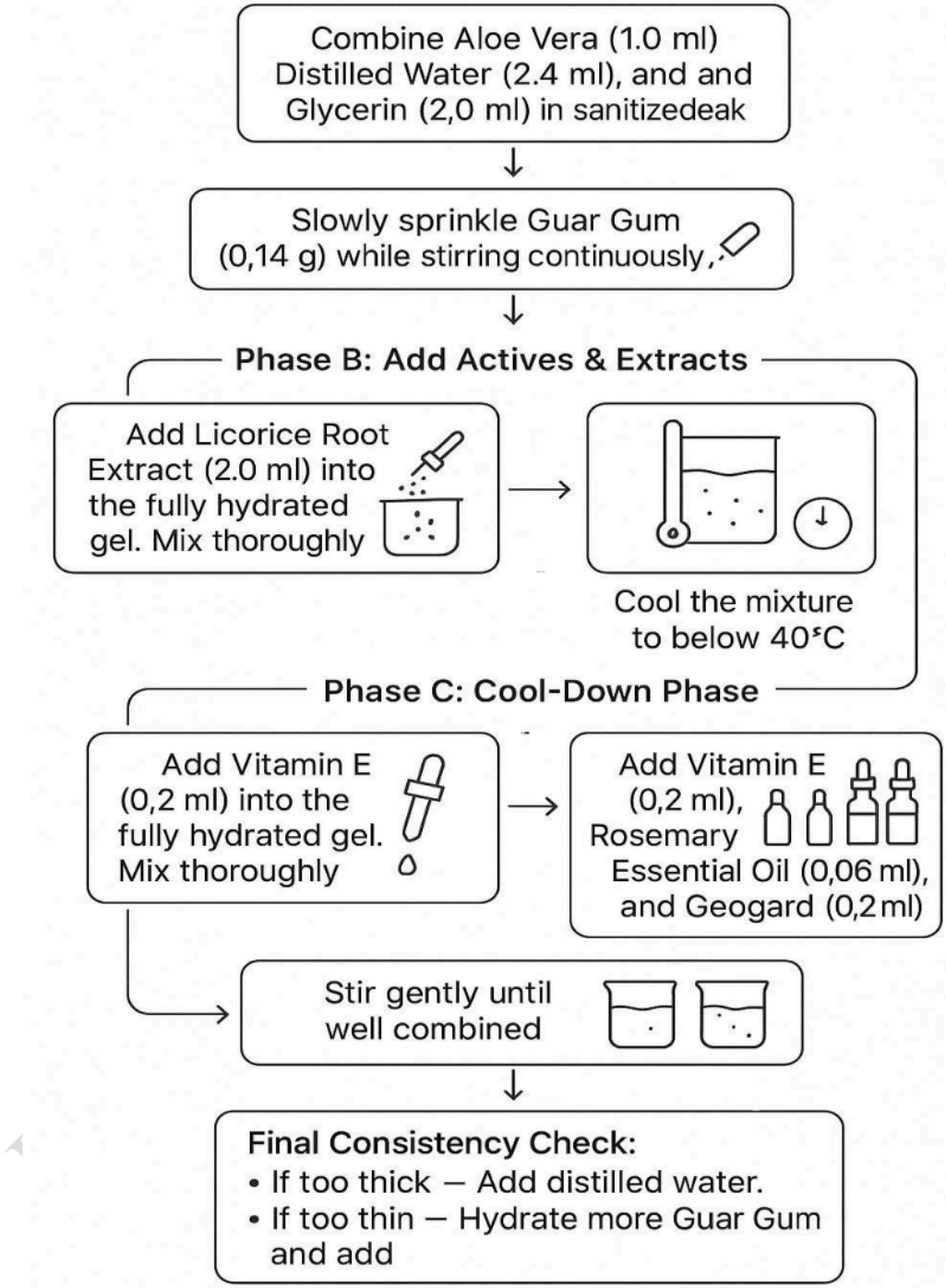
4. When the mixture is at or below 40°C, add: Vitamin E – 0.2 ml (approx. 4 drops) Rosemary Essential Oil – 0.06 ml (1–2 drops) Geogard – 0.2 ml (or per recommended % for 20ml)

5. Stir gently but thoroughly to combine all oil-based and water-based ingredients. [29,30]

Final Adjustments

6. Check consistency- It should be a lightweight gel-serum.

- If too thick: Add a few drops of distilled water.
- If too thin: Add a pinch more guar gum (hydrate separately before mixing in).[30]


Combine Aloe Vera (1.0 ml) Distilled Water (2.4 ml), and and Glycerin (2,0 ml) in sanitizedeak
Slowly sprinkle Guar Gum (0,14 g) while stirring continuously,
Phase B: Add Actives & Extracts
Add Licorice Root Extract (2.0 ml) into the fully hydrated gel. Mix thoroughly
Cool the mixture to below 40°C
Phase C: Cool-Down Phase
Add Vitamin E (0,2 ml) into the fully hydrated gel. Mix thoroughly
Add Vitamin E (0,2 ml), Rosemary Essential Oil (0,06 ml), and Geogard (0,2 ml)
Stir gently until well combined
Final Consistency Check:
• If too thick — Add distilled water.
• If too thin — Hydrate more Guar Gum and add

Flow Chart

EVALUATION TEST:

1. **Physical Evaluation**

The Colour and appearance of the formulation was observed visually. The formulation procedure uniform distribution of extracts. This test was confirmed by visual appearance and by touch.[31]

2. **pH Value**

A pH meter was calibrated using a standard buffer solution. Nearly 1 ml of the face serum was properly weighed and dissolved in 50 ml of distilled water and finally its pH was calculated. The skin has an acidic range, and the pH of the skin serum should be in the range of 4.1-6.7.[32]

3. **Determination of Spreadability**

2 gm of serum sample was placed on a surface. A slide was attached to a pan to which 20 gm weight was added. The time (seconds) required to separate the upper slide from surface was taken as a measure of Spread ability [33]

1. **Microbial Examination of the Product**

In this method, the mixed culture is diluted directly in tubes of liquid agar medium. The medium is maintained in a liquid state at a temperature of 45°C to allow thorough distribution of the inoculum. The inoculated agar medium is transferred into petri plates, allowed to solidify and incubate. In the series dilution technique, the original inoculum may be diluted by using sterile water or saline solution so that the concentration of the microbes gradually becomes less. Mix 1 ml dilute in 20 ml of liquid nutrient agar medium at 45°C. Shake the liquid agar nutrient agar medium & pour in a sterile petri plate, solidify and incubate it. [32,33]

2. **Stability Studies**

Formulation and development of a pharmaceutical product is not complete without proper stability analysis carried out on it to determine physical and chemical stability and

thus safety of the product. The stability studies is carried out as per ICH guidelines. Short term accelerated stability study was carried out for the period of few months for the prepared formulation. The samples were stored at different storage conditions of temperatures such as 3-5oC, 250C RH=60% and 40oC±2% RH=75%.[33]

3. Cyclical Temperature Test

This test is not carried out at any fixed temperature and humidity. In this test, the temperature changes cyclically every day. At room temperature and frizzy temperature to stimulate the changes in temperature.[33]

RESULT OF EVALUATION TEST

1. Physical Evaluation

Test	Result
Color	White translucent
Odor	Rose like
Taste	Tasteless
Texture	Smooth Homogenous
Homogeneity	Good
PH	5.30
Wash ability	Washable
Phase separation	Nil

2. pH:

The pH of formulation was found to be 5.30. As the skin having an acidic pH around 4.1-6.7, this range of formulation is suitable for skin.[32]

Figure 17 [34] PH test

3. Determination of Spreadability

Spreadability of liquid formulation is ability of the face serum to spread over the skin and play important role in administration of standard dose of medicament formulation on skin. Spreadability of face serum 5 to 6 cm was found.[33]

4. Determination of Viscosity

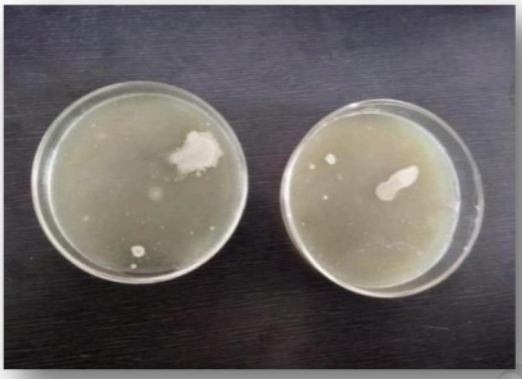
Viscosity is a critical parameter for topical formulation. Topical solutions with low viscosity have faster clearance than viscous solutions. In addition, highly viscous solutions can have an undesirable effect on the skin. Viscosity of the Face Serum was found to be 13759 Pas.

5. Microbial Examination of the Product

The formulation was free from microbes as they do not show zone of inhibition,

Figure 18[34] : Microbial test

when they got inoculated in the agar.[33]



6. Stability Studies:

The formulation was undertaken stability studies for physical and chemical changes. No considerable variations in properties of the formulation were observed.[33]

7. Cyclic Temperature Test

Parameters	Stability
Freezer Temperature	Unstable
Room temperature	Stable

CONCLUSION

The herbal face serum developed through this project demonstrated excellent physical and chemical stability, good spreadability, an ideal pH for skin application, and was free of microbial contamination. The formulation remained stable at room temperature, though unstable in freezing conditions Using natural ingredients like aloe vera, licorice, and vitamin E, the serum provided a hydrating, soothing, and brightening effect on the skin, making it a promising alternative to commercial skincare products.

Kaya (Fase serum)

Figure19 : label of Serum

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