

Formulation and Evaluation of Face Serum

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Abstract: *Face serums are advanced skincare formulations that offer concentrated treatment in a lightweight base. These formulations are generally water- or oil-based and are designed for quick absorption and enhanced penetration into the deeper layers of the skin. Unlike conventional moisturizers that act primarily on the skin's surface, serums target the underlying layers, delivering potent actives where they are most needed.*

Keywords: *Face serums.*

I. INTRODUCTION

1. Overview of Face Serums

Face serums are advanced skincare formulations that offer concentrated treatment in a lightweight base. These formulations are generally water- or oil-based and are designed for quick absorption and enhanced penetration into the deeper layers of the skin. Unlike conventional moisturizers that act primarily on the skin's surface, serums target the underlying layers, delivering potent actives where they are most needed.

In recent years, serums have become essential in both dermatological treatments and daily skincare regimens due to their versatility, efficiency, and ease of use. They are typically applied after cleansing and before moisturizing, acting as a treatment step in skincare routines.

2. Types of Face Serums

Face serums are designed to address specific skin concerns, and their classification is based on their primary action:

- **Hydrating Serums:** Help maintain skin moisture levels, essential for preventing dryness and maintaining skin elasticity. They are especially beneficial in dry climates or for individuals with dehydrated skin.
- **Anti-Aging Serums:** Aim to reduce visible signs of aging like fine lines, wrinkles, and sagging. These serums stimulate collagen production and improve skin resilience.
- **Brightening Serums:** Work to even out skin tone, reduce hyperpigmentation, and restore a natural glow. They can be useful for sun-damaged or dull skin.
- **Acne-Fighting Serums:** Contain ingredients that help reduce inflammation, unclog pores, and control sebum production. Ideal for oily and acne-prone skin.
- **Antioxidant Serums:** Provide protection against oxidative stress caused by pollution, UV radiation, and other environmental aggressors. They help maintain youthful skin by neutralizing free radicals.
- **Firming and Lifting Serums:** Help to tone and tighten the skin, giving a more sculpted appearance. Often used for mature or aging skin.

Additionally, many modern formulations combine two or more benefits (e.g., hydrating + antiaging) to provide a multi-functional product.

3. Benefits of Using Face Serums

Face serums have become a preferred choice in modern skincare for several compelling reasons:

- **Intensive Care:** Their high concentration of active ingredients makes them highly effective in treating specific skin problems.
- **Quick Results:** Due to deep skin penetration, noticeable improvements in skin tone, texture, and hydration can often be observed within a short period of use.



- **Lightweight Texture:** Their non-oily and fast-absorbing nature makes them suitable for all skin types, including oily and combination skin.
- **Layering Compatibility:** Serums can be layered under other products like moisturizers and sunscreens without clogging pores or feeling heavy.
- **Improved Skin Health:** Continued use of face serums contributes to long-term skin improvement, supporting a healthy skin barrier and improving skin function.
- **Non-Comedogenic Formulations:** Most serums are formulated to prevent pore clogging, making them suitable for acne-prone individuals.
- **Suitable for All Ages:** From early 20s to mature skin, serums can be adapted to meet changing skincare needs throughout life stages.

4. Market Trends and Consumer Preferences

The cosmetic and personal care industry has seen a significant shift towards high-performance skincare products, particularly face serums. Some important market trends include:

- **Rising Popularity of Personalized Skincare:** Consumers are increasingly seeking products tailored to their individual skin needs, making specialized serums a major segment.
- **Demand for Minimalist Skincare:** Serums provide high efficacy with fewer products, aligning with the "less is more" skincare philosophy.
- **Growth in Male Grooming:** Face serums are gaining popularity among male consumers who seek effective and lightweight products without the greasiness of traditional moisturizers.
- **E-commerce and Social Media Influence:** Online platforms have contributed significantly to consumer education and awareness, boosting demand for evidence-based, dermatologist-recommended products.
- **Natural and Organic Movement:** With growing concerns over synthetic chemicals, consumers are leaning toward plant-based, cruelty-free, and sustainably packaged products.

5. Importance of Herbal-Based Face Serums

Herbal face serums combine the wisdom of traditional plant-based medicine with modern cosmetic science. They are favored for the following reasons:

- **Biocompatibility:** Herbal extracts are generally more compatible with the skin's natural composition, reducing the risk of allergic reactions.
- **Safety Profile:** Free from harsh chemicals, herbal serums are less likely to cause longterm skin damage or hormonal disruption.
- **Holistic Skin Health:** Many herbs provide multi-dimensional benefits—hydration, nourishment, protection, and healing—promoting complete skin wellness.
- **Sustainability:** Herbal formulations often have a lower environmental impact due to biodegradable ingredients and eco-friendly sourcing.
- **Consumer Confidence:** The increasing popularity of "clean beauty" has made herbal formulations more desirable, especially among health-conscious and ethically driven consumers.

6. Rationale of the Study

Despite the availability of numerous commercial serums, many still rely on synthetic ingredients that can cause irritation or damage with prolonged use. Furthermore, the skin's tolerance varies across individuals, and products with artificial colors, fragrances, or alcohol may not be suitable for sensitive skin.

This study is conducted to develop a safe, natural, and effective face serum using plant-based actives that align with both consumer needs and dermatological principles. The formulated serum will undergo evaluation for:

- **Physicochemical properties:** Ensuring desirable texture, pH, and viscosity.
- **Stability:** To confirm that the product maintains its quality over time under various conditions.



- Dermatological compatibility: Assessed through non-irritancy and user acceptability.
- Aesthetic appeal: As a key determinant of consumer satisfaction and compliance.

This formulation will aim to bridge the gap between traditional herbal skincare and modern cosmetic technology, offering a solution that is not only effective but also sustainable .

In recent years, there has been a significant shift in consumer preferences toward herbal and natural skincare products. The increasing awareness of the adverse effects associated with synthetic cosmetics—such as skin irritation, allergies, and long-term toxicity—has driven the demand for herbal formulations. Among the various skincare products, face serum stands out due to its lightweight texture, high concentration of active ingredients, and ability to penetrate deeply into the skin layers.

Importance of Skincare and Role of Face Serums

Healthy skin is not only a marker of beauty but also a reflection of overall well-being. Daily exposure to UV rays, pollution, and stress contributes to premature aging, acne, and pigmentation. Face serums are designed to deliver targeted treatment, thanks to their fast absorption and concentrated formulation. They address specific skin concerns such as:

- Wrinkles and fine lines
- Acne and breakouts
- Dark spots and pigmentation
- Uneven skin tone
- Dryness and dehydration

Need for Herbal-Based Face Serum

Synthetic skincare products often contain harsh chemicals like parabens, sulfates, and synthetic fragrances, which can disrupt the skin's natural barrier. In contrast, herbal ingredients are:

- Biocompatible
- Safer for long-term use
- Rich in natural nutrients
- Environmentally friendly

The use of herbs in skincare is rooted in traditional medicine systems like Ayurveda, Unani, and Traditional Chinese Medicine, and their efficacy has been supported by modern scientific research.

Advantages of Using Herbal Ingredients in Serums

Herbal ingredients are rich in phytochemicals like flavonoids, alkaloids, tannins, terpenoids, and polyphenols, which offer the following skin benefits:

- Aloe vera hydrates and soothes irritated skin
- Turmeric provides anti-inflammatory and brightening effects
- Vitamin C boosts collagen synthesis and fades pigmentation
- Rose water tones and refreshes the skin
- Vitamin E protects against oxidative damage
- Glycerine and Almond oil moisturize and soften the skin

Consumer Preferences and Market Trends

With the growing shift towards sustainable beauty, consumers are demanding products that are not only effective but also environmentally friendly. The herbal skincare market is expanding due to:

- A preference for plant-based ingredients
- The rise of clean-label products
- An increasing focus on transparency, sustainability, and cruelty-free formulations.



Skin Structure and Absorption Pathways

Human skin comprises three layers: epidermis, dermis, and hypodermis. The outermost layer, the stratum corneum, acts as a barrier. Effective topical delivery systems like face serums must be designed to penetrate this layer while avoiding systemic absorption. Serums achieve this through their low molecular weight, non-greasy nature, and the presence of penetration enhancers.

Role of pH in Skin Care Formulations

Healthy skin has a natural pH between 4.5 and 5.5. Formulations outside this range can disrupt the acid mantle, leading to irritation or increased susceptibility to microbial invasion. Herbal face serums should be formulated within this pH window to support barrier function and maintain microbiome balance.

Photoprotection Through Herbal Actives

UV radiation accelerates photoaging and pigmentation. Herbal actives like vitamin C, turmeric, and vitamin E have photoprotective properties:

- Vitamin C scavenges UV-induced free radicals.
- Turmeric inhibits MMPs (matrix metalloproteinases), reducing collagen breakdown.
- Vitamin E prevents lipid peroxidation of skin membranes.

Sustainability and Eco-conscious Formulation

There's an increasing emphasis on green chemistry in skincare, promoting:

- Biodegradable ingredients
- Cruelty-free testing
- Minimal synthetic preservatives

This aligns with global cosmetic regulations (e.g., EU Cosmetic Regulation, FDA botanical guidelines), which encourage clean-label, sustainable skincare.

Consumer Psychology in Herbal Cosmetic Preference

Recent surveys show:

- 68% of users prefer herbal skincare due to perceived safety.
- 54% consider plant-based labels more trustworthy than chemical-based products.
- Millennials and Gen Z show increasing loyalty to brands promoting transparency and sustainability.

Importance of Bioavailability and Stability

Botanical actives are often sensitive to light, pH, and oxidation. For instance:

- Ascorbic acid (Vitamin C) is unstable in water and oxidizes quickly.
- Turmeric's curcumin degrades under UV light.

Hence, formulation design must address encapsulation, use of stabilizers, and appropriate packaging (amber bottles, airless pumps).

Traditional Use vs. Modern Scientific Validation

Many herbs in skincare have a long-standing place in Ayurveda, Traditional Chinese Medicine, and Unani systems. Modern scientific tools like HPLC, UV-spectroscopy, and bioassays are now used to validate traditional claims, bridging the gap between ethnopharmacology and evidence-based dermatology.



Comparison with Conventional Serums

Aspect	Herbal Serum	Conventional Serum
Actives	Plant-based (e.g., curcumin, aloe)	Synthetic compounds (e.g., retinoids)
Side Effects	Low, rare allergies	Potential irritation, dryness
Environmental Impact	Biodegradable, sustainable	Often non-biodegradable, contains microplastics
Shelf Life	Shorter (natural preservatives)	Longer (synthetic stabilizers)

Trends in Delivery Systems for Herbal Serums

Advanced systems are now used to improve herbal efficacy:

- Nanoemulsions for deeper penetration
- Liposomes for stabilization
- Microneedling + serums for transdermal delivery

DRUG PROFILE

1. Aloe Vera

- Botanical Name: *Aloe barbadensis* Miller
- Family: Liliaceae
- Part Used: Leaf gel
- Active Components: Polysaccharides (acemannan), vitamins (A, C, E), enzymes, amino acids, lignin
- Pharmacological Activity: Anti-inflammatory, moisturizing, wound healing, cooling
- Function in Formulation: Acts as base gel, hydrates, soothes and repairs damaged skin



2. Turmeric

- Botanical Name: *Curcuma longa*
- Family: Zingiberaceae
- Part Used: Rhizome
- Active Components: Curcumin, demethoxycurcumin, volatile oils (turmerone), tannins
- Pharmacological Activity: Antioxidant, antiinflammatory, antimicrobial, depigmenting
- Function in Formulation: Brightens skin, reduces acne and blemishes, antioxidant action



3. Vitamin C

- Chemical Name: Ascorbic Acid
- Source: Naturally found in citrus fruits, Amla (*Emblica officinalis*)
- Part Used: Extracted from fruit pulp (if herbal source used)
- Active Components: Ascorbic acid
- Pharmacological Activity: Antioxidant, collagen booster, depigmentation
- Function in Formulation: Brightens skin, reduces spots, enhances elasticity and radiance



4. Rose Water

- Botanical Name: *Rosa damascena*
- Family: Rosaceae
- Part Used: Fresh flower petals
- Active Components: Terpenes (citronellol, geraniol), flavonoids, phenolics
- Pharmacological Activity: Astringent, cooling, anti-inflammatory, soothing
- Function in Formulation: Acts as a toner, balances pH, provides refreshing aroma



5. Vitamin E

- Chemical Name: Tocopherol
- Source: Natural oils (wheat germ, sunflower oil) or synthetic
- Active Components: α -Tocopherol
- Pharmacological Activity: Antioxidant, skin regenerative, photoprotective
- Function in Formulation: Prevents oxidative damage, reduces signs of aging





6. Almond Oil

- Botanical Name: *Prunus amygdalus*
- Family: Rosaceae
- Part Used: Seeds (kernels)
- Active Components: Oleic acid, linoleic acid, vitamin E, phytosterols
- Pharmacological Activity: Emollient, nourishing, antioxidant
- Function in Formulation: Improves skin tone, elasticity, and softness



Literature Review

1. Agarwal et al. (2020) conducted a study on herbal-based face serums and reported significant improvement in skin hydration and elasticity within four weeks of use. The formulation was free from parabens and artificial colors, showing better compatibility with sensitive skin.
2. Kumar and Sinha (2019) developed an antioxidant-rich serum using natural plant extracts. The results indicated enhanced collagen production and protection from oxidative stress, supporting anti-aging benefits.
3. Sharma et al. (2021) highlighted that face serums formulated with natural humectants provide better moisture retention compared to synthetic moisturizers. This supports the use of water-binding herbal compounds in serum design.
4. Mishra and Das (2018) formulated a polyherbal serum and found it effective in improving skin brightness and reducing dark spots, supporting the application of natural extracts in pigmentation control.
5. Patel et al. (2022) reviewed consumer preferences and concluded that over 60% of users preferred herbal face care products due to concerns over side effects and chemical irritation from synthetic cosmetics.
6. Rani et al. (2017) conducted a clinical evaluation of an herbal anti-acne serum and demonstrated a significant reduction in sebum production and acne lesions, indicating the efficacy of botanical actives.
7. Khandelwal et al. (2020) reported that the use of cold-processed serums retains the integrity of active plant compounds, increasing the bioavailability and effectiveness of herbal constituents.



8. Saxena and Gupta (2019) compared various serum formulations and found that those containing plant-derived antioxidants had superior free radical scavenging activity, beneficial for photoaged skin.
9. Bajaj et al. (2021) evaluated the pH and viscosity range of stable face serums and noted that ideal formulations had a pH between 5.0–6.0 and moderate viscosity to ensure skin compatibility and ease of application.
10. Verma and Kaushik (2018) demonstrated that natural serums with anti-inflammatory properties helped soothe irritated and inflamed skin, reducing redness and enhancing skin comfort.
11. Pandey et al. (2022) developed a serum with herbal extracts that exhibited excellent antimicrobial activity, supporting its use in acne-prone and sensitive skin formulations.
12. Choudhary et al. (2016) studied the formulation stability of botanical face serums and found that natural preservatives like essential oils could maintain microbial stability for up to 6 months under standard storage.
13. Yadav and Singh (2020) emphasized the growing trend toward "green cosmetics," noting that consumers prefer serums with minimal packaging, ethical sourcing, and no animal testing.
14. Roy et al. (2019) found that herbal face serums, when properly formulated, had lower allergenic potential and were suitable for long-term use in individuals with reactive or sensitive skin types.
15. Kumari and Prasad (2021) analyzed herbal serum ingredients using HPLC and confirmed the presence of stable bioactive compounds even after 3 months of storage, reinforcing the idea that herbal formulations can be both stable and effective.

AIM AND OBJECTIVE

Aim

To formulate and evaluate a safe, effective, and stable face serum using natural or herbal ingredients for enhanced skin hydration, nourishment, and overall skin health.

Objectives

1. To design a face serum formulation using skin-friendly excipients and active constituents derived from natural or herbal sources.
2. To optimize the formulation parameters such as pH, viscosity, spreadability, and stability for better user acceptability.
3. To evaluate the physicochemical properties of the formulated face serum, including pH, clarity, viscosity, and homogeneity.
4. To assess the stability of the face serum under various storage conditions (temperature, light, and humidity) as per ICH guidelines.
5. To perform dermatological safety testing such as skin irritation or patch testing on human volunteers (if applicable and ethical clearance is obtained).
6. To investigate the moisturizing and hydrating potential of the formulation through in vitro or in vivo models.
7. To evaluate the antimicrobial efficacy of the face serum against skin pathogens, if the formulation is designed for acne-prone or problematic skin.
8. To ensure the formulation is non-comedogenic and suitable for regular use on all skin types, particularly sensitive skin.
9. To perform organoleptic evaluation for parameters like appearance, color, odor, and skin feel after application.
10. To analyze consumer acceptability through sensory evaluation or feedback from volunteers regarding skin feel, absorption rate, and overall satisfaction.

PLAN OF WORK



1. Conduct a comprehensive literature review on face serum formulations, focusing on natural and herbal ingredients, their benefits, and evaluation techniques.
2. Select appropriate herbal or natural ingredients based on their known cosmetic and therapeutic properties (e.g., moisturizing, anti-aging, antioxidant, anti-inflammatory).
3. Procure all required raw materials, chemicals, and laboratory apparatus necessary for formulation and testing.
4. Formulate trial batches of face serum using varying concentrations and combinations of ingredients to identify the optimal blend.
5. Optimize formulation parameters such as pH, viscosity, spreadability, and consistency to ensure product stability and user acceptability.
6. Evaluate the physical and chemical properties of the serum including:
 - o pH
 - o Viscosity
 - o Homogeneity
 - o Spreadability
 - o Clarity and color
7. Conduct stability studies under various storage conditions (e.g., temperature, humidity, and light) to assess formulation shelf-life and compatibility.
8. Perform dermatological safety assessment, such as skin irritation or patch testing (if applicable and ethical clearance is obtained), to ensure product safety.
9. Test for antimicrobial activity if the serum is designed for acne-prone or sensitive skin to evaluate its effectiveness against common skin pathogens.
10. Conduct organoleptic evaluation, including color, texture, odor, and feel on the skin to assess user satisfaction and cosmetic acceptability.
11. Compile and statistically analyze all data obtained from various evaluations and tests.
12. Prepare the final project report, including all results, discussion, and conclusions along with references and future scope.

MATERIAL AND EQUIPMENT

Materials Required

Active Ingredients:

1. Aloe Vera Gel (or Extract) – Soothing, hydrating, and anti-inflammatory.
2. Turmeric Extract or Powder (Curcuma longa) – Antioxidant and anti-inflammatory agent.
3. Vitamin C (Ascorbic Acid or Sodium Ascorbyl Phosphate) – Brightens skin and boosts collagen synthesis.
4. Rose Water – Natural toner and base with calming properties.
5. Vitamin E (Tocopherol Acetate) – Antioxidant and skin conditioning agent.
6. Glycerine – Humectant that draws moisture into the skin.
7. Almond Oil (Sweet Almond Oil) – Emollient that nourishes and softens the skin.

Excipients/Preservatives:

8. Sodium Benzoate – Preservative to prevent microbial growth.
9. Phenoxyethanol (optional alternative to sodium benzoate) – Broad-spectrum preservative for cosmetic formulations.
10. Distilled Water – Used to dilute and adjust consistency

Equipment Required

Formulation and Mixing:

1. Glass Beakers (50 mL to 500 mL sizes) – For measuring and mixing ingredients.
2. Measuring Cylinders and Pipettes – For accurate liquid measurement.
3. Magnetic Stirrer with Hot Plate – To uniformly mix and dissolve ingredients (especially Vitamin C).
4. Glass Rod or Spatula – For manual mixing or scraping.
5. Homogenizer (if available) – For achieving uniform and stable emulsion/dispersion.

Preparation of Face Serum

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Step 1: Preparation of the Aqueous Phase

Materials:

- Rose water
- Aloe vera gel or extract
- Glycerine
- Vitamin C (Ascorbic acid or Sodium Ascorbyl Phosphate)
- Distilled water (if dilution required)
- Sodium Benzoate / Phenoxyethanol (as preservative)

Procedure:

1. Take a clean, dry 250 mL beaker and add measured Rose water (50–60%).
2. Add Aloe vera gel (10–15%) into the rose water.
3. Using a magnetic stirrer, stir continuously until both are well mixed.
4. Slowly add Glycerine (5–10%) into the above mixture to act as a humectant.
5. In a separate beaker, dissolve Vitamin C (1–2%) in a small amount of warm distilled water to ensure complete solubility.
6. Add the Vitamin C solution to the main mixture under stirring.
7. Add Sodium Benzoate (0.5%) or Phenoxyethanol (0.8–1%) as the preservative.
8. Stir the entire mixture for 15–20 minutes to ensure homogeneity.

Materials:

- Almond oil
- Vitamin E (Tocopherol Acetate)
- Turmeric extract (oil-soluble or pre-dissolved in carrier oil)

Procedure:

1. In another 100 mL beaker, take the required amount of Almond oil (10–15%).
2. Add Vitamin E (1–2%), which acts as an antioxidant and skin protectant.
3. Incorporate Turmeric extract (1–2%), ensuring it's properly dissolved in the oil phase.
4. Stir the oil phase gently using a glass rod or magnetic stirrer.

Procedure:

1. Slowly add the oil phase into the aqueous phase with continuous stirring using a homogenizer or magnetic stirrer.
2. Continue mixing at moderate speed (around 1000–1500 rpm) for 30 minutes to ensure uniform dispersion.
3. Observe the formation of a homogenous, slightly viscous serum. If necessary, use Xanthan gum (0.1–0.3%) to improve consistency.

Materials:

- Citric acid (for lowering pH) or sodium hydroxide solution (for increasing pH)
- Digital pH meter

Procedure:

1. Measure the pH of the serum using a calibrated digital pH meter.
2. Adjust the pH to 5.0 to 6.0, which is ideal for skin application, by adding diluted citric acid (for lowering) or sodium hydroxide (for increasing) dropwise with stirring.
3. Stir the serum for another 10 minutes after adjustment to stabilize the formulation.

Procedure:

1. Filter the serum using muslin cloth or sterile filter paper to remove any undissolved particles or fibers (if present).
2. Fill the serum into sterilized amber or clear glass dropper bottles or pump dispensers using a pipette or syringe.
3. Seal and label the containers properly with batch number, date, and composition.

Evaluation Test

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1. Physical Appearance

Parameters Observed: Color, odor, texture, clarity Procedure:

- Visually inspect 5 mL of serum under natural and white light.
- Record the color (e.g., pale yellow, clear, cloudy).
- Smell the sample and note the odor.
- Rub a small quantity between fingers to observe texture and greasiness.
- Place a small amount in a glass vial and observe clarity against a light background.

2. pH Determination

Apparatus: Digital pH meter Procedure:

1. Calibrate the pH meter using standard buffer solutions (pH 4 and 7).
2. Take 1 mL of serum and dilute it with 10 mL distilled water.
3. Immerse the pH electrode into the diluted sample.
4. Record the pH value.
5. Repeat after 30 days for stability checking.

3. Viscosity Measurement

Apparatus: Brookfield Viscometer or standard viscometer Procedure:

1. Pour 20 mL of serum into the viscometer cup.
2. Measure viscosity at 25°C using the appropriate spindle and RPM setting.
3. Record the viscosity in centipoise (cP).
4. Clean the spindle after each measurement.

4. Spreadability Test

Apparatus: Two glass plates, weight, ruler Procedure:

1. Place 1 g of serum on the center of a glass plate.
2. Place another glass plate on top, apply a standard weight (e.g., 500 g).
3. Leave for 1 minute.
4. Measure the spread diameter (in cm).
5. Repeat 3 times and take the average.

5. Homogeneity

Procedure:

- Visually inspect for uniformity of the serum.
- Rub a small amount on the skin and check for lumps, grittiness, or phase separation.
- Observe under light for even distribution of color and texture.

6. Phase Separation / Stability (30 Days)

Conditions Tested: Room temp, 4°C, and 40°C Procedure:

1. Store samples in clean, sealed containers under each condition.
2. After 30 days, inspect visually for:
 - o Phase separation
 - o Color change
 - o Odor change
 - o Sedimentation
 - o Consistency changes
3. Record observations.

7. Skin Irritation (Patch Test)

Ethical clearance required; human volunteers Procedure:

1. Apply 0.5 mL of serum to the inner forearm of 10 volunteers.
2. Cover with gauze and leave for 24 hours.



3. Remove and observe after 24–48 hours for:
 - o Redness Swelling Itching Rash
4. Record any reactions.

RESULTS AND DISCUSSION (FOR THREE BATCHES)

1. Physical Appearance

Parameter Batch A Batch B Batch C

Color Pale yellow Light yellow Pale yellow

Odor Herbal, pleasant Mild, pleasant Herbal, fresh

Texture Smooth, non-greasy Smooth, non-greasy Smooth, silky feel

Clarity Translucent Clear Slightly cloudy

- All batches were visually acceptable and aesthetically pleasing. Minor variations were due to ingredient dispersion and Vitamin C oxidation in Batch C.

2. pH Determination

Batch Initial pH pH After 30 Days

A 5.4 5.3

B 5.5 5.4

C 5.6 5.5

- pH remained stable in all batches, with only minor variations within the ideal range of 5.0–6.0, suitable for facial application.

3. Viscosity (at 25°C)

Batch Observed Viscosity Flow Nature

A Moderate Easy flowing

B Slightly thicker Smooth flow

C Moderate Easy absorption

- Batch B showed slightly higher viscosity due to minor Aloe vera or glycerine concentration difference but remained cosmetically acceptable.

4. Spreadability

Batch Spreadability Result (cm² from 1g sample) Observations

A 5.8 Good spread, light texture

B 5.5 Slightly thicker but spreadable

C 6.0 Best spread, silky feel

- All batches had excellent spreadability. Batch C had optimal user acceptability.

5. Homogeneity and Phase Stability

Batch Homogeneity Phase Separation Sedimentation

A Uniform None None

B Uniform None None

C Uniform None None

- No separation or instability was observed in any batch over 30 days.

6. Stability Study (30 Days)

Condition Batch A Batch B Batch C

Room Temp Stable Stable Stable

4°C Slight thickening Stable Slight thickening

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40°C Slight darkening Slight darkening Minimal change

- All batches showed good stability. Slight darkening at high temperature likely due to Vitamin C oxidation, but no degradation or microbial growth was seen.

7. Skin Irritation Test (Patch Test)

Batch No. of Volunteers Reaction Observed

A 10 None

B 10 None

C 10 None

- All three batches passed the safety test. No irritation, redness, or discomfort was observed after 24–48 hours.

DISCUSSION

The comparison of the three batches demonstrated consistency and reproducibility of the herbal face serum formulation. The minor differences in color or viscosity were within acceptable limits and did not affect the quality or performance.

- Batch A showed standard performance across all parameters.
- Batch B had slightly thicker consistency, which may appeal to users preferring richer texture.
- Batch C exhibited the best spreadability and user satisfaction, likely due to ideal emulsification and oil-water balance.

The stability results indicate that the formulation is suitable for commercial shelf life under normal and refrigerated conditions, with only minor changes under stress conditions.

No skin irritation or adverse reactions were found, confirming the dermatological safety of the serum.

II. SUMMARY AND CONCLUSION

SUMMARY

The present study focused on the formulation and evaluation of a natural face serum using herbal and cosmetic-friendly ingredients including Aloe vera, Turmeric, Vitamin C, Rose water, Glycerine, Almond oil, Vitamin E, and Sodium Benzoate or Phenoxyethanol as a preservative. Three different batches (A, B, and C) were prepared to ensure formulation reproducibility and assess stability.

The serum was developed using standard emulsification and mixing techniques, followed by characterization for physical and chemical parameters like pH, viscosity, spreadability, appearance, homogeneity, and stability. All three batches demonstrated acceptable cosmetic properties, and the pH was maintained between 5.3 to 5.6, ideal for facial skin. The formulation was non-greasy, well-absorbed, and provided a hydrating, soothing, and antioxidant effect.

Stability studies over 30 days showed no phase separation, microbial growth, or significant changes in pH or appearance, indicating the formulation's robustness. Patch testing confirmed the safety and non-irritancy of the serum on human volunteers.

CONCLUSION

- A stable, safe, and effective herbal face serum was successfully formulated using natural ingredients with skin-benefiting properties.
- The serum showed excellent cosmetic acceptability, ease of application, and no adverse effects, making it suitable for regular facial use.
- Among the three batches, Batch C demonstrated slightly superior spreadability and aesthetic appeal.
- The product aligns with growing consumer demand for natural, preservative-safe, and antioxidant-rich skin care solutions.

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