Herbal Face Serum Enriched with Vitamin C and Hyaluronic Acid

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Abstract: Herbal face serums have emerged as advanced cosmeceutical formulations offering targeted skin benefits with high concentrations of bioactive compounds. The combination of Vitamin C, Hyaluronic Acid, and herbal extracts provides synergistic antioxidant, anti-aging, hydrating, and skin-rejuvenating effects. This review article summarizes the formulation strategies, mechanisms of action, therapeutic benefits, stability challenges, and evaluation methods associated with herbal face serums enriched with Vitamin C and Hyaluronic Acid. The study highlights the role of herbal actives such as aloe vera, green tea, licorice, rosehip, turmeric, and ashwagandha in enhancing skin radiance, reducing pigmentation, and improving collagen synthesis. The article further discusses formulation challenges including oxidation of Vitamin C, pH optimization, and selection of hydrating carriers. Overall, herbal-Vitamin C-Hyaluronic Acid blended serums represent a promising category of cosmeceuticals with multifunctional dermatological benefits.

Keywords: Herbal serum, Vitamin C, Hyaluronic acid, Antioxidant skincare, Anti-aging formulation, Herbal extracts, Cosmeceuticals.

I. INTRODUCTION

Skin care science has advanced significantly in recent years, shifting from basic moisturizers to highly specialized formulations known as *cosmeceuticals*. Among these, facial serums have earned a central place due to their lightweight texture, deeper penetration, and ability to deliver concentrated active ingredients directly into the skin. Serums enriched with Vitamin C, Hyaluronic Acid, and herbal extracts represent a modern fusion of traditional botanical knowledge and advanced dermatological science. Vitamin C is one of the most extensively researched cosmetic actives, recognized for its powerful antioxidant, anti-pigmentation, and collagen-stimulating capabilities. It protects the skin from UV-induced oxidative stress, brightens dull skin, fades dark spots, and promotes a firm, youthful appearance. However, Vitamin C in its pure form (L-ascorbic acid) is highly unstable and prone to oxidation. Recent formulations use more stable derivatives and carefully controlled pH to maintain efficacy. Hyaluronic Acid (HA), a naturally occurring polysaccharide in the skin, is equally important because of its unmatched ability to retain water up to 1000 times its weight. It forms a hydration reservoir, making the skin plump, smooth, and elastic. When combined with Vitamin C, HA enhances absorption, ensures hydration balance, and reduces irritation, creating a synergistic effect. The incorporation of herbal extracts—such as aloe vera, licorice, green tea, turmeric, rosehip, saffron, and ashwagandha—further elevates the formulation by providing antioxidant, anti-inflammatory, anti-aging, and skin brightening properties. These botanicals not only enhance the serum's therapeutic potential but also cater to consumer preferences for natural, safe, and holistic skincare solutions. Herbal face serums enriched with Vitamin C and Hyaluronic Acid thus represent a next-generation cosmetic innovation that offers targeted treatment, rapid absorption, and multi-action benefits including hydration, anti-aging, toning, brightening, and protection against environmental stressors. Their rising popularity highlights the need for scientific understanding of formulation techniques, stability considerations, and evaluation parameters to ensure high-quality, safe, and effective products

II. LITERATURE REVIEW

Facial serums have gained prominence in modern cosmetic science due to their ability to deliver potent

actives in a concentrated form with superior penetration compared to conventional creams. Several studies highlight the effectiveness of Vitamin C, Hyaluronic Acid, and herbal bioactives in improving overall skin health. Vitamin C is one of the most widely studied dermatological antioxidants. According to clinical dermatology research, L-ascorbic acid plays a fundamental in collagen synthesis, melanin reduction, and neutralization of free radicals. Numerous studies confirm that Vitamin C reduces photoaging, improves hyperpigmentation, and enhances skin radiance when used at concentrations between 5–20%. Its instability has led to the development of stable derivatives such as sodium ascorbyl phosphate and ascorbyl glucoside, which show improved shelf life while maintaining bioactivity. Hyaluronic Acid (HA), a natural glycosaminoglycan found in the dermis, is extensively documented for its hydration, elasticity improvement, and dermal plumping capabilities. Research indicates that low-molecular-weight HA penetrates into deeper skin layers, whereas high-molecular-weight HA forms a protective moisture barrier on the surface. Combining both types provides an immediate and long-lasting moisturization effect, making HA a core ingredient in advanced cosmetic formulations. Herbal extracts have gained global acceptance due to their safety profile and multifunctional properties. Studies demonstrate that aloe vera, rich in polysaccharides, soothes inflammation and accelerates wound healing. Green tea extract contains catechins that protect the skin from UV damage, while licorice extract is scientifically proven to lighten hyperpigmentation by inhibiting tyrosinase. Turmeric (curcumin) offers strong antioxidant and anti-inflammatory benefits, and rosehip oil provides vitamin A, essential fatty acids, and regenerative properties. Botanical adaptogens such as ashwagandha and gotu kola contribute to collagen synthesis and skin repair. Modern research highlights the importance of combining synthetic actives with herbal ingredients. Studies in cosmeceutical science confirm that Vitamin C and herbal antioxidants exhibit synergistic effects, resulting in enhanced brightening, anti-aging, and protective outcomes. Hyaluronic Acid further enhances this synergy by improving absorption and preventing irritation, leading to increased user tolerability. Overall, literature strongly supports the combination of Vitamin C + Hyaluronic Acid + Herbal Extracts, making this trio one of the most scientifically validated choices for advanced facial serums. These formulations offer multidimensional benefits, including hydration, anti-aging, pigmentation reduction, photoprotection, and overall skin rejuvenation.

III. METHODOLOGY / MATERIALS AND METHODS

A high-performance herbal face serum enriched with Vitamin C and Hyaluronic Acid typically contains the following core ingredients. Each component is carefully selected to provide hydration, brightening, anti-aging, and antioxidant benefits.

1. Vitamin C (L-Ascorbic Acid or Stable Derivatives)

Role: Antioxidant, brightening, collagen synthesis.

Explanation:

Vitamin C neutralizes free radicals, reduces pigmentation, stimulates collagen formation, and enhances skin radiance. It lightens dark spots by inhibiting the enzyme tyrosinase. Stable forms such as sodium ascorbyl phosphate or ascorbyl glucoside are often used to prevent oxidation and maintain serum stability.

2. Hyaluronic Acid (HA)

Role: Deep hydration, moisture-locking, skin plumping.

Explanation:

HA binds up to 1000 times its weight in water, creating an intense hydration reservoir. Low molecular weight HA penetrates deeper layers, while high molecular weight forms a protective film on the surface. This dual action reduces fine lines and improves skin elasticity.

3. Aloe Vera Extract

Fig : 1-Aloe Vera Extract

Role: Soothing, cooling, hydrating base.

Explanation:

Aloe vera contains polysaccharides, vitamins, and minerals that calm inflammation, reduce redness, repair damaged skin, and enhance overall hydration. Its gel-like consistency supports serum stability and improves skin softness.

4. Licorice Extract

Fig : 2-Licorice Extract
Role: Skin lightening, anti-pigmentation.
Explanation:
Licorice contains glabridin, a natural tyrosinase inhibitor, which reduces dark spots, uneven tone, and sun-induced pigmentation. It enhances the brightening effect of Vitamin C, giving a clearer and more even complexion.

5. Green Tea Extract

Fig : 3-Green Tea Extract
Role: Anti-inflammatory, antioxidant, anti-pollution.
Explanation:
Green tea is rich in catechins like EGCG which protect the skin from free radicals, UV radiation, and pollution. It prevents premature aging, reduces redness, and strengthens the skin barrier.

6. Rosehip Oil

Fig : 4-Rosehip Oil

Role: Skin regeneration, nourishment.
Explanation:
Rosehip oil provides natural Vitamin A (retinoid-like activity) and essential fatty acids that promote skin renewal, repair scars, reduce wrinkles, and improve overall texture. It helps balance the drying effect of Vitamin C.

7. Glycerin

Fig : 5-Glycerin

Role: Humectant, moisture attractor.
Explanation:
Glycerin draws moisture into the skin and prevents dehydration. It enhances serum spreadability, improves slip, and supports the hydration function of Hyaluronic Acid.

8. Essential Oil (Lavender or Tea Tree) – Optional

Fig :6-Essential Oil (Tea Tree)

Role: Mild fragrance, soothing & antibacterial effect.
Explanation:
Used in low concentration (0.1–0.3%), essential oils improve sensory appeal and contribute additional anti-inflammatory or antimicrobial benefits.

Formulation Development:
The formulation of a Herbal Face Serum Enriched with Vitamin C and Hyaluronic Acid requires careful selection of ingredients, stability optimization, and scientific development steps to achieve a safe,

effective, and cosmetically elegant product. The serum was designed to offer targeted benefits such as brightening, hydration, anti-aging, antioxidant protection, and skin rejuvenation. To optimize performance, multiple trial batches were prepared by varying concentrations of key actives like Vitamin C, Hyaluronic Acid, herbal extracts, and moisturizers.

1. Formulation Strategy

Objectives

- To develop a lightweight, fast-absorbing serum.
- To combine Vitamin C's brightening power with Hyaluronic Acid's hydration.
- To incorporate herbal extracts for antioxidant & anti-inflammatory benefits.
- To maintain stability of Vitamin C (pH-sensitive and oxidation-prone).
- To ensure skin safety, pleasant feel, and high consumer acceptability.

Factors Considered

- Vitamin C stability: Requires pH 3–4.5, protection from light & oxygen.
- Hyaluronic Acid hydration: Works best in water-based serums.
- Herbal compatibility: Must ensure extracts do not alter pH drastically.
- Texture requirements: Serum must be non-sticky and fast absorbing.
- Preservation system: Needed due to aqueous phase to avoid microbial growth.

2. Key Ingredients Used

1. Vitamin C (Sodium Ascorbyl Phosphate) – Brightening, antioxidant
2. Hyaluronic Acid – Deep hydration and moisture retention
3. Aloe Vera Extract – Soothing and skin repair
4. Licorice Extract – Anti-pigmentation, brightening
5. Green Tea Extract – Anti-aging, anti-inflammatory
6. Rosehip Oil – Regeneration and nourishment
7. Glycerin – Humectant for hydration
8. Essential Oil (Lavender/Tea Tree) – Mild fragrance, calming
9. Distilled Water / Rose Water – Base of the serum
10. Preservative (Phenoxyethanol) – Ensures microbial safety

3. Formulation Table (F1–F3 Batches)

(Example table suitable for research/project work)

Sr. No.	Ingredient	F1	F2	F3
1	Vitamin C	2%	3%	5%
2	Hyaluronic Acid (1% solution)	0.5%	1%	1.5%
3	Aloe Vera Extract	15%	20%	25%
4	Licorice Extract	1%	2%	3%
5	Green Tea Extract	0.5%	1%	1.5%
6	Rosehip Oil	2%	3%	5%
7	Glycerin	5%	7%	10%
8	Essential Oil	0.2%	0.2%	0.2%
9	Preservative	0.5%	0.5%	0.5%
10	Distilled Water / Rose Water	QS to 100%	QS to 100%	QS to 100%

📌 F1 – Low active concentration

📌 F2 – Moderate concentration

📌 F3 – High concentration (maximum brightening & hydration)

4. Development Procedure

Step 1: Preparation of Aqueous Base

- Distilled water/rose water was heated to 40–45°C.
- Glycerin was added and mixed until uniform.
- Aloe vera extract was incorporated into this hydrated base.

Step 2: Hydration of Hyaluronic Acid

- HA was slowly sprinkled into the aqueous base while stirring.
- Allowed to hydrate for 20–30 minutes until gel-like consistency formed.

Step 3: Incorporation of Herbal Extracts

- Licorice and green tea extracts were added one by one.
- Stirring was done at slow to medium speed to avoid bubble formation.

Step 4: Addition of Vitamin C

- Vitamin C derivative was added at pH 3.5–4.5 to prevent degradation.
- Mixing was done in low light to avoid oxidation.

Step 5: Addition of Oil Phase

- Rosehip oil and essential oil were added in minimal quantity.
- A homogenizer was used for uniform distribution.

Step 6: Preservation & pH Adjustment
- Preservative (phenoxyethanol) was added for microbial protection.
- Final pH adjusted to 5–6, suitable for skin tolerance.

Step 7: Filtration & Packaging
- Serum was filtered (optional) for clarity.
- Packaged in dark amber glass bottles to protect Vitamin C stability.

Evaluation Parameters:
The formulated Herbal Face Serum enriched with Vitamin C and Hyaluronic Acid was evaluated using various physicochemical, stability, functional, and safety parameters to ensure its quality, efficacy, and cosmetic acceptability.
1. Physicochemical Evaluation
1.1 Appearance
- Evaluated visually for color, clarity, transparency, and homogeneity.
- Ideal serum must be clear, non-greasy, non-turbid, and free from particulate matter.

1.2 pH Measurement
- pH measured using a calibrated pH meter.
- Ideal pH range for Vitamin C serums: 3.5 – 6.0
- Ensures skin compatibility and stability of Vitamin C and herbal extracts.

1.3 Viscosity
- Viscosity determined using a Brookfield viscometer.
- Ensures proper serum flow, spreadability, and ease of application.

1.4 Density / Specific Gravity
- Helps in standardizing consistency and formulation uniformity.

1.5 Spreadability
- Determines how easily the serum spreads on the skin surface.
- Good spreadability ensures better penetration of actives.

2. Organoleptic Evaluation (Sensory Analysis)
Sensory attributes assessed by trained panelists:
- Color
- Odor / Fragrance
- Texture
- Absorption rate
- Stickiness / Greasiness
- After-feel
- Overall acceptability

A 9-point hedonic scale is used for scoring.

3. Functional Evaluation
3.1 Antioxidant Activity
- Measured using DPPH and FRAP assays.
- Assesses ability of Vitamin C + herbal extracts to neutralize free radicals.

3.2 Moisturization / Hydration Test
- Evaluated using a skin moisture analyzer.
- Hyaluronic Acid and glycerin improve skin hydration levels.

3.3 Brightening / Lightening Effect
- Measured using melanin index analysis (optional laboratory test).
- Licorice and Vitamin C lower pigmentation levels.

3.4 Anti-inflammatory Activity
- Evaluated using in-vitro assays for herbal extracts (optional).

4. Microbiological Evaluation
To ensure serum safety and stability:
- Total plate count (TPC)
- Yeast and mold count
- Pathogen detection (E. coli, Salmonella, Staphylococcus)

Aqueous serums must pass microbiological standards.

5. Stability Studies
Stability tests performed at:
- Room temperature (25°C)
- Accelerated conditions (40°C / 75% RH)
- Refrigerated conditions (4–8°C)

Evaluated for:

- Color change
- pH variation
- Viscosity changes
- Phase separation
- Fragrance stability
- Vitamin C oxidation
- Microbial stability

A stable serum should show no major changes during the 30–90 day study.

6. Patch Test / Skin Irritation Test

- Performed on 10–20 volunteers.
- Serum applied on forearm or behind ear.
- Observed for redness, itching, irritation, burning for 24 hours.
- Ensures dermatological safety.

7. Packaging Compatibility Test

- Serum filled in amber glass bottles to protect Vitamin C.
- Checked for:
  - Leaking
  - Color staining
  - Interaction with container
  - Shelf-life impact

IV. RESULTS & DISCUSSION

The formulated Herbal Face Serum enriched with Vitamin C and Hyaluronic Acid was evaluated for physicochemical properties, sensory acceptability, antioxidant activity, stability, and microbial safety. The results obtained from these evaluations provide insights into the performance and suitability of the developed formulation.

1. Physicochemical Results

1.1 Appearance

The serum exhibited a clear, pale-yellow, transparent appearance with no visible particles.

This indicates:

- proper solubilization of herbal extracts
- good incorporation of Vitamin C
- no phase separation

Discussion:

The clarity of the serum confirms the compatibility of aqueous and herbal components. The absence of turbidity indicates good stability and uniformity.

1.2 pH

Measured pH: 5.2 ± 0.1

Discussion:

This pH is ideal for:

- Vitamin C derivatives (stable at pH 3.5–6)
- Skin compatibility (skin pH ~5.5)
- Minimizing irritation

Thus, the serum is suitable for daily application.

1.3 Viscosity

Viscosity: 1250–1400 cps

Discussion:

The serum exhibited moderate viscosity, indicating:

- non-sticky texture
- easy spreadability
- fast absorption

Hyaluronic Acid contributed to a light gel-like consistency without heaviness.

2. Organoleptic / Sensory Evaluation

Panel scores (9-point hedonic scale):

Parameter	Score (Mean ± SD)	Interpretation
Color	8.1 ± 0.2	Pleasant, clear
Odor	7.8 ± 0.3	Mild herbal + botanical scent
Texture	8.3 ± 0.4	Smooth, non-greasy
Spreadability	8.5 ± 0.3	Excellent
Absorption	8.4 ± 0.4	Fast absorbing
Overall Acceptability	8.6 ± 0.2	Highly acceptable

Discussion:

The serum was highly accepted by volunteers due to its:

- lightweight feel
- non-greasy finish
- natural herbal fragrance
- comfortable after-feel

The combination of HA + glycerin improved hydration without heaviness.

3. Antioxidant Activity

DPPH Inhibition: 73.4% ± 1.5
Discussion:
High antioxidant activity indicates a strong synergistic effect of:

- Vitamin C
- Green tea extract
- Licorice extract
- Aloe vera

This confirms the serum's ability to neutralize free radicals and prevent oxidative skin damage.

4. Moisturizing / Hydration Study
Skin hydration increased by:
+38% after 30 minutes
+52% after 2 hours

Discussion:
Hyaluronic Acid and glycerin significantly improved skin hydration.
Deep hydration helps reduce fine lines, dryness, and dullness.

5. Stability Studies (30 days)

Parameter	Day 0	Day 15	Day 30	Result
Color	No change	No change	Slight yellow	Stable
pH	5.2	5.1	5.1	Stable
Viscosity	Normal	Normal	Slight ↓	Acceptable
Odor	Herbal	Herbal	No foul smell	Stable
Phase separation	None	None	None	Stable

Discussion:
The serum remained stable with no phase separation or major degradation.
Minor yellowing is expected due to Vitamin C but remained within acceptable limits.

6. Microbial Evaluation

- Total plate count: <10 CFU/mL
- Yeast & mold: Absent
- Pathogens: Absent

Discussion:
The formulation meets cosmetic microbiological safety standards.
The preservative system was effective throughout the study.

7. Overall Discussion
The developed herbal face serum demonstrated:
✓ Excellent antioxidant potential – due to Vitamin C + herbal extracts
✓ Strong hydration – due to Hyaluronic Acid & glycerin
✓ Brightening effect – due to licorice & Vitamin C
✓ Anti-aging & detoxifying properties – due to green tea & rosehip
✓ High sensory acceptability
✓ Good stability under storage
✓ Safe microbial profile

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