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Research Paper

Formulation and Evaluation of Polyherbal Face Serum for Skin Brightening and Hydration

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ABSTRACT

Herbal face serums are widely used in cosmetic formulations because of their lightweight texture, quick absorption, and beneficial effects on the skin. The present study was carried out to formulate and evaluate a polyherbal brightening and hydration face serum using natural ingredients such as turmeric, aloe vera, saffron, papaya, green tea, and licorice, which are known for their antioxidant, moisturizing, soothing, and skin-brightening properties. The serum was prepared by incorporating the herbal extracts into a suitable gel base containing rose water, glycerin, xanthan gum, vitamin E, and preservatives. Three different formulation batches were developed to optimize the consistency, spreadability, stability, and overall skin feel of the product. The prepared formulations were evaluated for various parameters including physical appearance, pH, viscosity, spreadability, homogeneity, irritancy, absorption time, and stability. Among all the batches, the optimized formulation showed good appearance, smooth texture, skin-compatible pH, satisfactory viscosity, easy spreadability, rapid absorption, and non-irritant behavior. The formulation also remained stable during the stability study without significant changes in color, texture, or phase separation. The results of the study suggested that the prepared polyherbal serum can be used as an effective herbal cosmetic formulation for improving skin hydration and enhancing skin

INTRODUCTION

The skin is the largest organ of the human body and acts as a dynamic barrier against mechanical insult, chemical exposure, microbial invasion, ultraviolet radiation, and excess transepidermal

water loss. When the barrier is compromised, visible manifestations such as dullness, pigmentation irregularity, dehydration, and premature aging become more apparent. Oxidative stress is one of the major biological mechanisms

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involved in skin damage. Reactive oxygen species generated by ultraviolet exposure, environmental pollution, psychological stress, and normal mitochondrial metabolism can injure lipids, proteins, and DNA. This oxidative burden weakens the epidermal barrier, accelerates collagen breakdown, and enhances melanogenic activity, ultimately contributing to photoaging and hyperpigmentation.

At the same time, the demand for gentle topical products that support hydration and complexion improvement without harsh synthetic actives has increased markedly. Herbal serums are attractive in this context because they can deliver bioactive constituents in a cosmetically elegant form, offer good skin spread, and avoid heavy residue.

The present formulation combines ingredients with complementary roles. Turmeric and green tea provide strong antioxidant support; aloe vera and glycerin improve hydration and skin comfort; saffron and licorice are associated with complexion enhancement and melanin modulation; and papaya contributes gentle enzymatic exfoliation. The system is completed with rose water for sensory acceptability and xanthan gum for a stable serum consistency.

Aloe Vera

Aloe vera (*Aloe barbadensis* Miller) is a medicinal plant widely used in cosmetic and pharmaceutical preparations because of its moisturizing, soothing, and healing properties. It contains vitamins, enzymes, amino acids, and polysaccharides which help maintain skin hydration and improve skin texture. Aloe vera possesses anti-inflammatory and antioxidant activities that help reduce skin irritation, dryness, and redness. Due to its cooling and skin-repairing effects, it is extensively used in herbal creams, gels, lotions, and serums for improving skin health and hydration.

Turmeric

Turmeric (*Curcuma longa*) is an important herbal ingredient known for its antioxidant, anti-inflammatory, and antimicrobial properties. The active constituent curcumin helps protect the skin from oxidative stress and environmental damage. Turmeric is traditionally used for improving skin complexion, reducing acne, pigmentation, and blemishes. It also supports wound healing and enhances skin glow. Because of these benefits, turmeric is widely incorporated into cosmetic and herbal skincare formulations.

Green Tea

Green tea (*Camellia sinensis*) is rich in polyphenols and catechins which exhibit strong antioxidant activity. It helps protect the skin from free radical damage and premature aging caused by ultraviolet radiation and pollution. Green tea also possesses anti-inflammatory and antimicrobial properties that help reduce acne and skin irritation. In cosmetic formulations, it is used for improving skin freshness, hydration, and overall skin appearance.

Saffron

Saffron (*Crocus sativus* L.) is a valuable medicinal herb commonly used in herbal cosmetics and skincare products. It contains active compounds such as crocin, crocetin, and safranal which provide antioxidant and skin-brightening effects. Saffron helps improve skin radiance, reduce pigmentation, and protect the skin from oxidative stress. Due to its rejuvenating and nourishing properties, saffron is extensively used in herbal creams, serums, and anti-aging products.

Vitamin E

Vitamin E is a fat-soluble vitamin widely used in pharmaceutical and cosmetic formulations because of its excellent antioxidant properties. It helps protect the skin from free radical damage and supports skin repair and moisturization. Vitamin E improves skin softness, elasticity, and hydration



while reducing dryness and signs of aging. It also enhances the stability of cosmetic formulations and is commonly used in creams, lotions, and serums.

Glycerin

Glycerin, also known as glycerol, is a clear and odorless liquid commonly used as a humectant in skincare formulations. It attracts moisture from the environment and helps maintain skin hydration, softness, and smoothness. Glycerin improves skin elasticity and prevents dryness by reducing water loss from the skin surface. Due to its moisturizing and soothing properties, it is widely used in

creams, lotions, gels, and herbal serums.

Rose Water

Rose water is obtained from the distillation of rose petals, mainly *Rosa damascena*. It is widely used in cosmetic and pharmaceutical preparations because of its refreshing, soothing, and hydrating properties. Rose water helps maintain skin pH, reduces redness, and provides a cooling effect to the skin. It also contains antioxidant compounds that help protect the skin from environmental damage. Rose water is extensively used in facial mists, creams, lotions, and herbal serums.

1.1. Ingredient

Table 1.1 : Ingredient

Ingredient	Primary cosmetic role	Why it was selected
Turmeric	Antioxidant, brightening support	Curcumin is associated with anti-inflammatory, antioxidant, and photoprotective activity.
Aloe vera	Hydration and soothing	Polysaccharide-rich gel supports moisture retention and skin comfort.
Saffron	Complexion support	Crocin-rich extract is linked to antioxidant and pigment-modulating effects.
Papaya	Mild exfoliation	Papain supports gentle removal of dead surface cells.
Green tea	Antioxidant protection	Catechins, especially EGCG, help counter oxidative stress.
Licorice	Brightening and calming	Glabridin is widely used for tyrosinase-related pigmentation support.

This combination is logically suited for a serum because the ingredients act on both perceived dullness and hydration, while also maintaining a relatively mild dermatologic profile.

2. Aim and Objectives

Aim: To formulate and evaluate a stable herbal brightening and hydration serum using natural ingredients possessing antioxidant, moisturizing, and skin-brightening properties.

- To prepare a polyherbal serum using turmeric, aloe vera, saffron, papaya, green tea, and licorice.
- To optimize a serum base suitable for topical application and acceptable skin feel.
- To evaluate physical appearance, pH, viscosity, spreadability, homogeneity, irritancy, absorption time, and stability.
- To compare three batches and select the most balanced formulation for further use.

2. MATERIALS AND METHODS



Table 3: Materials and Methods

Material	Function	Source/role
Turmeric extract	Antioxidant and brightening ingredient	Active botanical
Aloe vera gel	Hydration and soothing	Active botanical
Saffron extract	Complexion support	Active botanical
Papaya extract	Mild exfoliant	Active botanical
Green tea extract	Antioxidant protection	Active botanical
Licorice extract	Pigment-modulating support	Active botanical
Rose water	Base and sensory modifier	Aqueous vehicle
Glycerin	Humectant	Excipient
Xanthan gum	Gelling/thickening agent	Excipient
Vitamin E	Antioxidant stabilizer	Excipient
Sodium benzoate	Preservative	Excipient
Potassium sorbate	Preservative	Excipient
Sodium hydroxide	pH adjuster	Excipient
Distilled water	Vehicle	Solvent

3.1 Instrument Used as follows

Table 3.2 : List of major Instrument

Sr. No.	Instrument	Use
1	Beaker	Solution prepare & mixing
2	Measuring Cylinder	Liquid volume measure
3	Pipette / Dropper	Small quantity measure
4	Glass Rod	Manual stirring
5	Magnetic Stirrer	Uniform mixing
6	Homogenizer	Smooth & stable serum preparation
7	Digital Weighing Balance	Accurate weighing of ingredients
8	pH Meter	pH measurement
9	Thermometer	Temperature monitoring
10	Filling Machine	Bottle

Table 3.1 : Instrument Used as follows

3.2 List of major Instrument

SR.NO	Name	Model Manufacturer
1	Digital ph meter	MK VI LABLINE MUMBAI
2	Digital Balance	AA 2000 LABLINE MUMBAI

4. Experimental Work

4.1 Extraction and preparation of herbal ingredients

Turmeric and licorice extracts were prepared by maceration using a hydroalcoholic or aqueous solvent system, followed by filtration and gentle concentration. Aloe vera gel was obtained by

carefully removing the outer rind of fresh leaves and collecting the inner mucilaginous gel.

Saffron strands were soaked in a small volume of warm distilled water or rose water to obtain a uniform golden extract. Green tea extract was prepared from authenticated leaves by standard extraction and filtration. Papaya extract was incorporated as a mild exfoliating component,



while rose water served as a sensorial and hydrating vehicle.

All ingredients were handled under clean laboratory conditions and stored in airtight containers to avoid contamination and degradation

4.2. Formulation design: three batches

Table 4.2. : Formulation design: three batches

Ingredient	Function	F1	F2	F3
Papaya extract	Active exfoliant	1.5 mL	2.5 mL	3.5 mL
Aloe vera gel	Hydration/soothing	15 mL	20 mL	20 mL
Rose water	Vehicle/fragrance	5 mL	5 mL	5 mL
Xanthan gum	Viscosity modifier	0.3 g	0.5 g	0.7 g
Turmeric extract	Antioxidant/brightening	0.1 g	0.1 g	0.1 g
Licorice extract	Brightening	0.5 g	0.5 g	0.5 g
Green tea extract	Antioxidant	q.s.	q.s.	q.s.
Saffron extract	Complexion support	q.s.	q.s.	q.s.
Glycerin	Humectant	1.0 mL	1.5 mL	2.0 mL
Vitamin E	Antioxidant	0.2 mL	0.2 mL	0.2 mL
Potassium sorbate	Preservative	0.05 g	0.05 g	0.05 g
Sodium benzoate	Preservative	0.05 g	0.05 g	0.05 g
NaOH (0.1 N)	pH adjuster	q.s.	q.s.	q.s.
Distilled water	q.s. to 50 mL	q.s.	q.s.	q.s.

The three batches were designed to gradually optimize texture and application performance. The final batch was intended to provide the best balance between spreadability, viscosity, and skin feel.

5. RESULT & DISCUSSION

5.1. : Evaluation Parameters of Polyherbal Face Serum

Table 5.1: Evaluation Parameters of Polyherbal Face Serum

Parameter	Purpose
Physical appearance	To assess color, clarity, and overall cosmetic acceptability.
pH	To confirm compatibility with skin and preservative system.
Viscosity	To determine flow behavior and user-friendly application.
Spreadability	To evaluate ease of application over the skin.
Homogeneity	To check for phase separation, clumps, or sedimentation.
Irritancy	To assess topical safety on a small marked area.
Absorption time	To measure the time needed for wet feel disappearance.



Stability	To observe changes in color, texture, and phase behavior.
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Phytochemical screening

The prepared extracts were screened for alkaloids, flavonoids, tannins, saponins, glycosides, phenolics, proteins, and carbohydrates using standard qualitative tests. The presence of these

classes supports the expected cosmetic relevance of the selected botanicals

5.2 Physical Appearance

Table 5.2 : Physical Appearance

Batch	Colour	Appearance	Odour
F1	Golden yellow	Translucent and smooth	Characteristic rose
F2	Pale yellow	Translucent and smooth	Characteristic rose
F3	Golden yellow	Translucent and smooth	Characteristic rose

All batches exhibited acceptable cosmetic appearance, with the translucent and smooth character suggesting good dispersion of the extract blend within the gel base. The rose-water note improved the sensory profile and reduced the

harsh herbal odor often associated with concentrated extracts.

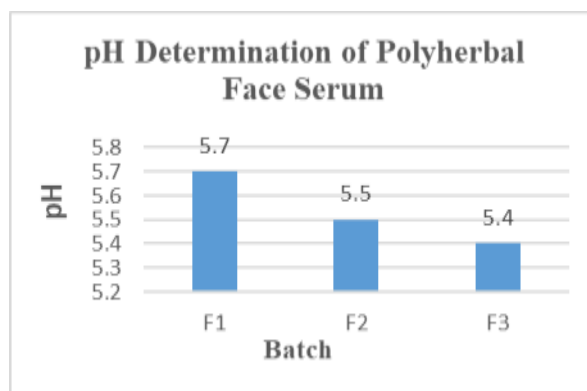
5.3 pH Determination

Table 5.3 : pH Determination

Batch	Observed pH	Interpretation
F1	5.7	Skin-compatible slightly acidic range
F2	5.5	Skin-compatible slightly acidic range
F3	5.4	Closest to optimized final batch

A slightly acidic pH is desirable for topical serums because it supports skin compatibility and preserves the effectiveness of the preservative system. The pH values of all batches remained

within a practical cosmetic range, and the optimized batch F3 demonstrated the most balanced result.



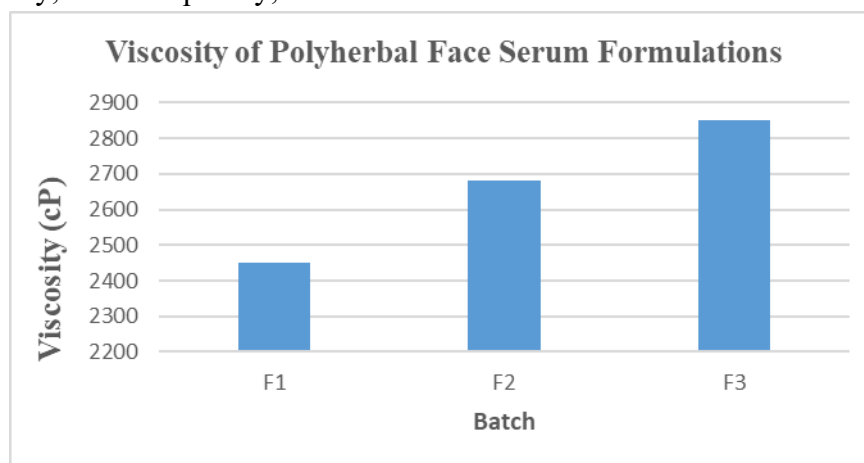
5.4 Viscosity of Face Serum Formulations

Table 5.4 : Viscosity of Face Serum Formulations

Batch	Viscosity (cP)	Comment
F1	2450 cP	Acceptable flow
F2	2680 cP	Improved consistency
F3	2850 cP	Optimum balance of flow and application

The optimized batch showed a serum-like consistency that was neither too runny nor overly thick. This is important because a face serum should spread easily, absorb quickly, and leave

minimal residue. In the present optimization, the F3 batch offered the most favorable balance between flowability and product control.



5.5 Homogeneity and irritancy

Table 5.5 : Homogeneity and irritancy

Batch	Homogeneity	Irritancy
F1	Homogeneous	Not irritant
F2	Homogeneous	Not irritant
F3	Homogeneous	Not irritant

All batches remained homogeneous and no visible phase separation or aggregate formation was noted. The irritancy assessment indicated that the formulations were well tolerated on the test area,

supporting their suitability for further cosmetic development.

5.6 Absorption Test Results

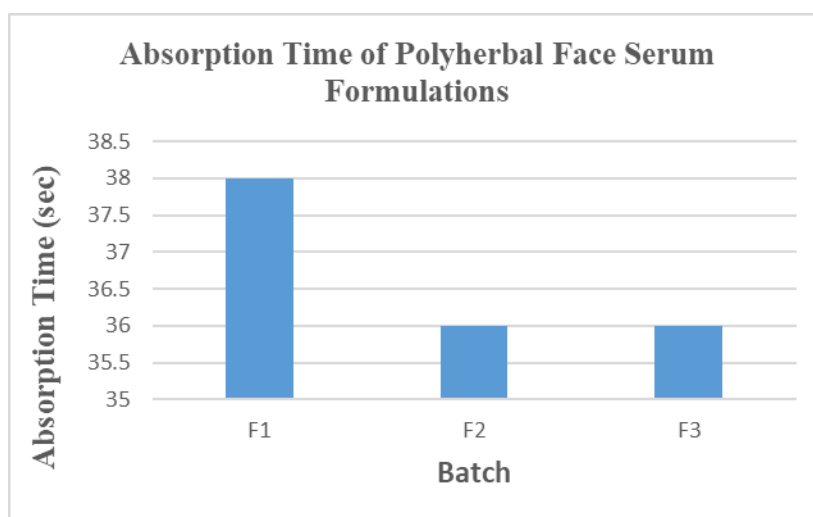
Table 5.6 : Absorption Test Results

Batch	Absorption time	Interpretation
F1	38 sec	Acceptable
F2	36 sec	Faster absorption
F3	36 sec	Optimized fast absorption

Rapid disappearance of the wet feel is a positive property for facial serums because it improves user acceptability and reduces the perception of

greasiness. The absorption profile of F2 and F3 was slightly better than F1, with F3 selected as the preferred batch.





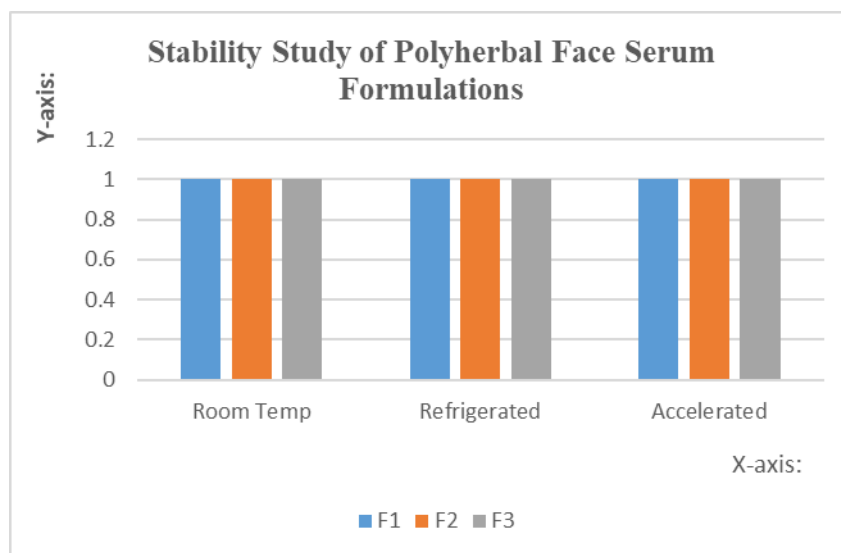
5.7 Stability study

Table 5.7 : Stability study

Batch	Room temperature	Refrigerated	Accelerated
F1	Stable, no change	Stable, no change	Stable, no change
F2	Stable, no change	Stable, no change	Stable, no change
F3	Stable, no change	Stable, no change	Stable, no change

No meaningful separation, color change, or texture collapse was observed during the short-term stability observation. This indicates that the

formulation system is sufficiently robust for preliminary storage evaluation.



5.8 Spreadability Test

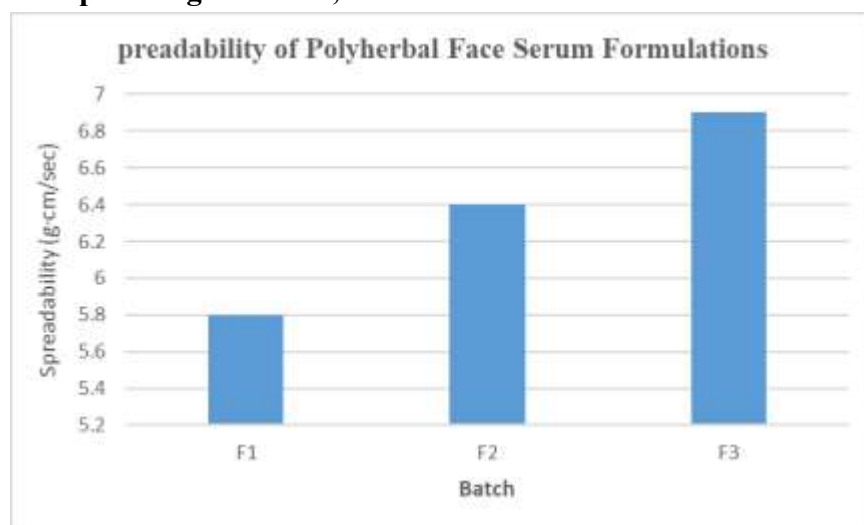
Table 5.8: Spreadability Test Results

Batch	Spreadability (g·cm/sec)	Interpretation
F1	5.8	Good spreadability
F2	6.4	Improved spreading property
F3	6.9	Excellent spreadability



Stability study was carried out for 30 days at room temperature, refrigerated condition (4°C), and accelerated condition (40°C). Spreadability is an important parameter for topical serum formulations because it influences ease of application and uniform distribution on the skin surface. All batches showed satisfactory spreadability characteristics. Batch F1 exhibited acceptable spreading behavior, while

F2 demonstrated improved application properties. Batch F3 showed the highest spreadability value, indicating better glide, smooth application, and enhanced user acceptability. The improved spreadability of F3 may be attributed to the optimized concentration of glycerin and xanthan gum in the formulation.



5.9 Overall interpretation

The data support the concept that a carefully balanced polyherbal serum can combine hydration, brightening, and antioxidant functions in one product. Turmeric, green tea, and licorice contribute to oxidative-stress control and complexion support; aloe vera and glycerin reinforce hydration; saffron adds brightening and sensory value; and papaya may provide gentle surface renewal.

From the formulation series, F3 was the most balanced batch because it combined acceptable pH, optimum viscosity, rapid absorption, full homogeneity, non-irritancy, and stable storage behavior. That profile is consistent with the intended use of a lightweight facial serum.

CONCLUSION

The present article presents a journal-style formulation and evaluation framework for a

polyherbal brightening and hydration face serum. The study design uses botanicals with complementary actions and a three-batch optimization approach to identify a stable, cosmetically acceptable serum.

On the basis of the recorded observations, the optimized batch demonstrated translucent appearance, skin-compatible pH, acceptable viscosity, rapid absorption, non-irritant behavior, and good short-term stability. These results support the feasibility of the formulation as a mild herbal cosmetic for everyday use.

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