



FORMULATION AND EVALUATION OF FACE GEL USING PERILLA FRUTESCENS AND ALOE VERA EXTRACT

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ABSTRACT

The present study aimed to formulate and evaluate a herbal face gel containing Perilla frutescens leaf extract and Aloe vera for topical application. Herbal cosmetics are increasingly preferred due to their safety, biocompatibility and therapeutic benefits. Perilla frutescens is known for its anti-ageing, antioxidant and anti-inflammatory properties, while Aloe vera exhibits moisturizing, soothing, and wound-healing effects. Four formulations (F1–F4) were prepared using a suitable gelling agent and evaluated for physicochemical and microbiological parameters. The prepared gels were assessed for appearance, pH, viscosity, spreadability, extrudability, washability, homogeneity, and microbial load. The pH values of all formulations ranged between 5.4 and 5.9 which is compatible with skin pH. Viscosity studies using a Brookfield viscometer demonstrated appropriate consistency for topical use. Spreadability and extrudability tests confirmed ease of

application and dispensing. Washability studies indicated easy removal without residue. Microbial analysis revealed that all formulations were within acceptable limits for cosmetic preparations. Among the four formulations, F4 exhibited optimal physicochemical properties and overall performance. The results suggest that the developed herbal face gel is stable, safe, and suitable for cosmetic application, with potential antioxidant and skin-protective benefits.

KEYWORDS: *Perilla frutescens*, *Aloe vera*, Herbal face gel, Anti-aging, Antioxidant activity, Anti-inflammatory activity.

I. INTRODUCTION

Skin aging is a multifactorial biological process influenced by intrinsic factors and environmental stressors such as ultraviolet radiation, oxidative stress, and inflammation. These factors accelerate degradation of collagen and elastin, leading to wrinkle formation, reduced elasticity, dryness, and uneven pigmentation. Herbal bioactives rich in antioxidants and anti-inflammatory compounds offer a promising approach to prevent and delay these changes.^[4]

Basis for Selection of *Perilla frutescens*

Perilla frutescens (Family: Lamiaceae) was selected due to its high content of rosmarinic acid, flavonoids, and polyphenolic compounds. These phytoconstituents exhibit strong antioxidant activity by scavenging reactive oxygen species and reducing oxidative stress-induced dermal damage. Additionally, *Perilla frutescens* demonstrates anti-inflammatory and antimicrobial properties, which support skin protection, reduce irritation, and contribute to maintenance of extracellular matrix integrity. Its reported ability to modulate inflammatory mediators and protect against photo-induced damage makes it a suitable candidate for anti-aging formulations.^{[01][02]}



Fig. 1: *Perilla frutescens*.

Basis for Selection of *Aloe vera*

Aloe vera (Syn. *Aloe barbadensis* Miller) was selected for its well-established moisturizing, soothing, and regenerative properties. The gel contains polysaccharides such as acemannan and glucomannan that enhance fibroblast proliferation and collagen synthesis. It also improves skin hydration by promoting moisture retention and strengthening the epidermal barrier. The anti-inflammatory and wound-healing effects of *Aloe vera* further support its role in reducing skin irritation and improving overall skin texture.^[03]



Fig. 2: Aloe vera plant.

Concept of Combined Herbal Approach

The combination of *Perilla frutescens* and Aloe vera is based on a synergistic concept targeting multiple pathways of skin aging. While *Perilla frutescens* primarily provides antioxidant and anti-inflammatory protection against environmental stressors, Aloe vera enhances hydration, tissue repair, and collagen support. Together, they address oxidative damage, inflammation, extracellular matrix degradation, and moisture loss, resulting in a comprehensive anti-aging effect.

Justification for Gel Dosage Form

A gel dosage form was selected due to its non-greasy texture, ease of application, rapid absorption, and enhanced patient compliance. Gels provide a cooling effect and are particularly suitable for herbal actives requiring uniform topical distribution. The aqueous gel base supports hydration and allows efficient incorporation of plant extracts while maintaining skin-friendly pH and stability.

Mechanism of Anti-Aging Action

The formulated herbal gel exerts anti-aging effects through multiple mechanisms:

- Neutralization of reactive oxygen species to prevent oxidative damage
- Inhibition of collagen-degrading enzymes and preservation of extracellular matrix
- Stimulation of fibroblast activity and collagen synthesis
- Reduction of inflammatory mediators
- Enhancement of skin hydration and barrier function

By targeting oxidative stress, inflammation, and collagen degradation simultaneously, the formulation provides a scientifically rational approach for delaying visible signs of skin aging.^[04]

II. MATERIALS AND METHOD

LIST OF MATERIALS USED

Perilla frutescens extract, Aloe vera extract, Carbapol 940, Propylene glycol, Iscaguard

PEG, Disodium EDTA, Triethanolamine, Glycerin, Purified water.

LIST OF APPARATUS USED

Mortar and Pestle, Beaker, Weighing Balance, Stirrer, Watch glass, Measuring cylinder.

FORMULATION

S.NO	INGREDIANTS	QUANTITY	QUANTITY	QUANTITY	QUANTITY
		F1	F2	F3	F4
1	Perilla Frutescens	1g	1g	1.5g	1.5g
2	Aloe vera	5g	5g	5g	5g
3	Carbapol 940	0.4g	0.4g	0.4g	0.4g
4	Propylene glycol	2g	2g	2g	2g
5	Iscaguard PEG	0.5g	0.5g	0.5g	0.5g
6	Disodium EDTA	0.025g	0.025g	0.025g	0.025g
7	Triethanolamine	0.1g	0.2g	0.6g	0.25g
8	Glycerin	3g	3g	3g	3g
9	Purified Water	q.s	q.s	q.s	q.s

PROCEDURE

Take Carbapol 940 and dispersed with distilled water with continuous stirring



Add Aloe vera to a gel base slowly with gentle stirring and perilla frutescens



In a separate beaker, add a disodium EDTA and dissolved in a small quantity of purified water to this solution



Add propylene glycol and iscaguard PEG and stir continuously



Pour this solution into the perilla and aloe vera gel base



Make up the volume using glycerin



Add Triethanolamine slowly to the mixture to neutralize its pH

III. Evaluation test

The prepared formulations (F1–F4) were evaluated for various physicochemical and microbiological parameters as described below.^[06]

1. Physical Appearance

The prepared gels were visually inspected for color, clarity, homogeneity, consistency, and presence of phase separation. The evaluation was performed under normal daylight conditions.^[06]

2. pH Determination

The pH of each formulation was determined using a calibrated digital pH meter. About 1 g of gel was dispersed in 10 mL of distilled water and the electrode was immersed into the dispersion. The pH was recorded at room temperature ($25 \pm 2^\circ\text{C}$). All measurements were performed in triplicate and mean values were calculated.^[06]

3. Viscosity Measurement

Viscosity of the formulations was measured using a Brookfield viscometer equipped with spindle No. 6 at $25 \pm 2^\circ\text{C}$. The spindle was immersed in the gel sample and operated at 10 rpm. The dial reading was recorded after stabilization and viscosity was calculated in centipoise (cP).^[06]

4. Spreadability Test

Spreadability was determined by the slip and drag method. A known quantity of gel was placed between two glass slides. A fixed weight was applied to obtain uniform thickness. The time required for the upper slide to move a specified distance under applied weight was recorded.^[06]

Spreadability was calculated using the formula

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

Where

S = Spreadability (g·cm/sec)

M = Weight tied to upper slide (g)

L = Length moved (cm)

T = Time taken (sec)

5. Extrudability Test

Extrudability was determined by filling the gel into collapsible tubes and applying constant pressure. The amount of gel extruded was measured and expressed as percentage extrudability.^[06]

6. Washability Test

A small amount of gel was applied on the skin and washed with water. The ease of removal was observed visually and graded accordingly.^[06]

7. Microbial Limit Test

The microbial load was determined using standard plate count method. The gel samples were diluted appropriately and plated on nutrient agar. The plates were incubated at 37°C for 24–48 hours and colony forming units (CFU/g) were counted.^[06]

IV. RESULTS

1. PHYSICAL EVALUATION

S.NO	PARAMETER	OBSERVATION			
		F1	F2	F3	F4
1	COLOUR	Light greyish white	Light greyish white	Greyish white	Light greyish-white
2	APPEARANCE	Slightly translucent gel	Translucent gel	Slightly opaque gel	Translucent to slightly opaque gel
3	ODOUR	Mild characteristic herbal odour	Mild characteristic herbal odour	Strong characteristic herbal odour	Mild Characteristic herbal odour
4	HOMOGENISITY	Smooth, uniform No lumps	Smooth and homogenous	Smooth, uniform	Smooth, no lumps or coarse particles
5	TEXTURE	Smooth, slightly watery	Smooth, on-sticky	Smooth slightly thick	Smooth, slightly foamy
6	CONSISTENCY	Semi-liquid/low viscosity	Semi-solid/moderate viscosity	Semi-solid/high viscosity	Semi-solid consistency
7	PHASE	No phase	No phase	No phase	No phase

	SEPARATION	seperation	seperation	seperation	separation
8	GRITTINESS	No gritty particles	No gritty particles	No gritty particles	No gritty particles

2. pH Determination

The pH of the formulated herbal face gels (F1–F4) was determined using a calibrated digital pH meter at 25°C.

Observed pH Values

FORMULATION	pH
F1	5.4
F2	5.6
F3	5.9
F4	5.7

3. Spreadability

OBSERVATION

FORMULATION	WEIGHT(M) (g)	LENGTH(L) (cm)	TIME (T) (sec)	SPREADABILITY (S)
F1	20	5	8	12.5 g.cm/sec
F2	20	5	7	14.2 g.cm/sec
F3	20	5	9	10.8 g.cm/sec
F4	20	5	6	15.6 g.cm/sec

4. Viscosity

Observation

FORMULATION	SPINDLE NO.	SPEED (rpm)	TEMPERATURE (°C)	DIAL READING	VISCOCITY (cP)
F1	6	10	25±2	43	21,500 cP
F2	6	10	25±2	54	26,800 cP
F3	6	10	25±2	65	32,500 cP
F4	6	10	25±2	58	28,900 cP

5. Extrudability test

OBSERVATION

Trail	Weight applied (g)	Amount Extruded (%)	Remarks
F1	500	85%	Good
F2	500	90%	Very good
F3	500	78%	Moderate
F4	500	92%	Excellent

6. Washability test

To determine the ease of removal of the prepared *Perilla frutescens* and *Aloe vera* face gel from the skin.

OBSERVATION

Formulation	Amount applied(g)	%Removed with water	Remarks
F1	1g	88%	Good
F2	1g	92%	Very good
F3	1g	85%	Good
F4	1g	95%	Excellent

7. Microbial Limit Test (MLT)

Microbial evaluation of the prepared *Perilla frutescens* and *Aloe vera* face gel was carried out as per Indian Pharmacopoeia (IP) guidelines.

Total Aerobic Microbial count (TAMC)

Formulation	Dilution	No. Of colonies	Calculated CFU/g	IP limit	Result
F1	10 ⁻¹	12	1.2 × 10 ² CFU/g	NMT 10 ³ CFU/g	Within limit
F2	10 ⁻¹	9	9.0 × 10 ¹ CFU/g	NMT 10 ³ CFU/g	Within limit
F3	10 ⁻¹	16	1.6 × 10 ² CFU/g	NMT 10 ³ CFU/g	Within limit
F4	10 ⁻¹	8	8.0 × 10 ¹ CFU/g	NMT 10 ³ CFU/g	Within limit

Overall Evaluation Table of Herbal Face Gel (F1–F4)

Parameter	F1	F2	F3	F4
Appearance	Clear	Clear	Slightly Thick	Clear
pH	5.4	5.6	5.9	5.7
Viscosity (cP)	21,500	26,800	32,500	28,900
Spreadability (g.cm/sec)	12.5	14.2	10.8	15.6
Extrudability (%)	85%	90%	78%	92%
Washability (%)	88%	92%	85%	95%
Homogeneity	Good	Good	Very good	Excellent
Microbial Load (CFU/g)	120	95	150	80

- All formulations were within acceptable limits.
- F3 showed highest viscosity but lower spreadability and extrudability.
- F4 showed optimum balance of viscosity, spreadability, extrudability, pH, and washability.
- F4 was selected as the best formulation.

V. DISCUSSION

The present study focused on the formulation and evaluation of a herbal face gel containing *Perilla frutescens* extract and *Aloe vera*. All formulations exhibited satisfactory physical characteristics with acceptable appearance, homogeneity, and absence of phase separation. The pH values (5.4–5.9) were within the normal skin pH range, indicating suitability for topical application without risk of irritation.

Viscosity studies demonstrated appropriate semisolid consistency, ensuring adequate retention on the skin. Spreadability results indicated ease of application, while extrudability and washability tests confirmed convenient dispensing and removal of the gel. The microbial load was found to be within acceptable limits, ensuring product safety and stability.

Among the formulations, F4 showed optimal balance of viscosity, spreadability, pH, and overall performance, suggesting improved user acceptability and stability compared to other batches.

VI. CONCLUSION

The developed herbal face gel containing *Perilla frutescens* and *Aloe vera* was successfully formulated and evaluated. The results confirmed that the formulation is stable, safe, and suitable for topical cosmetic application. The combination of antioxidant-rich *Perilla frutescens* and moisturizing *Aloe vera* may provide enhanced skin-protective and anti-aging benefits. Further studies, including long-term stability and in vivo evaluation, may support its potential for commercial development.

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