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Research

Formulation and Evaluation of Face Serum Using Guava Leaf Extract

Saranya M^{1*}, Sherlin Maggie F, Vijayalatchumi R.L, Avilasha S, Sangavi G, Deepa T

Department of Pharmaceutics, Shri Venkateshwara College of Pharmacy, Puducherry, India

*Author for Correspondence: Saranya M

Email: pharmsaranya@gmail.com

	Abstract
Published on: 29 Oct 2025	The present study was conducted to formulate and evaluate a herbal face serum containing Psidium guajava (guava) leaf extract, a natural source of antioxidants and antimicrobial agents. Guava leaves contain potent bioactive compounds such as flavonoids, tannins, and phenolic compounds that contribute to skin rejuvenation and protection. Ethanolic extract of guava leaves was prepared using the Soxhlet extraction method and incorporated into a biphasic oil-in-water serum. The serum was formulated using flaxseed gel, glycerine, grape seed oil, sandalwood oil, Tween 80, triethanolamine, sodium benzoate and rose water. Three formulations (F1–F3) were evaluated for their physical appearance, pH, viscosity, spreadability, microbial contamination, and stability. The optimized formulation (F2) showed a pH of 5.69, viscosity of 8.402 Pa·s, smooth texture, homogeneity and excellent spreadability. Stability studies confirmed no significant physical or chemical changes. The formulated serum exhibited good cosmetic acceptability and non-irritant properties, indicating its potential as a safe, effective, and natural skincare product.
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Keywords: Guava leaf extract, Psidium guajava, face serum, herbal cosmetics, formulation, evaluation.

1. INTRODUCTION

Skin is the body's largest organ, acting as a physical and chemical barrier against environmental pollutants, microbial invasion, and chemical exposure. Cosmetic products play a vital role in maintaining skin health and appearance. Among various cosmetic formulations, face serums have gained increasing popularity due to their high concentration of active ingredients and lightweight nature, allowing deeper penetration and faster results. Guava (*Psidium guajava* L.) a member of the Myrtaceae family, is a tropical plant known for its medicinal and cosmetic properties. Guava leaves are rich in bioactive constituents such as flavonoids, phenolic

acids, tannins, and quercetin, which possess antioxidant, anti-inflammatory, and antimicrobial properties. These compounds are beneficial in protecting the skin from oxidative stress, premature aging, and microbial infections. The present study focuses on the formulation and evaluation of a stable herbal face serum containing guava leaf extract and natural excipients to enhance its cosmetic potential.

2. MATERIALS AND METHODS

2.1 Materials

The study utilized self-prepared guava leaf extract, flaxseed gel (emollient), glycerine (humectant), sodium benzoate (preservative), grape seed oil and sandalwood oil (essential oils), Tween 80 (emulsifier), triethanolamine (surfactant), rose water and purified water (aqueous base). All ingredients used were of analytical grade.

2.2 Extraction of Guava Leaf

50g of shade-dried and powdered guava leaves were extracted using 250 mL of ethanol in a Soxhlet apparatus for 16 hours at 70°C. The obtained extract was concentrated on a water bath at 80°C to yield a semi-solid mass. The extractive yield was calculated as 12.31 g. The extract was stored in an airtight container for further formulation.

2.3 Phytochemical Screening

Preliminary phytochemical screening was performed to detect major bioactive constituents. The tests confirmed the presence of alkaloids (Dragendorff's test), tannins (Ferric chloride test), phenolic compounds (Ferric chloride and potassium ferrocyanide test), and flavonoids (Alkaline reagent test), indicating the therapeutic potential of the extract.

2.4 Preparation of Face Serum

The oil phase comprising sandalwood oil, grape seed oil, Tween 80, and triethanolamine was mixed uniformly for 10 minutes. Simultaneously, the aqueous phase containing guava leaf extract, flaxseed gel, glycerine, sodium benzoate, and rose water was prepared. The oil phase was added dropwise into the aqueous phase under continuous homogenization at 2500–4000 rpm for 30 minutes to obtain a uniform and stable oil-in-water emulsion.

2.5 Different Compositions of Formulations

Three formulations (F1–F3) were prepared by varying the concentration of guava leaf extract and triethanolamine to optimize stability, pH, and viscosity.

Ingredients	F1	F2	F3
Guava leaf extract	5%	10%	20%
Flaxseed gel	5 g	5 g	5 g
Glycerine	12.5 mL	12.5 mL	12.5 mL
Sodium benzoate	0.1 g	0.1 g	0.1 g
Grape seed oil	1 mL	1 mL	1 mL
Sandalwood oil	1 mL	1 mL	1 mL
Tween 80	1 mL	1 mL	1 mL
Triethanolamine	-	1 mL	2 mL
Rose water	q.s.	q.s.	q.s.
Purified water	q.s. to 50 mL	q.s. to 50 mL	q.s. to 50 mL

2.6 Evaluation Parameters

The formulations were evaluated for physical appearance, pH, viscosity, spreadability, microbial contamination, and stability.

1. Physical appearance / visual inspection

The prepared serum was tested for physical appearance and homogeneity by visual inspection.

2. pH Value

pH meter was calibrated using a standard buffer solution. Nearly 1 ml of the face serum was properly weighed 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 5.4-5.6.

3. Determination of Viscosity

Viscosity is a critical parameter for topical formulation. Topical solutions with low viscosity have faster clearance than viscous solutions. Viscosity was calculated using Ostwald viscometer. The Ostwald viscometer, a U-shaped glass tube with a capillary, measures the viscosity of a liquid by determining the time it takes for a fixed volume to flow through the capillary under the influence of gravity. The time taken is compared to the flow time of a reference liquid (e.g., water) with a known viscosity, allowing for the calculation of the unknown liquid's viscosity.

4. 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 incubated. 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.

5. 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.

$$\text{FORMULA } S = M \times L / T$$

Where, S= Spreadability M= Weight tide to the upper slide L= Length of glass slide T=Time taken to separate the slides.

6. Homogeneity

The formulation was tested for the homogeneity by visual inspection and touch. A good preparation should be free from clumping of particles.

7. Stability Studies

The stability studies are carried out as per ICH guidelines. Short term accelerated stability study was carried out for the period of few months for the prepared formulation at 25°C ±5 °C & RH 60%±5%.

3. RESULTS AND DISCUSSION

3.1 RESULTS

The ethanolic extraction of guava leaves produced a yield of 12.31 g (Table 1), confirming efficient recovery of phytoconstituents.

Table 1: Extractive Value of Guava Leaf

S. No	Herb	Yield Value (g)
1	Guava Leaf	12.31

Phytochemical screening revealed the presence of alkaloids, tannins, phenolic compounds, and flavonoids, confirming strong antioxidant and antimicrobial potential (Table 2).

Table 2: Phytochemical Screening of Guava Leaf Extract

S. No	Test	Reagent	Observation
1	Alkaloids	Dragendorff's reagent	+
2	Tannins	Ferric chloride reagent	+
3	Phenolic compounds	Ferric chloride + Potassium ferrocyanide	+
4	Flavonoids	Alkaline reagent	+

All formulations (F1–F3) showed green colour and pleasant odour, with F2 exhibiting the best physicochemical properties (smooth, homogeneous, pH 5.69, easily washable). The comparative evaluation is shown in Table 3.

Table 3: Physical Evaluation of Serum Formulations (F1–F3)

Formulation	Colour	Odour	Texture	pH	Homogeneity	Washability
F1	Green	Characteristic	Watery, phase separation	5.2	Very Poor	Very poorly washable
F2	Green	Characteristic	Smooth, homogeneous	5.69	Excellent	Washable
F3	Green	Characteristic	Thick, phase separation	6.1	Poor	washable

The optimized formulation (F2) exhibited ideal viscosity (8.402 Pa·s), excellent spreadability (5–6 cm), and no microbial contamination. FTIR analysis confirmed compatibility between extract and excipients. Stability testing over 4 weeks showed no significant change in colour, odour, or pH (Table 4).

Table 4: Stability Study of Optimized Formulation (F2)

Temperature	Parameter	1st Week	2nd Week	4th Week
25°C (RH 60%)	Visual appearance	Green	Green	Green
25°C (RH 60%)	Phase separation	Nil	Nil	Nil
25°C (RH 60%)	Homogeneity	Good	Good	Good

Overall, formulation F2 demonstrated optimal physicochemical stability, excellent cosmetic acceptability, and microbial safety, confirming its suitability as a natural skincare product.

3.2 DISCUSSIONS

The prepared formulations were evaluated for various parameters to ensure stability and performance. All formulations exhibited a green color with a characteristic odor and semi-liquid consistency. F2 was identified as the optimized formulation based on its superior physicochemical characteristics. The pH of the formulations ranged between 5.2 and 6.1, which is within the acceptable range for topical skin products. The optimized formulation (F2) showed a pH of 5.69, indicating good compatibility with skin pH. The viscosity of F2 was measured as 8.402 Pa·s, suggesting appropriate consistency for smooth application and easy absorption. Spreadability studies confirmed that F2 spread uniformly over the skin surface (5–6 cm range), ensuring proper dose distribution and user acceptability.

Microbial testing revealed no contamination, confirming effective preservation using sodium benzoate. Stability studies indicated no change in physical appearance, odor, or pH values after four weeks at room temperature conditions, establishing the formulation's stability. The presence of flavonoids and phenolic compounds contributed to the antioxidant and antimicrobial properties of the serum, supporting its use as a natural cosmetic preparation.

4. CONCLUSION

A stable and effective guava leaf extract-based herbal face serum was successfully formulated and evaluated. The optimized formulation (F2) demonstrated excellent pH, viscosity, spreadability, and stability profiles, along with being non-irritant and microbiologically safe. This herbal serum offers a promising, safe, and cost-effective alternative to synthetic cosmetic products. Further studies involving in-vitro antioxidant evaluation and clinical efficacy testing are recommended to validate its therapeutic potential.

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