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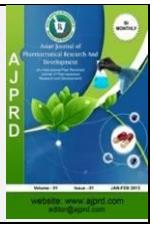

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Research Article

Formulation and Evaluation of Herbal Face Serum

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ABSTRACT

This study aimed to develop and evaluate a polyherbal face serum containing guava leaf extract for skincare applications. Nine formulations (F1–F9) were prepared using suitable herbal and cosmetic ingredients and assessed for their physicochemical properties, including appearance, homogeneity, pH, viscosity, washability, and stability.All formulations exhibited good appearance, smooth texture, and acceptable consistency. The pH value was 5.4 within the suitable range for skin application, indicating good compatibility. Washability testing showed that the formulations could be removed easily without leaving any residue on the skin.Stability studies were conducted under room temperature and freezer conditions. F9 formulation remained physically stable throughout the study period, whereas a few batches showed instability under freezer conditions. Among all the formulations, F9 was identified as the optimized batch due to its excellent homogeneity, easy washability, appropriate viscosity (1910 cp), and superior stability. No noticeable changes in colour, odour, pH, or consistency were observed in F9 during the stability study.The findings demonstrated that the developed polyherbal face serum possesses desirable quality attributes, good physical stability, and satisfactory user acceptability. Therefore, the optimized F9 formulation has potential as an effective and stable herbal skincare product for regular facial care.

KEYWORDS: Antioxidant, Face serum, acne remover, moisturizer, Penetrate, Active substance, Polyherbal

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INTRODUCTION

A. **Face serum:**

A face serum is a lightweight and fast-absorbing skincare formulation Designed to deliver a high concentration of active ingredients into the skin. In comparison To creams and lotions, serums have a thinner consistency, allowing deeper penetration and Enhanced effectiveness. They are mainly used to address specific skin concerns such as Acne, dryness, pigmentation, fine lines, and dullness[1].Face serums are commonly formulated with active components such as vitamins, Antioxidants, plant extracts, and moisturizing agents. These ingredients help nourish the skin, Improve texture, and protect against environmental stressors like pollution and ultraviolet(UV) radiation[2]. Due to their nongreasy nature, serums are suitable for various skin types, Including oily and sensitive skin. In recent years, there has been a growing preference for Herbal and natural cosmetic products because of their perceived safety and reduced side Effects. Plant-based ingredients are widely used in skincare formulations due to their Therapeutic benefits. Among these, guava leaves (*Psidium guajava*) are known for their Antimicrobial, anti-inflammatory, and antioxidant properties, which make them effective in Managing acne and promoting healthy skin[3]. Thus, herbal face serums play a significant Role in modern skincare by providing targeted treatment and improving overall skin Condition.

A quality face serum helps improve skin firmness, smoothness, and hydration. Skincare products such as serums, anti-aging creams, anti-wrinkle formulations, and moisturizers should contain antioxidants, cell-communicating ingredients, and skin-replenishing substances, as these components are essential for maintaining healthy skin. Face serums mainly exert their effects on the face and neck and are suitable for

individuals of all age groups. In the present work, a polyherbal serum was formulated using extracts of guava leaves along with glycerin, aloe vera gel, coconut oil, and rose water. The formulation was designed to provide rapid and effective skin-enhancing benefits[4].Face serums are highly concentrated formulations containing active ingredients with minimal unnecessary additives. Their lightweight texture and lack of heavy oils improve skin absorption and deeper penetration, making them highly effective for skin nourishment and easy layering. By focusing on essential ingredients and reducing the use of emulsifiers, serums ensure efficient delivery and uniform distribution of active compounds such as vitamins and herbal extracts[5].

a) Guava leaf:

Psidium guajava is a small evergreen tropical tree belonging to the family Myrtaceae and is widely distributed in India, South America, Africa, and other tropical regions. The plant is well known for its nutritional as well as medicinal value. Guava leaves are simple, opposite, oblong to oval in shape, with a characteristic aromatic odor and prominent pinnate veins[6].The extract helps reduce acne, control excess oil secretion, improve skin texture, minimize dark spots, and protect the skin from oxidative damage[7].The medicinal activity of guava leaves is mainly attributed to active constituents such as quercetin, gallic acid, catechin, and other polyphenolic compounds. Because of its therapeutic benefits and natural origin, guava leaf extract has gained significant importance in herbal and cosmetic formulations[8].

b) Phytochemistry of Psidium guajava Leaves:

There are various kinds of chemical compounds found in guava leaves according to several phytochemical studies. The primary constituents are flavonoids, tannins, phenolic compounds, terpenoids, saponins, alkaloids, glycosides, volatile oils, vitamins, and amino acids.

1. **Flavonoids (2–5%)** include quercetin, guaijaverin, avicularin, rutin, kaempferol, and myricetin.Activities include antioxidant, antibacterial, anti-inflammatory, and antidiabetic properties.
2. **Phenolic Compounds (10–18%)**Gallic acid, epicatechin, chlorogenic acid, caffeine, and ferulic acid.Contribute mostly to antioxidant and free radical scavenging actions.
3. **Tannins (8–12%)** Ellagic acid, corilagin, and Pedunculagin.Has astringent, antibacterial, and antidiarrheal effects.
4. **Terpenoids and volatile oils (0.2 to 0.8%)** β-caryophyllene, limonene, α-pinene, and β-pinene.Display antibacterial and anti-inflammatory properties.
5. **Saponins (1–3%)** It is known for its antibacterial and immunomodulatory properties.
6. **Alkaloids and glycosides (<1%)** Present in tiny concentrations and contribute to therapeutic effects.
7. **Vitamins and Amino acids** High in vitamin C (80-200 mg/100 g dried leaves) and amino acids.Provides antioxidant and skin-protective properties[9,10].

c) Pharmacological Effects of Guava Leaf:

The leaves of Psidium guajava possess several important pharmacological activities due to the presence of flavonoids, tannins, saponins, alkaloids, and essential oils.

1. **Antioxidant activity**

   Guava leaves contain flavonoids such as quercetin and vitamin C, which help neutralize free radicals and protect cells from oxidative damage.

2. **Antimicrobial activity**

   The leaf extract shows antibacterial and antifungal action against various microorganisms, helping in the treatment of skin infections and wounds.

3. **Anti-inflammatory activity**

   Guava leaves reduce inflammation by inhibiting inflammatory mediators and are useful in acne, swelling, and skin irritation.

4. **Antidiabetic activity**

   Guava leaf extract helps lower blood glucose levels by improving insulin sensitivity and reducing carbohydrate absorption.

5. **Antidiarrheal activity**

   Traditionally, guava leaves are used to treat diarrhea due to their antimicrobial and intestinal relaxing properties.

6. **Wound healing activity**

   The tannins and flavonoids present in guava leaves promote tissue repair and faster wound healing.

7. **Anti-acne activity**

   Guava leaves help reduce acne by controlling bacterial growth, excess oil production, and inflammation.

8. **Anticancer activity**

   Certain phytochemicals in guava leaves may inhibit the growth of cancer cells and prevent cellular mutation.

9. **Analgesic activity**

   Guava leaves possess mild pain-relieving properties and are used traditionally for toothache and body pain11.

d) Benefits of Guava Leaf Face Serum on Skin:

Guava leaf extract (Psidium guajava) is rich in flavonoids, tannins, phenolic compounds, and vitamin C, which

provide several beneficial effects on the skin.[12] It exhibits anti-acne, antioxidant, anti-inflammatory, and antimicrobial activities, helping to reduce pimples, control excess sebum, and protect the skin from oxidative damage[13]. The extract also promotes skin brightening, improves elasticity, reduces fine lines and wrinkles, and supports wound healing and scar reduction[14]. Additionally, its astringent properties help tighten pores and maintain a smooth skin texture, while aiding in skin hydration and overall skin health[15].

MATERIALS AND METHODS

Table 1: Materials and Methods

Sr. No.	Ingredients	Role of ingredients
1.	Guava leaf extract	Antioxidant, Antimicrobial
2.	Aloe Vera	Moisturizer,Soothing agent
3.	Methylparaben	Preservative
4.	Glycerin	Humectant,Moisturizer
5.	Almond oil	Fragrance,Antiinflammatory
6.	Coconut oil	Emollient,Nourisher
7.	Tween 20	Emulsifier
8.	Rose water	Hydrating,Face freshener,

EXTRACTION

Extraction of Guava Leaf:

Fresh guava leaves were collected and washed thoroughly with tap water to remove any dust and impurities. The leaves were then shade-dried and ground into a fine powder. The powdered material was stored in an airtight container until further use. For extraction, 25 g of the powder was placed in a conical flask and mixed with ethyl acetate. The mixture was allowed to stand for 24 hours to ensure proper extraction of the active constituents. It was then filtered using Whatman No. 1 filter paper, and the filtrate obtained was concentrated to produce the guava leaf extract. The extract was subsequently used for phytochemical screening and formulation studies.

Test of Herbal Extract:

A. Test for Carbohydrates

a. Molisch's Test
Procedure:

2 mL of extract was taken in a test tube and 2–3 drops of Molisch's reagent were added. Concentrated sulfuric acid was carefully added along the sides of the test tube.

b. Fehling's Test
Procedure:
Equal volumes of Fehling's solution A and B were mixed and added to the extract. The
mixture was heated in a water bath.

c. Benedict's Test
Procedure:
2 mL of Benedict's reagent was added to the extract and heated for 2–5 minutes.

B. Test for Alkaloids

a. Mayer's Test
Procedure:
A few drops of Mayer's reagent were added to the extract.

b. Hager's Test
Procedure:
The extract was treated with Hager's reagent (saturated picric acid solution).

c. Dragendorff's Test
Procedure:
The extract was treated with Dragendorff's reagent.

C. Test for Cardiac Glycosides

a. Keller-Killiani Test
Procedure:
The extract was treated with glacial acetic acid containing ferric chloride, followed by careful addition of concentrated sulfuric acid.

D. Test for flavonoids

a. Alkaline Reagent Test
Procedure:
A few drops of sodium hydroxide solution were added to the extract.

E. Test for saponins

a. Froth Test
Procedure:
The extract was diluted with distilled water and shaken vigorously.

b. Foam Test
Procedure:
The extract was mixed with water and shaken vigorously for several minutes.

F. Test for Steroids

a. Liebermann–Burchard Test
Procedure:
The extract was treated with acetic anhydride followed by concentrated sulfuric acid.

b. Salkowski's Test
Procedure:
The extract was mixed with chloroform and concentrated sulfuric acid.

G. Test for Tannins and Phenols

a. Gelatine Test
Procedure:
1% gelatin solution containing sodium chloride was added to the extract.

b. Dilute Nitric Acid Test
Procedure:
The extract was treated with dilute nitric acid.

Method of Preparation of Face Serum:

1. Firstly, all the required ingredients and apparatus were collected and cleaned properly to avoid contamination during the preparation process. The ingredients used for the oil phase included coconut oil, almond oil, and Tween 20, while the aqueous phase consisted of aloe vera gel, glycerin, guava leaf extract, and rose water.
2. The oil phase was prepared by taking measured quantities of coconut oil, almond oil, and Tween 20 in a clean and dry beaker. These ingredients were mixed continuously with the help of a glass rod or magnetic stirrer for about 10–15 minutes until a clear and homogeneous oily mixture was obtained.
3. Simultaneously, the aqueous phase was prepared in another beaker by mixing aloe vera gel, glycerin, guava leaf extract, and rose water. The mixture was stirred properly to ensure uniform distribution of all the ingredients and to obtain a smooth aqueous solution.
4. After the preparation of both phases, the oil phase was added slowly, drop by drop, into the aqueous phase with continuous stirring. Constant stirring was maintained to achieve proper emulsification and to prevent phase separation.
5. The resulting mixture was stirred continuously for 20–30 minutes until a smooth, uniform, and stable serum formulation was obtained. The serum was checked visually for its consistency, color, homogeneity, and absence of lumps.
6. Finally, the prepared herbal face serum was transferred into a clean, dry, and airtight container or amber-colored bottle to protect it from light and contamination. The formulation was then stored at room temperature for further evaluation and use.

Formulation Table:

Composition of F1-F9

Table 2: Formulation Table

Sr. No.	Ingredients	F1	F2	F3	F4	F5	F6	F7	F8	F9
1.	Guava leaf extract(ml)	20	20	21	22	23	24	25	25	25
2.	Aloe Vera(ml)	10	10	9	8	7	6	7	5.5	5
3.	Methylparaben (gm)	0.3	0.2	0.2	0.3	0.1	0.2	0.1	0.1	0.1
4.	Glycerin(ml)	10	11	11.5	10.5	12	10	12.5	12	12.5
5.	Almond oil(ml)	1	1	0.5	1.5	1	2	1	1	1
6.	Coconut oil(ml)	0.5	1	1	1	1.5	0.5	1	1	1
7.	Tween20(ml)	1	1	1	1	1	1	1	1	1
8.	Rose water	Qs	Qs	Qs	Qs	Qs	Qs	Qs	Qs	Qs

EVALUATION PARAMETER:

1. Physical Appearance / Visual Inspection:

The prepared serum formulation was evaluated visually for its physical appearance, colour, Clarity, consistency and homogeneity.

2. Determination of homogeneity:

The homogeneity of the herbal preparation was observed by visual appearance and by touch.

3. pH Determination:

The pH of the serum formulation was measured using a calibrated pH meter.

4. Washability:

Formulation was applied on the skin and then ease extend of washing with Water and Checked.

5. Phase Separation :

Prepared serum is kept in tightly closed container at room temperature Away from sunlight and Observed for 24 hours for phase.

6. Irritancy test:

The formulated Serum shows no redness, edema, irritation and inflammation during studies. The Formulated Serum is safe to use.

7. Stability Studies:

The development of a pharmaceutical formulation requires stability evaluation to ensure its Physical and chemical stability as well as product safety. Stability studies were conducted According to ICH guidelines. Short-term accelerated stability testing of the prepared Formulation was performed for a few months under different storage conditions, including 3–5°C, 25°C/60% RH, and 40°C ± 2°C/75% RH.

8. Viscosity Studies:

The rheological behaviour of the serum formulation was analysed using a Brookfield Viscometer at 25°C. Measurements were recorded at different rotational speeds, beginning from 10 rpm, with a 30-second interval maintained between successive speed settings in descending Order.

RESULT & DISCUSSION:

Preliminary phytochemical Screeningof Guava Extract:

Table 03: Phytochemical Screening

Sr. no.	Chemical Test	Guava leaf Extract
1	**Test For Carbohydrate**	
	a. Molisch's Test	+
	b. Fehling's Test	+
	c. Benedict's Test	+
2	**Test for Alkaloids**	
	a. Mayer's Test	-
	b. Hager's Test	-
	c. Dragendorff's Test	-
3	**Test for Cardiac Glycosides**	-
4	**Test for Flavonoids**	+
5	**Test for Saponins**	
	a. Froth Test	+
	b. Foam Test	+
6	**Test for Steroids**	
	a. Liebermann–Burchard Test	-
	b. Salkowski's Test	-
7	**Test for Tannins and Phenols**	
	a. Gelatine Test	+
	b. Dilute Nitric Acid Test	+

Evaluation of Face SerumF1 -F9

1. Physical Evaluation:

Physical appearance of prepared serum was observed visually. All batches Observed light brown serum. Organoleptic properties: The serum formulations were organoleptic Properties was shown in Table No: 5.2

Table 04: Organoleptic Properties of Serum

Batch	Colour	Odour	Consistency
F1	Light brown	Characteristics	Semi solid
F2	Light brown	Characteristics	Semi solid
F3	brown	Characteristics	Liquid
F4	Faint brown	Characteristics	Semi solid
F5	Dark brown	Characteristics	Semi solid
F6	Light brown	Characteristics	Semi solid
F7	brown	Characteristics	Semi solid
F8	Light brown	Characteristics	Semi solid
F9	Light brown	Characteristics	Semi solid

The F9 was selected as the optimized batch because it showed acceptable color, odor, semi-solid consistency, good stability, and easy application, making it suitable for further studies.

2. Determination of homogeneity:

The prepared formulation was visually examined to assess its uniformity and overall appearance.

Table 05: Determination of homogeneity

Sr.No.	Batch	Homogeneity
1.	F1	Poor
2.	F2	Good
3.	F3	Very poor
4.	F4	Poor
5.	F5	Poor
6.	F6	Good
7.	F7	Good
8.	F8	Good
9.	F9	Excellent

The F9 batch was chosen because it exhibited good homogeneity, indicating a uniform distribution of constituents without any lumps or phase separation. This suggested that the formulation was more stable, consistent, and of higher overall quality than the other batches.

3. pH of formulations:

Table 06: pH of Formulations

Sr.No.	Batch	pH
1.	F1	5.5
2.	F2	5.2
3.	F3	5.7
4.	F4	5.3
5.	F5	5.7
6.	F6	5.3
7.	F7	5.4
8.	F8	5.5
9.	F9	5.4

The F9 batch was selected because its pH (5.4) was compatible with the natural pH of the skin, indicating good skin compatibility and suitability for topical application.

Washability of Formulations:

Table 07: Washability of Formulations

Sr.No.	Batch	Wash ability
1.	F1	Poorly Washable
2.	F2	Washable
3.	F3	Very poorly Washable
4.	F4	Washable
5.	F5	Washable
6.	F6	Washable
7.	F7	Washable
8.	F8	Washable
9.	F9	Easily Washable

The F9 batch was selected because it was easy to wash off from the skin without leaving any residue. This makes the serum more comfortable to use and more acceptable to users. Therefore, F9 showed better overall performance than the other formulations.

Phase Separation:

Table 08: Phase separation of formulation

Sr. No.	Batch	Phase Separation
1.	F1	No
2.	F2	No
3.	F3	Yes
4.	F4	No
5.	F5	No
6.	F6	Yes
7.	F7	No
8.	F8	No
9.	F9	No

No phase separation was observed in the F9 batch, indicating proper mixing of ingredients and good physical stability of the formulation.

Irritancy Test:

Table 09: Irritancy test of formulations

Sr.No.	Batch	Irritant effects
1.	F1	Nil
2.	F2	Nil
3.	F3	Nil
4.	F4	Nil
5.	F5	Nil
6.	F6	Nil
7.	F7	Nil
8.	F8	Nil
9.	F9	Nil

No signs of irritation or allergic reaction were observed indicating good skin compatibility of the herbal formulation.

Stability Test:

The formulation was stored under different temperature conditions for 30 days and evaluated periodically.

Table 10: Stability test of formulations

Sr.No.	Batch	Freezer Temp.	Room Temp.
1.	F1	Stable	Stable
2.	F2	Stable	Stable
3.	F3	UnStable	Stable
4.	F4	Stable	Stable
5.	F5	Stable	Stable
6.	F6	UnStable	Stable
7.	F7	Stable	Stable
8.	F8	Stable	Stable
9.	F9	Stable	Stable

No significant changes in the colour, odour, pH, or consistency of Batch F9 were observed during the stability study period, indicating good stability of the formulation.

Viscosity studies:

Table 11: Viscosity studies of formulation

Sr.No.	Batch	Viscosity
1.	F1	1690cp
2.	F2	1940cp
3.	F3	1688 cp
4.	F4	1955cp
5.	F5	1811 cp
6.	F6	1900 cp
7.	F7	1755 cp
8.	F8	1800 cp
9.	F9	1910cp

This viscosity was suitable for a face serum as it allowed quick absorption into the skin without leaving a greasy or sticky feel. Compared to formulations with higher viscosity, F9 offered better ease of application and improved user comfort, making it more acceptable for regular use.

CONCLUSION:

The polyherbal face serum was effectively developed and analyzed. F9 was chosen as the optimal formulation from all batches due to its high homogeneity, appropriate pH, acceptable viscosity, easy washability, and great stability. There were no notable changes found throughout the stability investigation. As a result, F9 was identified as a stable, safe, and effective herbal face serum that may be applied topically.

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