WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 14, Issue 14, 828-842. Research Article ISSN 2277–7105

PREPARATION AND EVALUATION OF DIFFERENT FORMULATIONS BY USING IVY GOURD LEAF EXTRACT

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Article Received on
27 May 2025,

Revised on 16 June 2025,
Accepted on 06 July 2025,

DOI: 10.20959/wjpr202514-37594

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ABSTRACT

The present study focuses on the extraction and formulation of herbal cosmetic and therapeutic products using Coccinia grandis(ivy gourd) leaves. The leaves were subjected to Soxhlet extraction using methanol as the solvent to obtain a phytochemical-rich extract. This extract, known for its antioxidant, antimicrobial property was then incorporated into various topical formulations, including a cream, ointment and face serum. Each formulation was prepared with suitable excipients and evaluated for phytochemical tests and physicochemical parameters like colour, odour, texture, washability, spread ability, viscosity, and pH. The phytochemical screening has shown the presence of Alkaloids, flavonoids and glycosides. The physicochemical evaluation of the developed formulations has shown pale green colour, Aromatic odour, smooth texture, easy washability, good spread ability and almost neutral pH with no lumps were observed. And additionally, the antimicrobial activity of the ivy gourd extract was assessed through a Minimum Inhibitory Concentration (MIC) test against selected bacterial strain Staphylococcus. The results demonstrated significant antimicrobial potential, suggesting the extract's suitability for topical applications in skincare. This study highlights the potential of Coccinia grandis leaf extract as a natural and effective ingredient in herbal cosmetic formulations. The promising results of the evaluation tests and MIC assay supports its further development in the cosmetic and pharmaceutical industries. The use of plant-based bioactives provides a sustainable and skin-friendly alternative to synthetic ingredients.

KEYWORDS: Ivy gourd leaf, Soxhlet extraction, anti-microbial, antioxidant, Cream, Ointment, Face serum.

1. INTRODUCTION

Coccinia grandis, commonly known as Ivy gourd, belongs to the Cucurbitaceae family. It is widely distributed in several countries, including India, Bangladesh, Pakistan. And it has various medicinal uses.

The leaves of this plant are the most valued part, shaped like hearts. Phytochemical analysis has revealed the presence of several bioactive compounds, including alkaloids, flavonoids, saponins, phenols, and glycosides. These constituents contribute to the plant's wide range of pharmacological activities, such as anti-diabetic, anti-inflammatory, anti-microbial, wound healing and antioxidant effects.[1]

Fig. 1: ***Cocciniagrandis plant.***

Botanical name: Coccinia grandis

Family: Cucurbitaceae

Scientific classification[2]

- **Kingdom :** Plantae
- **Super Division :** Spermatophyta
- **Division :** Magnoliophyta
- **Class :** Magnoliopsida
- **Order :** Cucurbitales
- **Family :** Cucurbitaceae
- **Genus :** Coccinia

- **Species :** Coccinia grandis

Chemical constitutions: Leaves and stems consists of β-Sitosterol, Cephalandrol, Cephalandrine A & B, Heptacosane.

Creams: creams are thick liquids or semi-solid formulations intended for application to the skin. They are emulsions, which means they consist of a mixture of oil and water and can be classified as either oil-in-water or water-in-oil types based on their composition.

Creams serve both cosmetic and therapeutic purposes. Cosmetically, they are used for cleansing, protection, and enhancing the appearance of the skin. Therapeutically, they are employed to deliver active ingredients to the skin or mucous membranes.[3]

Ointments: Ointments are soft, semi-solid preparations applied to the skin or mucous membrane. They often contain one or more medicines that are dissolved. Mixed, or emulsified in a base. Ointments are used to protect, soften, or heal the skin, and can also serve as carriers for other medicines.[4]

Face Serum: A face serum is a highly concentrated liquid formulation, available in both water-based and oil-based forms. It typically contains up to 10 times more active ingredients than regular creams, making it more effective for treating skin issues.

Serums consist of small molecules that penetrate deeply and quickly into the skin. They are commonly used to reduce wrinkles, target specific skin issues, and enhance the skin's natural barrier.[5]

MATERIALS AND METHODS

Collection of materials

Materials used in the preparation of Cream, Ointment and Face serum are as follows:

Coocinia grandis leaf extract.

Chemicals: Cetyl alcohol,Stearic acid, Almond oil, Triethanolamine, Methyl paraben, White Bees wax, Borax,Glycerine, Liquid paraffin, Propyleneglycol, Petroleum jelly, Acacia, Vitamin E, Aloe vera, Sunflower oil, Lemon juice, Rose water, Distilled water.

Soxhlet Extraction Process[6]

A Soxhlet Extractor has a thimble to hold powdered plant material and a condenser. The thimble is placed in the extractor, and 500 ml of methanol is used as the solvent in a round-bottom flask. The setup is heated using a heating mantle, Keeping the temperature around 40°C. The methanol boils, turns into vapour, and moves up into the condenser. It then cools, turns back into liquid, and drips onto the plant material. The hot solvent dissolves useful compounds from the plant and carries them back into the flask. This cycle repeats until the extraction is complete. Finally, the solvent is evaporated to get the concentrated plant extract.

Fig. 2: Soxhlet extraction.

PRELIMINARY PHYTOCHEMICAL SCREENING

Preliminary phytochemical screening involves the testing of Methanolic extract of the plant material for the presence of various classes of phyto constituents.

Test for Alkaloids

The extract is treated with a few drops of dilute hydrochloric acid (HCL). The addition of a few drops of Dragendroff's reagent to the solution may result in the formation of a yellow precipitate, indicating the presence of alkaloids,

Test for Flavonoids

A portion of the extract is treated with concentrated hydrochloric acid (HCL). The appearance of a yellow colour, becomes colourless upon addition of a few drops of dilute ammonia solution, shows presence of flavonoids.

Test for Glycosides

The extract is treated with a few drops of Fehling's solution A and B(or) Benedict's reagent and gently heated. The formation of a brick-red precipitate indicates the presence of glycosides.

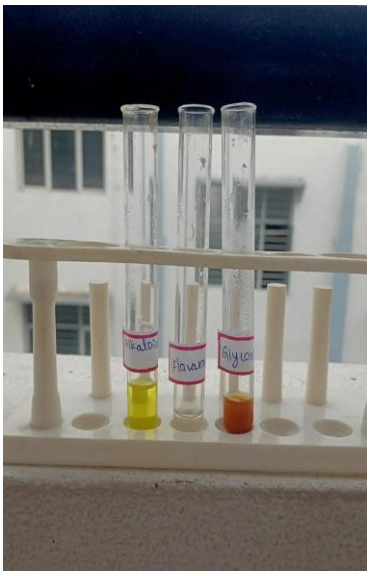

Fig.3 Phytochemical screening.

Preparation of cream

Liquid plant extract was used to make an o/w cream. Oily ingredients like stearic acid, liquid paraffin, and almond oil were melted in a beaker at 75˚c. and Remaining water-based ingredients like, water, glycerine, methyl paraben, triethanolamine, and the plant extract were heated separately to the same temperature. The water-soluble components were slowly added to the oil Phase with constant stirring to form the cream.[7]

Fig. 4: Cream.

Evaluation Tests for cream[8,9]

1. Physical Appearance: The cream was Checked for its colour, smell & over all appearance.

2. pH determination: The pH of different cream formulations was measured using digital pH meter one gram of cream was dissolved in 100ml of distilled water and left to stand for 2 hours.

Fig. 5: Digital pH meter.

3. Spreadability: This test measures how easily the cream spreads on the skin, which also affects bioavailability. Cream was placed between two glass slides, and a constant weight was applied and the time taken for the slides to separate was recorded. Spreadability(S) is calculated as: S = M x L/T

S = Spreadability (g.cm/sec)

M = weight on the upper slide(g)

L = length of the glass slide(cm)

T = Time to separate the slides (sec)

Fig. 6: Spreadability.

4. Irritability Test: A 1.sq.cm area on the back of the hand was marked and cream applied. The area was observed up to 24hours for signs of redness or swelling.

Fig. 7: Before application on the skin.

Fig.8After application on to the skin.

5. Viscosity: Viscosity of cream was measured at 100rpm at 25˚c using a Brookfield viscometer.

Fig. 9: Brookfield viscometer.

6. Phase separation: Prepared cream is kept in tightly closed container at room temperature away from sunlight and observed for 24 hours.

7. Dye Test: Scarlet red dye was mixed with the cream, and a drop was examined under a microscope. If the dispersed globules appear red and the background colourless then the cream is an oil-in-water(O/W) type.

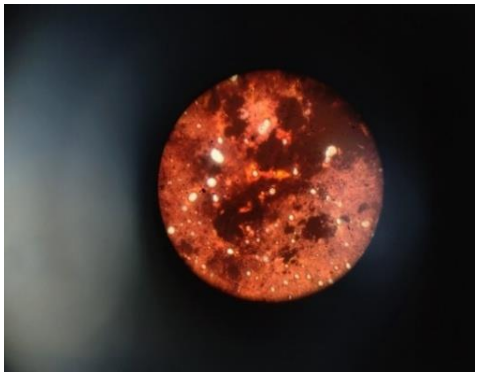

Fig. 10: Dye Test.

Table 1: Formulation of Oil-in-Water Cream.

Ingredients	Composition%			Uses
	F1(g)	F2(g)	F3(g)	
Ivy Gourd extract	0.25	0.5	0.75	Anti-bacterial
Stearic acid	5	3	3	Emulsifier
Cetyl alcohol	1	1.2	1.6	Emollient
Liquid paraffin	1	1	1	Emollient
Almond oil	2.5	2.5	2.5	Fragrance
Tri-ethanol amine	q.s	q.s	q.s	pH adjuster
Glycerine	1	1	1	Moisturizer
Methyl paraben	0.4	0.5	0.6	Preservative
Water	30	30	30	Vehicle

Preparation of ointment

For the preparation of ointment, oily ingredients such as beeswax and petroleum jelly were melted at 75°c. And Aqueous ingredients Such as stearic acid, triethanolamine, propylene glycol, and water were taken in another China dish. The water-soluble components were then added to the oil phase with constant stirring.[10]

Fig. 11: Ointment.

Evaluation Tests for ointments[11]

1.Physical Appearance: The ointment was examined for its colour, odour, and overall look.

2.pH Test: A digital pH meter was used to measure the pH of different ointment samples. One gram of ointment was mixed in 100 ml of distilled water and left to stand for 2 hours.

3.Spreadability: Ointment sample was placed between two glass slides with a constant weight applied. Spreadability was calculated using the formula.

$$S = M \times L/T$$

4.Irritability Test: A 1.sq.cm area on the back of the hand was marked, ointment was applied, and the area was observed for signs of irritation, redness, or swelling over 24 hours.

5.Solubility: This test checks how well the ointment dissolves in water, alcohol, ether and chloroform which affects absorption and effectiveness.

Fig. 12: Solubility.

6.Rancidity Test: This checks for spoilage due to fat and oil oxidation. When mixed with phloroglucinol solution, the presence of free fatty acids causes a pink colour, indicating rancidity. But no pink colour was observed.

Fig. 13: Rancidity test.

7. Viscosity: The thickness of the ointment was measured at 100rpm with 25˚c using a Brookfield viscometer.

Table 2: Formulation of Ointment.

Ingredients	Composition%			Category
	F1(g)	F2(g)	F3(g)	
Ivy Gourd extract	0.5	0.75	1.0	Anti-bacterial
Stearic acid	1.5	1.5	1.5	Emollient
Beeswax	0.2	0.2	0.2	Emulsifier
Petroleum gel	0.8	0.8	0.8	Moisturizer
Triethanolamine	0.2	0.2	0.2	pH adjuster
Propylene glycol	0.8	0.8	0.8	Humectant
Water	10	10	10	Vehicle

Preparation of Face serum

A serum was prepared using a liquid plant Extract, Oily ingredients like vitamin E, Coconut oil, and sunflower oil were placed in one beaker. Aqueous ingredients Such as aloe vera gel, rose water, acacia, methyl paraben and the plant extract were placed in another beaker. The oil phase was added dropwise to the Aqueous phase under mechanical stirring at 700 to 800rpm to form an oil-in-water(o/w) emulsion.[12]

Fig. 14: Face Serum.

Table 3: Formulation of Face Serum.

Ingredients	Composition%			
	F1(g)	F2(g)	F3(g)	Category
Ivy Gourd extract	0.5	0.75	1.0	Antioxidant
Aloe vera	7	7	7	Moisturizing
Vit-E	1	1	1	Antiaging
Sunflower oil	1	1	1	Moisturizer
Lemon juice	1	1	1	Skin brightening
Rose water	4	4	4	Toner
Acacia	1	1	1	Emulsifying agent
Methyl paraben	0.5	0.5	0.5	Preservative
Water	q.s	q.s	q.s	Vehicle

Evaluation Tests for Face serum

1. Physical Appearance: The colour and texture of the serum were checked visually and by touch to ensure even distribution of the extract.

2. pH Test: A digital pH meter was used to measure the pH. One gram of Face serum was mixed with 100ml of distilled water and left to stand for 2hours.

3. Spreadability Test: A small amount of Face serum was placed between two glass slides with a constant weight applied. Spreadability was calculated using the formula.

$$S = M \times L/T$$

4. Washability: A small amount of serum was applied to the hand and washed off with tap water to check if it was easily washable.

5. Phase separation: The Face serum was stored in a closed container at room temperature(25˚c) and away from light. After 24hours, it was checked for any phase separation.

Determination of microbial growth

Table 4: Composition of Nutrient Media.

Ingredients	Composition (gm/ml)
Agar	4gms
Peptone	1.6gms

Preparation of Nutrient Media[8]

Agar and peptone were dissolved in 20ml of distilled water, mixed well, and sterilized in an autoclave at 121˚c for 15mins, the hot liquid was poured into petri dishes and allowed to solidify.

Zone of Inhibition Test

Wells were made in the solidified agar using a borer. One gram of each prepared formulation was added to the wells containing Microorganism like Staphylococcus aureus. A marketed product was also added as a standard for comparison. The plates were incubated for 48hours after which the zone of inhibition was observed.

RESULTS

Table 5: Evaluation of Cream.

Tests	F1	F2	F3
Colour	Pale green	Olive green	Green
Odour	Aromatic	Aromatic	Aromatic
Appearance	Smooth	Smooth	Smooth
pH	4.20	4.37	5.15
Washability	Washable	Washable	Washable
Dye test	O/W	O/W	O/W
Spreadability	170.45gm/cm	208gm/cm	220.58gm/cm
Irritancy	Non-irritant	Non-irritant	Non-irritant
Viscosity	2155.7cp	2165.6cp	2175.6cp
Phase separation	Nill	Nill	Nill

Table 6: Evaluation of Ointment.

Tests	F1	F2	F3
Colour	Pale green	Olive green	Green
Odour	Aromatic	Aromatic	Aromatic
Appearance	Smooth	Smooth	Smooth
Washability	washable	washable	washable
pH	6.17	6.54	6.39
Spreadability	625gm/cm	416gm/cm	625gm/cm
Irritancy	Non-irritant	Non-irritant	Non-irritant
Viscosity	1124.2cp	1346.5cp	1346.5cp

Table 7: Evaluation of Face serum.

Tests	F1	F2	F3
Colour	Pale green	Olive green	Green
Odour	Aromatic	Aromatic	Aromatic
Consistency	Semi-liquid	Semi-liquid	Semi-liquid
pH	5.98	6.12	6.14
Washability	Washable	Washable	Washable
Irritancy	Non irritant	Non irritant	Non irritant
Phase separation	Nill	Nill	Nill

Determination of microbial studies

Coccinia grandis extract gave potent antibacterial activity against staphylococcus aureus as observed by the zone of inhibition ranges from 14mm to 16mm.

Zone of inhibition standard and prepared formulations

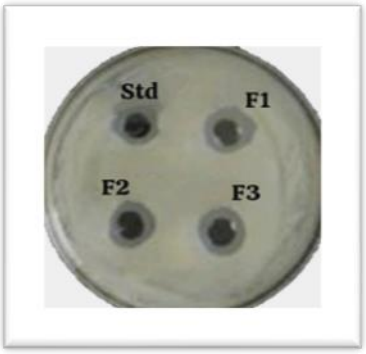

Fig. 15: Cream.

Fig. 16: Ointment.

Fig. 17: Face serum.

DISCUSSION

Ivy gourd leaves were subjected for Soxhlet extraction method, and the obtained extract is used for the preparation of Cream, Ointment and Face serum and those developed formulations were also evaluated.

Homogeneous test: All the formulations were tested for colour, odour, appearance and found to be olive green-pale green in colour, Aromatic odour with smooth texture.

pH test: All the formulations were tested for pH using pH meter and their pH was found to be near to Skin pH.

Spreadability(cm/sec): Spreadability was determined by slide and weight method and all the formulations were shown good spreadability.

Viscosity(cps): The viscosity of all the formulations were determined using Brookfield viscometer and all the formulations were shown good viscosity.

Irritancy test: All the formulations are non-irritant to the skin.

Washability: All the formulations are easily washable with water.

Anti-microbial activity: The anti-microbial activity was done with agar cup plate method against Staphylococcus and Zone of inhibition was measured which ranges from 14mm to 16mm.

CONCLUSION

This study focused on creating and testing topical products-cream, ointment, and face serum using Ivy gourd (Coccinia grandis) leaf extract. Known for its antioxidant, antibacterial The extract was successfully added to each product. The formulations were made using standard methods and tested for Physicochemical parameters such as colour, odour, and texture and for its pH, spreadability, viscosity, washability, microbial safety, and user acceptance. Results showed that all three products had good characteristics and effectively delivered the benefits of the extract. The cream worked well as a moisturizer with good absorption and feel and the ointment was effective for its activity. At last, the Face serum was also worked well.

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