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FORMULATION AND EVALUATION OF A POLYHERBAL COSMECEUTICAL CREAM CONTAINING CARICA PAPAYA, BACOPA MONNIERI, AND PSORALEA CORYLIFOLIAEXTRACTS

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ABSTRACT

The present study focuses on the formulation and evaluation of a polyherbal anti-tanning and anti-aging cream containing extracts of papaya peel, bakuchi, and brahmi. The formulation was developed to provide skin brightening, tan reduction, antioxidant protection, mild SPF activity, and improvement in overall skin appearance through the synergistic action of herbal ingredients. Active phytoconstituents such as papain, bakuchiol, and bacosides are known for their exfoliating, antioxidant, and skin-rejuvenating properties. The herbal extracts were prepared using hydroalcoholic maceration and Soxhlet extraction methods and incorporated into a suitable cream base. The formulated cream was evaluated for parameters such as organoleptic properties, pH, homogeneity, spreadability, irritancy, and stability. The formulation showed smooth texture, good spreadability, skin-friendly pH, and no signs of irritation. hus, the developed polyherbal cream may serve as a safe and effective herbal alternative for anti-tanning, anti-aging, and skin protection.

KEYWORDS: Carica papaya; Bacopa monnieri; Bakuchiol; Herbal cosmeceuticals; Antioxidant activity, UV Protectant, Anti- Ageing; Formulation and evaluation.

1. INTRODUCTION

Skin is the largest organ of the human body and acts as a protective barrier against environmental factors such as ultraviolet (UV) radiation, pollution, and microorganisms.[1] Continuous exposure to UV radiation increases melanin production, leading to skin tanning, pigmentation, premature aging, and oxidative stress, which may damage skin cells and reduce skin elasticity.[2]

Herbal cosmetic formulations are widely preferred due to their safety, biocompatibility, and fewer side effects compared to synthetic products.[3] Papain, a proteolytic enzyme found in papaya peels, aids in exfoliation, the elimination of dead skin cells, and the enhancement of skin texture and brightness.[4] Bakuchi contains bakuchiol, a natural alternative to retinol, which helps in reducing pigmentation, improving skin tone, and providing anti-aging benefits.[5] Brahmi contains bacosides that exhibit strong antioxidant activity and protect the skin from oxidative damage and premature aging.[6] The combination of these herbal ingredients provides anti-tanning, antioxidant, anti-aging, and mild sun-protective effects. Therefore, the present study aims to formulate and evaluate a polyherbal cream for skin protection and improved skin appearance.

1.1 AIM

To create and assess a polyherbal anti-aging and anti-tanning cream with extracts of Bacopa monnieri, Psoralea corylifolia, and Carica papaya.

1.2 OBJECTIVES OF WORK

- To prepare extracts of papaya peel, bakuchi, and brahmi using suitable extraction methods.
- To formulate a stable polyherbal anti-tanning and anti-aging cream using suitable excipients.
- To incorporate active phytoconstituents such as papain, bakuchiol, and bacosides for exfoliating, antioxidant, and skin-protective effects.
- To evaluate the prepared formulation for parameters such as appearance, pH, homogeneity, spreadability, irritancy, and stability.
- To assess the suitability and safety of the formulation for topical application

1.3 RATIONALE OF WORK

Herbal ingredients are widely used in cosmetic formulations due to their natural origin, safety, and therapeutic benefits. Papaya peel contains papain and phenolic compounds that help in exfoliation and improvement of skin texture. Bakuchi contains bakuchiol, which is known for its anti-aging and skin-brightening properties. Brahmi contains bacosides that provide antioxidant protection against oxidative stress caused by UV radiation and environmental pollutants.

The combination of these herbal extracts provides synergistic anti-tanning, antioxidant, anti-aging, and skin-protective effects. Therefore, the formulation may serve as a safe and effective herbal alternative for skin care applications.

PLAN OF WORK

1. **Collection of Plant Materials**

Collection of *Carica papaya*, *Psoralea corylifolia* seeds, and *Bacopa monnieri* from local market.

2. **Authentication of Herbs**

Authentication of collected plant materials from recognized authority.

3. **Drying and Powdering**

Shade drying of plant materials and grinding into fine powder.

4. **Extraction of Herbal Constituents**

Extraction of plant powders using suitable methods (Soxhlet / Maceration).

5. **Phytochemical Evaluation**

Preliminary phytochemical screening of the extract.

6. **Formulation of Polyherbal Cream**

Preparation of polyherbal cream by incorporating extracts into suitable base.

7. **Evaluation of Formulation**

Evaluation of physical, chemical, and biological parameters of formulated cream.

8. Stability Studies

Stability studies of the optimized formulation under various conditions.

9. Packaging and Storage

Packaging of final formulation and storage under suitable conditions.

Extraction of Papain from Papaya Peel

Materials Required

- Raw green papaya peel
- Phosphate buffer (pH 6.8)
- Distilled water
- Mortar and pestle or blender
- Muslin cloth
- Whatman filter paper
- Beaker
- Centrifuge Preparation of Phosphate Buffer.

Figure 1: Centrifuge Separation of Papain Enzyme.

Prepare a phosphate buffer pH 6.8 by dissolving the following

- 0.68 g potassium dihydrogen phosphate ($KH_2\ PO_4$)
- 0.89 g disodium hydrogen phosphate ($Na_2\ HPO_4$) Make up the volume to 100 mL using distilled water.

1. Collection and Washing

Fresh raw green papaya was collected and washed thoroughly with distilled water to remove dirt and impurities.

2. Preparation of Papaya Peel Powder

The outer peel was removed carefully and cut into small pieces. The peel pieces were shade-dried for several days until complete drying was achieved. The dried peel was then ground using a mixer grinder to obtain coarse powder and stored in an airtight container.

3. Preparation of Extract

The prepared papaya peel powder was mixed with phosphate buffer (pH 6.8–7.0) and blended properly to obtain a uniform mixture.

4. Filtration

The mixture was filtered through muslin cloth or filter paper to separate the liquid extract from solid residues.

5. Centrifugation

The filtrate was centrifuged at 5000 rpm for 10–15 minutes. The clear supernatant containing crude papain enzyme was collected.

6. Ammonium Sulfate Precipitation

Ammonium sulfate (NH4)2SO4(NH_4)_2SO_4(NH4)2SO4 was added slowly to the crude extract with continuous stirring until 40–80% saturation was achieved. The mixture was kept at 4°C for precipitation of papain enzyme.

7. Separation of Precipitated Papain

The mixture was centrifuged again at 5000 rpm for 10 minutes, and the precipitated papain enzyme was collected.

8. Storage

The obtained papain extract was stored at 4°C in a refrigerator for further studies and formulation work.

Extraction of Bakuchiol from Psoralea Corylifolia Seeds

Materials Needed

- Dried bakuchi seeds
- Ethanol
- Soxhlet extractor
- Thimble (cellulose or filter paper)

- Round-bottom flask
- Condenser
- Heating mantle or water bath
- Analytical balance
- Filter paper and glassware

Figure 2: Soxhlet Extraction of Bakuchiol.

1. Sample Preparation

The bakuchi seeds were dried properly and ground into coarse powder using a grinder.

2. Loading the Soxhlet

About 20–30 g of Bakuchi seed powder was weighed and placed in a thimble. The thimble was loaded into the Soxhlet chamber. The powdered material was passed through sieve no. 40.

3. Setup

The round-bottom flask was filled with 100–150 mL of ethanol. The Soxhlet apparatus was assembled properly, consisting of a round-bottom flask, a Soxhlet chamber, and a condenser. Continuous water flow through the condenser was maintained.

4. Extraction

The ethanol was heated gently using a heating mantle at 40–50 °C. The solvent vaporized, condensed, and passed through the bakuchi seed powder. The extraction process was continued for about 6–8 hours until the solvent became nearly colorless.

5. Post-Extraction

After completion of extraction, the apparatus was allowed to cool and dismantled carefully.

The obtained extract was subjected to steam distillation for removal of ethanol solvent and concentration of the extract. The concentrated crude extract obtained was stored in an airtight container in a cool and dark place for further use.

Extraction of Bacoside from Brahmi (Bacopa Monnieri) Materials Required

- Dried brahmi powder
- Ethanol
- Soxhlet extractor
- Thimble (cellulose or filter paper)
- Round-bottom flask
- Condenser
- Heating mantle or water bath
- Analytical balance
- Filter paper and glassware

Figure 3: Soxhlet Extraction of Bacoside from Brahmi.

1. Sample Preparation

The Brahmi plant material was shade-dried and ground into coarse powder using a grinder.

2. Loading the Soxhlet

About 20–30 g of brahmi powder was weighed and placed in a thimble. The thimble was loaded into the soxhlet chamber.

3. Setup

The round-bottom flask was filled with 100–150 mL of ethanol. The soxhlet apparatus was assembled properly, and water circulation through the condenser was maintained continuously.

4. Extraction

The ethanol was heated gently at 40–50 °C using a heating mantle. The solvent vaporized and condensed into the soxhlet chamber containing brahmi powder. The extraction cycles were continued for 6–8 hours until complete extraction was achieved.

5. Post-Extraction

After extraction, the apparatus was allowed to cool. The obtained extract was subjected to steam distillation for removal of ethanol solvent and concentration of the extract. The concentrated crude extract obtained was stored in an airtight container for further formulation studies.

Phytochemical Testing

Phytochemical testing was performed using standard qualitative chemical tests for the identification of various phytochemical constituents.[7, 8, 9,10,11]

1. Test for Proteins: Biuret Test

2 mL of extract was mixed with an equal quantity of biuret reagent containing sodium hydroxide and copper sulfate solution. The mixture was shaken properly and allowed to stand for a few minutes. The appearance of a violet or purple color indicated the presence of proteins.[7]

2. Test for Amino Acids: Ninhydrin Test

1–2 mL of extract was mixed with a few drops of 0.2% ninhydrin solution and heated in a boiling water bath for 1–2 minutes. Development of blue or violet coloration confirmed the presence of amino acids.[8]

3. Test for Alkaloids: Mayer's Test

1 mL of extract was treated with a few drops of Mayer's reagent (potassium mercuric iodide solution). Formation of cream-colored precipitate indicated the presence of alkaloids.[9,10]

4. Test for Phenolic Compounds: Ferric Chloride Test

1 mL of extract was mixed with 2–3 drops of 5% ferric chloride solution. Theappearance of

blue, green, or black coloration indicated the presence of phenolic compounds.[10]

5. Test for Terpenoids: Salkowski Test

2 mL of extract was mixed with chloroform, and concentrated sulfuric acid was added carefully along the side of the test tube. Formation of reddish-brown coloration at the interface confirmed the presence of terpenoids.[10,11]

6. Test for Flavonoids: Lead Acetate Test

Few drops of lead acetate solution were added to the extract. Formation of yellow precipitate indicated the presence of flavonoids.[10]

7. Test for Saponins: Foam Test

0.5 g of extract was mixed with 2 mL of distilled water and shaken vigorously for 2–3 minutes. The formation of stable persistent foam confirmed the presence of saponins.[10]

8. Test for Glycosides: Keller–Killiani Test:

1 mL of extract was treated with a few drops of ferric chloride solution, followed by careful addition of concentrated sulfuric acid along the side of the test tube. The formation of a reddish-brown ring at the interface indicated the presence of glycosides.[11]

Formulation Table

Table 1: Formulation Table.

Ingredient	F1 Quantity	F2 Quantity	Role
Papain	0.15 g	0.25 g	Exfoliant
Bacoside	0.5 g	0.75 g	Antioxidant
Bakuchiol	0.5 g	1 g	Anti-aging agent
Stearic Acid	4 g	5 g	Emulsifier
Cetyl Alcohol	2 g	3 g	Thickener
Liquid Paraffin	9 mL	11 mL	Emollient
Beeswax	1.5 g	2 g	Stiffening agent
Triethanolamine	0.5 mL	0.8 mL	Ph adjuster
Glycerin	3 mL	4 mL	Humectant
Methyl Paraben	0.15 g	0.18 g	Preservative
Propyl Paraben	0.01 g	0.02 g	Preservative
Vitamin E	0.3 mL	0.5 mL	Antioxidant
Water	78.4 mL	71.5 mL	Vehicle

- **Method of preparation**

The polyherbal cream was prepared by the emulsification method using separate oil and aqueous phases. In the oil phase, stearic acid, cetyl alcohol, beeswax, and liquid paraffin were

accurately weighed and heated at 70–75°C until completely melted. Bakuchiol, being an oil-soluble active constituent, was added to the melted mixture and mixed thoroughly. In the aqueous phase, distilled water was taken in a separate beaker, and glycerine, along with methyl paraben and propyl paraben, was added. The aqueous phase was heated to 70°C to match the temperature of the oil phase. Triethanolamine was added as a pH adjuster and emulsifying agent to maintain a suitable pH and improve the stability of the formulation.

The oil phase was then added slowly into the aqueous phase with continuous stirring while maintaining the temperature around 70°C to obtain a smooth oil-in-water (O/W) emulsion. The prepared emulsion was allowed to cool gradually. When the temperature dropped below 40°C, heat-sensitive ingredients such as bacosides (Brahmi extract), papain, vitamin E, and apple cider fragrance were added and mixed gently to ensure uniform distribution. Finally, a homogeneous polyherbal cream was obtained and stored in a suitable container for further evaluation studies.

EVALUATION TESTS FOR CREAM

1. pH Determination

The pH of the formulated cream was determined to ensure its suitability for topical application and compatibility with skin pH. About 1 g of cream was dispersed in 10 mL of distilled water, and the pH was measured using pH paper by comparing the colour obtained with the standard pH chart.[12]

2. Viscosity Determination

The viscosity of the formulated cream was determined to evaluate its consistency and flow properties. The cream sample was analyzed using a Brookfield viscometer with spindle No. 64 at controlled temperature and speed.[13,14]

3. Spreadability Test

The spreadability test was performed to evaluate the ease of application of the cream on the skin surface. A small amount of cream was placed between two glass slides, and a specified weight was applied.[15,16]

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

Where:

- S = Spreadability (g·cm/s)

- M = Weight tied on upper slide (g)
- L = Length moved by slide (cm)
- T = Time taken to separate slides (s)

4. Washability Test

The washability test was carried out to determine the ease of removal of the cream from the skin surface using water.

5. SPF Determination

The sun protection factor (SPF) of the formulated cream was determined by the UV spectrophotometric method to evaluate its photoprotective activity. The cream sample was dissolved in ethanol, and absorbance was measured at different wavelengths between 290 and 320 nm.[18]

Formula:

$$SPf = cf \times \sum_{290}^{320} EE\ (\lambda) \times I(\lambda)$$

Where:

- CF = Correction factor (10)
- EE × I = constant values
- Abs = Absorbance at each wavelength.

6. DPPH Antioxidant Assay

The antioxidant activity of the cream was evaluated using the DPPH radical scavenging assay. The cream extract was mixed with DPPH solution and incubated in dark conditions, followed by absorbance measurement at 517 nm.[19]

Preparation of DPPH solution

1. Accurately weigh 1 mg of DPPH powder.
2. Transfer it into a volumetric flask.
3. Add 25 mL ethanol and mix until complete dissolution.
4. Cover the flask with aluminum foil and keep protected from light because DPPH is light sensitive.

Preparation of sample solution

1. Accurately weigh 1 g of polyherbal cream.
2. Transfer into a beaker containing 10 mL ethanol.
3. Stir thoroughly using a magnetic stirrer for 15–20 minutes.
4. Filter using filter paper to obtain a clear extract solution.
5. Prepare sample concentrations of 0.2 mL, 0.6 mL, and 1 mL.

PROCEDURE

1. Take separate test tubes for different sample concentrations.
2. Add 0.2 mL, 0.6 mL, and 1 mL sample solutions into respective test tubes.
3. Add 3 mL freshly prepared DPPH solution to each tube.
4. Prepare a control by taking 3 mL of DPPH solution with ethanol without a sample.
5. Mix all solutions thoroughly.
6. Incubate all test tubes in dark conditions at room temperature for 30 minutes.
7. Measure absorbance at 517 nm using a UV-visible spectrophotometer.
8. Record absorbance values and calculate percentage inhibition.

CALCULATION

$$Ac - As \div Ac \times 100$$

%Inhibition= Where:

- Ac = Control absorbance
- As = Sample absorbance

7. Franz Diffusion Study

The Franz diffusion study was performed to evaluate the in vitro diffusion of active constituents from the formulated cream. The sample was placed in the donor compartment separated by a membrane, and absorbance of withdrawn samples was measured at different time intervals using a UV spectrophotometer.[24]

Preparation of Phosphate Buffer pH 7.4

1. Accurately weigh potassium dihydrogen phosphate ($KH_2 PO_4$) and dissolve in distilled water

1. Add sodium hydroxide solution gradually.
2. Adjust pH to 7.4 using a pH meter.

3. Make up the volume with distilled water.

Preparation of Membrane

1. Take a suitable membrane (egg membrane).
2 Soak the membrane in phosphate buffer pH 7.4 for 30 minutes before use.
3. This allows hydration and proper diffusion.

Preparation of Sample

1. Accurately weigh approximately 1 g of polyherbal cream.
2. Keep the sample ready for loading into the donor compartment.

PROCEDURE

1. Assemble the Franz diffusion cell apparatus properly.
2. Mount the hydrated membrane carefully between donor and receptor compartments.
3. Fill the receptor compartment with phosphate buffer pH 7.4.
4. Maintain receptor medium temperature at 37 ± 0.5°C.
5. Place the receptor compartment on a magnetic stirrer and maintain stirring at 100–150 rpm.
6. Add 1 g of cream formulation to the donor compartment.
7. Withdraw 2 mL samples at predetermined time intervals (0, 15, 30, 45, and 60 minutes).
8. Replace each withdrawn sample with an equal volume of fresh phosphate buffer to maintain sink conditions.
9. Analyze samples using a UV-visible spectrophotometer at 280 nm, 262 nm, and 210 nm.
10. Record absorbance and calculate percent drug release.

$$\%\boldsymbol{Release} = \boldsymbol{At} \div \boldsymbol{Amax} \times \mathbf{100}$$

8. Irritancy Test

The irritancy test was carried out to determine the safety of the formulation for topical application. A small quantity of cream was applied on the skin and observed for signs of redness, itching, or irritation.[27]

9. Phase Separation Study

The phase separation study was performed to evaluate the physical stability of the cream formulation during storage. The cream was observed visually for any separation of phases or

formation of layers over a specific period.[22,23]

10. Rancidity

Rancidity test: The rancidity test was performed by taking 1 g of cream in a test tube and dissolving it in 5 ml of chloroform. To this solution were added 5 drops of phloroglucinol solution and 5 drops of concentrated hydrochloric acid. The mixture was shaken slightly, and a change in color was observed.[25]

11. Stability

Short Stability Study: A stability study of the polyherbal cream was carried out by storing the formulation at different conditions such as refrigerated temperature (4 ± 2°C), room temperature (25 ± 2°C), and accelerated conditions (40 ± 2°C with 75 ± 5% relative humidity) for 7-14 days.[26]

12. Organoleptic Evaluation

Organoleptic evaluation was performed to assess the physical appearance of the cream, including color, odor, texture, consistency, and appearance.[21]

RESULTS AND DISCUSSION

The present study was carried out to formulate and evaluate a polyherbal anti-tanning and anti-aging cream containing papaya peel extract, bakuchiol extract, and brahmi extract. The formulated cream was evaluated for various physicochemical and stability parameters.

The organoleptic evaluation showed that the prepared cream possessed smooth texture, homogeneous appearance, characteristic herbal odor, and good consistency, indicating acceptable cosmetic properties. The pH of the formulation was found within the range of 5–7, which is suitable for topical application and compatible with normal skin pH.

The viscosity study using a Brookfield viscometer showed appropriate semi-solid consistency with good stability and spreadability. The spreadability test indicated that the cream spread easily on the skin surface without grittiness, providing smooth application. The washability study confirmed that the formulation was easily washable with water, indicating oil-in-water-type emulsion characteristics.

The SPF determination by the UV spectrophotometric method showed an SPF value of 10.87, indicating moderate sun protection activity. The presence of herbal antioxidants such as

bacosides and bakuchiol may contribute to photoprotective activity.

The DPPH antioxidant assay demonstrated free radical scavenging activity of the formulation, indicating antioxidant potential of the incorporated herbal extracts. Franz diffusion studies confirmed gradual diffusion of active constituents through the membrane, suggesting effective release of phytoconstituents from the cream base.

The irritancy study revealed no redness, itching, swelling, or irritation after topical application, indicating that the formulation was safe and non-irritant. The phase separation study showed no evidence of separation during the observation period, confirming good physical stability of the cream. Overall, the developed polyherbal cream exhibited satisfactory physicochemical properties, stability, antioxidant activity, moderate SPF value, and good topical acceptability.

Among the prepared formulations, F2 showed comparatively better consistency, spreadability, homogeneity, and stability.

✓ **Phytochemical test result**

Table 2: Phytochemical Test Result for Papaya Peel Extract.

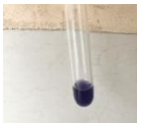
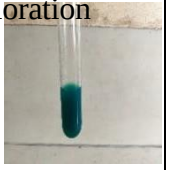
Test	Detects	Observation	Result
Biuret Test	Proteins (Papain)	Violet/purple color 	Positive
Ninhydrin Test	Amino acids	Blue color 	Positive
Mayer's Test	Alkaloids (Carpaine)	Cream-colored precipitate 	Positive

Table 3: Phytochemical Test Result for Psoralea Corylifolia Seeds.

Test	Detects	Observation	Result
Ferric Chloride Test	Phenols (Bakuchiol)	Blue, green, or black coloration 	Positive

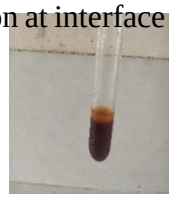
Salkowski Test	Terpenoids	Reddish-brown coloration at interface 	Positive
Lead Acetate Test	Flavonoids	Yellow precipitate formation 	positive

Table 4: Phytochemical Test Result for Bacopa Monnieri Extract.

Test	Detects	Observation	Result
Foam Test.	Saponins (Bacosides)	Persistent stable foam lasting ≥10 min 	Positive
Keller–Killiani Test	Glycosides	Reddish-brown ring at interface 	positive

✓ **Evaluation test result**

1. **pH Test Result**
2. **(Table 5) pH Test Result.**

Sample	Observed Color	Approx. pH	Nature
F1	Light green	5–6	Slightly acidic
F2	Dark green	6–7	Near neutral

Figure 3: pH Test of Formulated Cream.

3. Viscosity test result

Table 6: Viscosity Test Result.

Parameter	Observation
Series	LV Series
Spindle No.	64
Speed	10 RPM
Temperature	31.6°C
Viscosity	8,880 cP
Torque	14.8%

Figure 4: Brookfield Viscometer for Viscosity Test.

"The viscosity of the formulation was found to be 8,880 cP using a Brookfield viscometer (DV2T, LV series) with spindle 64 at 10 RPM and 31.6°C."

4. Spreadability Test Result

Table 7: Spreadability Test Result.

Trial	Weight (g)	Length (cm)	Time (sec)	Spreadability(g.cm/s)
1	20	7.5	13	11.53
2	20	7.5	11	13.63

With an average value of roughly 12.58 g·cm/s, the formulated polyherbal cream demonstrated good spreadability, indicating uniform spreading over the skin's surface and ease of application.

5. Washability test result

The formulated cream was easily removed with water and showed good washability, indicating the oil-in-water (O/W) nature of the formulation.

6. SPF test result

Table 8: SPF Test Result.

Wavelength (nm)	Abs	EE × I × Abs
290	1.3383	0.0200745
295	1.2168	0.0994126
300	1.1165	0.320882
305	1.0668	0.349697
310	1.0405	0.193949
315	1.0154	0.0851921
320	0.9837	0.0177066
		T = 1.0869138

Total = 1.0869138

Using the Mansur equation : SPF=10×1.0869138=10.87

The SPF value of the formulated cream was found to be 10.87, indicating moderate sun protection activity.

7. DPPH Antioxidant Assay Result

Table 9: DPPH Absorbance Result.

Sample	Absorbance (517.0nm)
0.2mL	1.7053
0.6 mL	1.1542
1.0mL	1.1512

RESULT TABLE

Table 10: DPPH Antioxidant Assay Result.

Sample Concentration	Absorbance	Percent Inhibition
0.2mL	1.7053	14.73
0.6 mL	1.1542	42.29
1.0mL	1.1512	42.

The formulation showed antioxidant activity due to the presence of herbal phytoconstituents such as bacosides, phenolic compounds, and papaya constituents.

7. Franz diffusion test result

Table 11: Franz Diffusion Result at 280 nm for Bacoside.

Time (min)	Absorbance at 280 nm	Percent Drug Release
0 min	0.0080	4.67
15 min	0.1420	82.90
30 min	0.1713	100
45 min	0.1480	86.40
60 min	0.1463	85.41

Table 12: Franz Diffusion Result at 262 nm for Bakuchiol.

Time (min)	Absorbance at 262 nm	Percent Drug Release
0 min	0.0014	0.58
15 min	0.2431	100
30 min	0.2422	99.63
45 min	0.2178	89.59
60 min	0.2043	84.04

Table 13: Franz Diffusion Result at 210 nm for Papain.

Time (min)	Absorbance at 210 nm	Percent Drug Release
0 min	0.1611	13.94
15 min	0.8940	77.35
30 min	1.1557	100
45 min	0.9249	80.03
60 min	0.8863	76.69

Franz diffusion study confirmed successful release and permeation of all active constituents (Bacoside, Bakuchiol, and Papain) from the polyherbal cream. Bacoside and Papain exhibited maximum release at 30 minutes, whereas Bakuchiol showed maximum release at 15 minutes. These results indicate that the developed formulation possesses favorable drug release characteristics and good permeation potential for anti-aging, anti-tanning, and UV-protective activity.

8. Irritancy Test

Table 14: Irritancy Test Result.

Parameter	Observation
Redness	Absent
Swelling	Absent
Irritation	Absent
Itching	Absent

After application no redness, swelling, or irritation was observed, indicating that the formulated polyherbal cream was non-irritant and suitable for topical use.

9. Phase separation result

Table 15: Phase Separation Result.

Sr. No	Formula	Phase sepration
1	F1	No phase sepration observed
2	F2	No phase sepration observed

10. Rancidity

No pink or red color was observed, and this confirms the absence of rancidity and indicates

that the formulation remained chemically stable.

11. Stability Test

For F1.

Table 16: Stability Study Result for F1.

Parameter	Initial	After Study
Color	Light Cream	No Change
Odor	Characteristic	No Change
pH	5.9	6.0
Homogeneity	Uniform	Uniform
Phase Separation	Absent	Absent

For F2

Table 17: Stability Study Result for F2.

Parameter	Initial	After Study
Color	Light Cream	No Change
Odor	Characteristic	No Change
pH	6.1	6.3
Homogeneity	Uniform	Uniform
Phase Separation	Absent	Absent

The formulation showed no significant change in color, odor, pH, viscosity, and phase separation, indicating good stability under storage conditions.

12. Organoleptic Evaluation Result

Table 18: Organoleptic Evaluation Result.

Parameter	Observation
Odor	Characteristic herbal odor.
Texture	Smooth and soft.
Consistency	Semi-solid.
Appearance	Homogeneous cream with good appearance.

CONCLUSION AND FUTURE SCOPE

CONCLUSION

The present work successfully formulated and evaluated a polyherbal anti-tanning and anti-aging cream containing extracts of *Carica papaya*, *Psoralea corylifolia*, and *Bacopa monnieri*. The herbal extracts were prepared using suitable extraction methods and incorporated into an oil-in-water cream base.

The prepared formulation showed satisfactory organoleptic properties, suitable pH, good spreadability, appropriate viscosity, good washability, and absence of phase separation. The

formulation also exhibited antioxidant activity and moderate SPF value, indicating protective effects against oxidative stress and UV radiation.

The irritancy study confirmed that the cream was safe and non-irritant for topical application. Thus, the developed polyherbal cream may serve as a safe, effective, and economical herbal formulation for anti-tanning, skin protection, and anti-aging applications.

FUTURE SCOPE

- Further studies can be performed for long-term stability evaluation of the formulation.
- Advanced studies such as microbial stability and skin permeation studies may be carried out.
- Clinical evaluation on human volunteers can be performed to confirm efficacy and safety.
- The formulation may be modified by incorporating additional herbal ingredients for enhanced cosmetic benefits.
- Large-scale production and commercialization studies can be explored in the future.

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