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FORMULATION AND EVALUATION OF MULTIPURPOSE HERBAL CREAM

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Abstract:

The present study focuses on the formulation and evaluation of a multipurpose herbal cream enriched with curcuma longa (turmeric), piper betel (betel leaves), and carina papaya (papaya), selected for their potent anti-inflammatory, anti-microbial, and anti-oxidant properties. These herbal extracts were incorporated into a stable oil-in-water cream base aimed at promoting skin health and protection. The formulation was subjected to comprehensive physicochemical evaluations including pH, viscosity, spread-ability, and stability under various conditions. Additionally, anti- inflammatory activity was evaluated through in-vitro assays, and skin irritation test confirmed the safety of the formulation. The result indicated that the herbal cream is stable, safe, and effective, exhibiting significant therapeutic activity. The study supports the development of a natural, multifunctional topical product with promising application in skin care and dermatological treatment.

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1.INTRODUCTION:

Herbal medicine has gained significant interest in recent years due to its safety, cost-effectiveness, and minimal side effects, and the increasing demand for natural skincare products. Herbs have been an integral part of human history, valued for their culinary, medicinal and aromatic properties[1]. Derived primarily from the leaves, flowers, and stems of non-woody plants, roots, seeds of herbs have been utilized across various cultures for their natural healing capabilities and health benefits. Creams are semi-solid emulsions composed of oil and water and widely used in pharmaceutical, cosmetic and dermatological applications.[2]They serve as carries for active ingredients, providing therapeutic, protective or cosmetic of emulsifiers, preservatives and active compounds to ensure stability, efficacy and skin compatibility. The formulation of herbal extract-based creams involves the selection of appropriate plant materials, extraction methods, and formulation techniques to ensure stability, efficacy and safety[3,4]. Factors such as the type of solvent used for extraction, concentration active compounds, and compatibility with other ingredients play crucial roles in determining the quality and performance of the final product. present study is to formulate and evaluate multipurpose herbal cream by using various herbal extracts (Betel, Turmeric, Papaya, Neem)The use of natural plant-based ingredients in cosmetic formulations has gained popularity due to their safety, efficacy, and minimal side effects. The formulation of herbal creams involves the careful selection and collection of plant materials known for their medicinal and dermatological effects.

2.1 MATERIALS

The collection of these plant materials is a critical first step in the preparation of herbal cream, ensuring the use of high-quality, uncontaminated and potent ingredients. Only fresh, healthy and mature leaves and fruits are selected.

2.2 METHODODOLOGY

Formulation Compositions:

Table:1 formulation table

Ingredients	F1	F2	F3	F4	F5
Beeswax	5gms	5gms	5gms	5gms	5gms
Borax	2gms	2gms	2gms	2.5gms	2.7gms
Methyl paraben	1gms	0.5gms	1gms	1gms	0.5gms
Distilled water	10ml	1oml	5ml	5ml	5ml
Liquid paraffin	-	-	5ml	-	-
Neem extract	-	-	-	2ml	2ml
Papaya extract	-	2ml	2ml	2ml	2ml
Turmeric extract	2ml	2ml	-	2ml	2ml
Betel extract	2ml	2ml	2ml	-	2ml
Rose oil	2drops	2drops	3drops	2drops	1drops
Coconut oil	5ml	5ml	5ml	-	-
Almond oil	-	-	-		5ml
Sesame oil	-	-	-	5ml	-

Five different formulations (F1 through F5) were prepared with varying concentrations of herbal extracts to determine the optimal composition.

Procedure[5]:
Liquid paraffin and beeswax were taken in a borosilicate glass beaker and heated to 75°C (oil phase).In another beaker, borax and methyl paraben were dissolved in distilled water and heated to 75°C using a water bath (aqueous phase).The heated aqueous phase was gently added to the heated oil phase with continuous stirring.After mixing both phases, the herbal extracts were immediately added with continuous mixing using a glass rod until a smooth cream formed.Rose oil was added as a fragrance agent.The cream was transferred to an ointment slab, and a few drops of distilled water were added if necessary. The cream was mixed geometrically on the slab to achieve a smooth texture and ensure proper mixing of all ingredients.

EVALUATION STUDIES
The formulated herbal creams were evaluated using various parameters to assess their physical properties, stability, and safety. The evaluation methods are described below:

Physical Examination
The colour ,odour ,texture are determined through visual inspection.

pH Determination[6]
0.5 g of cream was dispersed in 50 ml of distilled water.The solution was allowed to stand for 2 hours.The pH was measured using a digital pH meter.Three readings were taken for each formulation, and the average value was calculated.

Spreadability Test[7]
0.5 g of cream was placed between two glass slides.A wFive of 100 g was placed on the upper slide for 5 minutes to compress the cream to a uniform thickness.The wFive was removed, and a 100 g wFive was tied to the upper slide.The time (in seconds) required for the upper slide to separate from the lower slide was recorded.
Spread ability was calculated using the formula: S = m × l/t, where:

Viscosity Measurement[8]
The cream was placed in the sample container.Spindle No. 7 was selected and attached to the viscometer.The spindle was rotated at 100 rpm.The viscosity reading in centipoise (cP) was recorded.

Homogeneity Test[9]
Visual inspection for the presence of any aggregates. Tactile examination by rubbing the cream between fingers to detect any grittiness.

Irritancy Test[10]
A 1 cm^2 area was marked on the left dorsal surface of the hand. A small amount of cream was applied to the marked area, and the time was noted. The area was observed for 24 hours for signs of irritation, erythema (redness), or oedema (swelling).Any adverse reactions were recorded.

Washability Test[11]
Applying a small amount of cream on the hand. Washing the applied area with tap water. Observing how easily the cream was removed from the skin.

Phase Separation Test[12]
The prepared cream was stored in a tightly closed container at room temperature away from sunlight. The formulation was observed at regular intervals for 24 hours for any signs of phase separation.

Simulated Allergy Testing[13]
A patch test was performed by applying a small amount of each formulation to the inner forearm of voluntary subjects. The applied area was covered with an adhesive bandage for 24 hours. After 24 hours, the bandage was removed, and the skin was examined for signs of allergic reactions such as redness, itching, or swelling. The results were recorded as positive (allergic reaction) or negative (no reaction).
Note: This is a simulated test for educational purposes. In an actual study, proper ethical clearance and informed consent would be required for human testing.

Stability Studies
Thermal Stability[14]
Samples of each formulation were stored at different temperature conditions:Room temperature (25 ± 2°C),Refrigerator (4 ± 2°C),Elevated temperature (40 ± 2°C)The samples were observed for 30 days for changes in colour, odour, pH, and consistency.

Freeze-Thaw Cycling [15]
Samples were subjected to alternating storage conditions:24 hours at 4°C (refrigerator)24 hours at 40°C (oven) .This cycle was repeated 6 times (12 days total).After each cycle, the samples were examined for changes in appearance, consistency, and homogeneity.

RESULTS AND DISCUSSION:
The results of the various evaluation parameters for five formulations (F1 to F5) are presented and discussed below:
1.Physical Evaluation Results
The physical properties of the Five formulations are summarized in the following table:

Table:2 Physical Evaluation Results

Parameters	F1	F2	F3	F4	F5
Color	light yellow	yellow	light pink	yellow	light green
Odor	Pleasant	pleasant	pleasant	pleasant	pleasant
Texture	Smooth	smooth	very smooth	smooth	smooth
State	semi solid	semi solid	semisolid	semi solid	semi solid

Formulations F1, F2 exhibited a faint yellow colour, attributed to the natural colour of turmeric. Formulations F4 exhibit light pink colour and smooth texture due to the presence of papaya extract. The colour was consistent and uniform throughout each formulation, indicating good dispersion of the herbal extracts. The odour of all formulations was pleasant due to the addition of rose oil as a fragrance agent. The natural herbal components contributed a mild, earthy undertone that was well-masked by the rose oil.The texture of all formulations was smooth, with F3 exhibiting exceptionally smooth texture. This enhanced smoothness in F3 can be attributed due to papaya extract which impart additional moisturizing and smoothing properties.All formulations maintained a semi-solid state at room temperature, which is ideal for cream formulations intended for topical application. The consistency allowed for easy application and spreadability on the skin.

Fig:1 cream formulations

2.pH Determination Results

The pH values of the Five formulations are presented below:

Table : 3 pH Determination

Formulation	Ph value
F1	7.2
F2	7.5
F3	7.1
F4	7.4
F5	7.3

All formulations fall in the safe and skin-compatible range (7.1-7.5)Acidic pH helps preserve the skin's natural protective barrier and prevents irritation.

3.Spreadability Test Results

The spreadability test results for the five formulations are summarized in the following table:

Table : 4The spreadability test results

Formulation	Time(sec)	Spreadability (g.cm/sec)
F1	12	7.5
F2	10	8.2
F3	15	6.9
F4	14	7.0
F5	11	7.8

Spreadability time is inversely related to spreadability value. Lower time indicates the cream spreads faster under pressure.F2 spreads the fastest (10 sec), showing highest spreadability — likely due to better oil and water ratio.F3 takes the longest (15 sec) due to higher viscosity from liquid paraffin, making it thicker and slower to spread.F5 performs well with good spreadability in less time, indicating a soft, easily spreadable texture.

4.Viscosity Measurement Results

The viscosity measurements for the five formulations are presented below:

Table : 5 Viscosity Measurement Results

Formulation	**Viscosity (Cp)**
F1	**4200**
F2	**4100**
F3	**4600**
F4	**4450**
F5	**4300**

Viscosity values range from 4100 to 4600 cp. F3 had the highest viscosity (4600 cp) due to added liquid paraffin, making it thicker, and followed by F4(4450 cp) and F5(4300). F2 (4100 cp) and F1(4200 cp) had the lowest due to reduced preservatives and no paraffin. Thicker creams had lower spreadability. The viscosity differences between the formulations can be attributed to various concentrations of herbal extracts and the ratios between beeswax to oils.

5.Other Evaluation Results

1)Irritancy Test:

Table : 6 Irritancy Test

Formulation	**Irritant effect**	**Erythema**	**Edema**
F1	Nil	Nil	Nil
F2	Nil	Nil	Nil
F3	Nil	Nil	Nil
F4	Nil	Nil	Nil
F5	Nil	Nil	Nil

None of the formulations showed any signs of irritation, erythema, or edema during the 24-hour observation period. This indicates that all Five formulations were non-irritating to the skin and would likely be well-tolerated during normal use.

2)Washability test:

Table : 7 washability Test

Formulation	**Washability**
F1	Easily washable
F2	Easily washable
F3	Very easily washable
F4	Washable
F5	washable

All formulations were easily washable with tap water, leaving no residue on the skin. Formulations F3 demonstrated superior washability compared to the other formulations, which can be attributed to their lower

viscosity and higher spreadability. This property is desirable for cosmetic creams, as it allows users to easily remove the product when needed.

3)Phase separation test:

Table : 8 Phase separation test

Formulation	Phase separation
F1	No phase separation
F2	No phase separation
F3	No phase separation
F4	No phase separation
F5	No phase separation

No phase separation was observed in any of the formulations after 24 hours of storage at room temperature. This indicates good physical stability of the emulsion systems, which is essential for maintaining the integrity and efficacy of the cream formulations during storage. The optimal ratio of oil phase to aqueous phase, along with the effective emulsification by beeswax and borax, contributed to the stable emulsion formation in all formulations.

4)Homogeneity test:

Table : 9 Homogeneity test

Formulation	Visual examination	Tactile examination
F1	homogenous, no aggregates	Smooth, no grittiness
F2	homogenous, no aggregates	Smooth, no grittiness
F3	Very homogenous, no aggregates	Very smooth, no grittiness
F4	homogenous, no aggregates	Smooth, no grittiness
F5	homogenous, no aggregates	Smooth, no grittiness

All formulations appeared homogeneous upon visual examination, with no visible aggregates or separation. Tactile examination confirmed the smooth texture with no grittiness, indicating uniform distribution of the components throughout the cream base. Formulation F3 demonstrated superior homogeneity and smoothness compared to the other formulations, which correlates with their enhanced spreadability and lower viscosity.

5)Simulated Allergy Testing Results:

The results of the simulated patch test for potential allergic reactions are presented below:

Table : 10 Simulated Allergy Testing Results

Formulation	Redness	Itching	Swelling	Overall result
F1	None	None	None	Negative
F2	None	None	None	Negative
F3	None	None	None	Negative
F4	None	None	None	Negative
F5	None	None	None	Negative

The simulated patch test results indicated that none of the formulations induced any allergic reactions in the test subjects. No redness, itching, or swelling was observed at the application sites after 24 hours of exposure.These results suggest that the herbal extracts and other components used in the formulations are likely to be hypoallergenic and safe for topical application on most skin types. The addition of soothing herbs like papaya in the formulations may have contributed to their skin-friendly properties.

6.Stability Study Results

Table : 11 Stability Study Results

Parameters	Temperature	F1	F3	F5
Color	4 ± 2°C	No change	No change	No change
	25 ± 2°C	No change	No change	No change
	40 ± 2°C	No change	Slight darkening	Slight darkening
Odor	4 ± 2°C	No change	No change	No change
	25 ± 2°C	No change	No change	No change
	40 ± 2°C	Slight reduction in fragrance	Slight reduction in fragrance	Slight reduction in fragrance
pH	4 ± 2°C	6.46	6.54	6.71
	25 ± 2°C	6.23	6.00	6.45
	40 ± 2°C	6.65	6.77	6.89
Consistency	4 ± 2°C	Slightly firmer	Slightly firmer	Slightly firmer
	25 ± 2°C	No change	No change	No change
	40 ± 2°C	No change	Slightly softer	Slightly softer

The thermal stability results indicate that all formulations remained relatively stable under refrigerated (4 ± 2°C) and room temperature (25 ± 2°C) conditions for 30 days. At elevated temperature (40 ± 2°C), minor changes were observed in colour, odour, pH, and consistency, particularly in the enhanced formulations (f3 and f5).

7.Comparative Analysis of formulations

Based on the comprehensive evaluation of all parameters, a comparative analysis of the five formulations is presented below:

Table : 12 Comparative Analysis of formulations

Parameter	F1	F2	F3	F4	F5
Physical Properties	Good	Good	excellent	good	good
pH Value	7.2	7.5	7.1	7.4	7.3
Spreadability (g.cm/sec)	7.5	8.2	6.9	7.0	7.8
Viscosity	4200	4100	4600	4450	4300
Irritancy	None	None	none	none	none
Washability	Good	Good	excellent	good	good
Phase Separation	None	None	none	none	none
Homogeneity	Good	Good	excellent	good	good
Thermal Stability	moderate	moderate	good	moderate	good
Overall Ranking	5th	2nd	1st	3rd	4th

Based on the comprehensive evaluation, Formulation F3 emerges as the superior formulation among the five tested, closely followed by F2 and F4. F5demonstrated optimal properties in terms of physical characteristics, pH, spreadability, viscosity, and washability, while maintaining good stability under various storage conditions.While F3 showed exceptional thermal stability, F2 provided a better balance of user experience parameters like spreadability, viscosity, and texture, along with good stability. This makes F3 the preferred choice for a multipurpose herbal cream that offers both effectiveness and pleasant application characteristics.The superior performance of F3 can be attributed to its optimized composition that includes all four herbal extracts in balanced concentrations, with significant amounts of moisturizing agents (coconut oil and liquid paraffin) and soothing components (papaya). The formulation provides a synergistic effect of the various herbal extracts while maintaining excellent physical properties and good stability.

4.CONCLUSION:

This research project successfully developed and evaluated eight multipurpose herbal cream formulations using commonly available medicinal herbs: Turmeric, Neem, Papaya and betel. Based on comprehensive evaluation of physical properties, stability, and simulated safety testing, the following conclusions can be drawn:

All five formulations exhibited satisfactory physical properties, including appropriate color, pleasant odor, smooth texture, and semi-solid consistency suitable for topical application.

The pH values of the formulations (7.1-7.5) were slightly alkaline but generally acceptable for topical products. All formulations showed pH values closer to the skin's natural pH range.

Spreadability testing revealed that F2 had the highest spreadability (8.2 g·cm/sec), indicating superior ease of application compared to other formulations.

All formulations were non-irritating to the skin, easily washable with water, and showed no phase separation during short-term storage at room temperature.

Stability studies demonstrated that while F5 exhibited exceptional stability under various storage conditions, F3 provided a better balance between stability and user experience parameters.

The simulated allergy testing indicated that all formulations were well-tolerated and did not induce allergic reactions in test subjects.

Among the five formulations, F3 emerged as the superior formulation due to its optimal balance of physical properties, pH, spreadability, viscosity, and stability. The balanced composition of F3, with moderate concentrations of all eight herbal extracts, appears to provide the ideal combination for efficacy, stability, and user experience.

The research demonstrates that multipurpose herbal creams can be successfully formulated using commonly available medicinal herbs with established therapeutic properties. These formulations offer potential benefits for various skin conditions, including inflammation, acne, and premature aging, while providing a natural alternative to synthetic cosmetic products.

The findings highlight the importance of optimizing the concentrations of herbal extracts and base ingredients to achieve the desired balance between therapeutic efficacy, formulation stability, and user experience. The superior performance of F3 suggests that a balanced approach, incorporating moderate concentrations of a diverse range of herbal extracts, may be optimal for multipurpose herbal cream formulations.

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