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# Formulation And Evaluation Of Natural Moisturizer Prepared From *Mangifera Indica* Leaf Extract

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## ABSTRACT

The present research work was carried out to formulate and evaluate a natural herbal moisturizer prepared using *Mangifera indica* leaf extract. Mango leaves contain various bioactive phytoconstituents such as flavonoids, tannins, mangiferin, glycosides, and phenolic compounds which possess antioxidant, antimicrobial, anti-inflammatory, and skin-protective properties beneficial for skincare applications. The mango leaves were collected, shade dried, powdered, and extracted using the Soxhlet extraction method with methanol as solvent. The obtained extract was subjected to preliminary phytochemical screening which confirmed the presence of important active constituents. Three batches of herbal moisturizer formulations were prepared using different concentrations of mango leaf extract along with suitable excipients by using the oil-in-water emulsion method. The prepared formulations were evaluated for various physicochemical parameters including organoleptic properties, pH, spreadability, viscosity, homogeneity, centrifugation test, dye test, irritancy test, mechanical vibration test, and microbial stability. The evaluation results revealed that all formulations showed good appearance, smooth texture, suitable pH, satisfactory spreadability, acceptable stability, and no signs of irritation. Among all formulations, batch F2 showed superior consistency, optimum spreadability, desirable viscosity, enhanced stability, and overall better performance compared to other batches. The study concluded that *Mangifera indica* leaf extract can be effectively utilized in the preparation of herbal moisturizers and may serve as a safe and natural alternative to synthetic skincare products, with F2 identified as the optimized formulation due to its superior physicochemical characteristics and stability profile.

**KEYWORDS:** *Mangifera indica* Leaf Extract, Herbal Moisturizer, Phytocosmeceuticals, Skin Hydration, Antioxidant Activity.

# 1. INTRODUCTION

## 1.1 Introduction to Skin

Skin is the largest organ of the human body and acts as a protective barrier against microorganisms, pollutants, chemicals, and ultraviolet radiation. It also performs important functions such as temperature regulation, prevention of water loss, sensory perception, and maintenance of body homeostasis. Exposure to environmental factors, stress, and synthetic products can lead to dryness, irritation, and premature aging; therefore, maintaining proper skin hydration is essential. [1]

## 1.2 Moisturizers and Their Importance

Moisturizers are topical formulations used to hydrate the skin, prevent moisture loss, and maintain skin softness and elasticity. They help restore the skin barrier and improve skin texture. [2]

## 1.3 Limitations of Synthetic Moisturizers

Synthetic moisturizers often contain ingredients such as parabens, mineral oils, and artificial additives that may cause irritation, allergies, and skin sensitivity after prolonged use. This has increased the demand for herbal formulations. [3]

## 1.4 Herbal Cosmetics

Herbal cosmetics are products prepared from plant-derived ingredients containing phytoconstituents such as flavonoids, tannins, glycosides, and phenolic compounds. These compounds possess antioxidant, antimicrobial, anti-inflammatory, and moisturizing properties with fewer side effects.[4]

## 1.5 Introduction to *Mangifera indica*

*Mangifera indica* (mango) belongs to the family Anacardiaceae and is widely used for medicinal purposes. Mango leaves contain bioactive compounds such as mangiferin, flavonoids, tannins, and polyphenols with therapeutic and cosmetic benefits. [5]

## 1.6 Benefits of Mango Leaves in Skin Care

Mango leaves possess antioxidant, anti-inflammatory, antimicrobial, and skin-protective properties. These activities help reduce skin irritation, protect against free radical damage, and improve skin nourishment and hydration. [6]

## 1.7 Formulation of Herbal Moisturizer

Formulation of a herbal moisturizer requires suitable ingredients to produce a stable and effective product with good consistency, texture, and spreadability. Mango leaf extract may provide additional moisturizing and skin-protective effects. [7]

## 1.8 Evaluation of Moisturizer

Evaluation studies are performed to determine the quality, stability, safety, and effectiveness of the formulation using different physicochemical parameters. [8]

**Table 1: Important Phytoconstituents Present in Mango Leaves and Their Activities [10]**

| Sr. No. | Phytoconstituent | Biological Activity | Importance in Skin Care |
|---|---|---|---|
| 1 | Mangiferin | Antioxidant | Protects skin from free radical damage |
| 2 | Flavonoids | Anti-inflammatory | Reduces skin irritation and redness |
| 3 | Tannins | Antimicrobial | Prevents microbial growth on skin |
| 4 | Polyphenols | Skin protective activity | Improves skin health and elasticity |
| 5 | Vitamins | Nourishing activity | Provides nourishment and hydration |
| 6 | Terpenoids | Healing activity | Supports skin repair and protection |

## 2. Materials and Method

### 2.1. Plant Profile

#### a. Biological Source

The plant selected for the present research work is *Mangifera indica* commonly known as Mango. The leaves of the plant were used for the preparation of herbal moisturizer. [11]

Fig 1 Picture of Mangifera indica Leaves

#### b. Taxonomical Classification [12]

The plant *Mangifera indica* belongs to Kingdom Plantae, Division Magnoliophyta, Class Magnoliopsida, and Order Sapindales. It is a member of the family Anacardiaceae, with Mangifera as the genus and *Mangifera indica* as the species.

#### c. Common Names

*Mangifera indica* is commonly known as Mango in English, Aam in Hindi, Amba in Marathi, and Amra in Sanskrit. [13]

#### d. Geographical Source

*Mangifera indica* is widely cultivated throughout India and other tropical and subtropical regions. The plant is commonly found in Maharashtra, Gujarat, Uttar Pradesh, Karnataka, and Andhra Pradesh. [14]

#### e. Morphological Characteristics

Mango is a large evergreen tree with dense foliage and broad canopy. The leaves are simple, lanceolate, dark green, leathery, and arranged alternately. Young leaves appear reddish or copper-colored and become dark green on maturity. The leaves contain various phytoconstituents responsible for medicinal and cosmetic activities. [15]

**Table: Chemical Constituents of Mango Leaves**

| Sr. No. | Constituent | Activity |
|---|---|---|
| 1 | Mangiferin | Antioxidant, anti-inflammatory, antimicrobial |
| 2 | Flavonoids | Antioxidant, anti-aging |
| 3 | Tannins | Astringent, antimicrobial |
| 4 | Polyphenols | Antioxidant, skin protective |
| 5 | Terpenoids | Anti-inflammatory, skin repair |
| 6 | Saponins | Cleansing, moisturizing |
| 7 | Alkaloids | Antioxidant, antimicrobial |
| 8 | Glycosides | Antioxidant, anti-inflammatory |

**Table: Uses of Mango Leaves**

| Sr. No. | Uses | Function |
|---|---|---|
| 1 | Antioxidant activity | Protects against oxidative damage |
| 2 | Antimicrobial activity | Prevents microbial growth |
| 3 | Anti-inflammatory activity | Reduces irritation and redness |
| 4 | Wound healing property | Promotes tissue repair |

## 2.2 Methods

### 2.2.1 Collection of Plant Material

Fresh leaves of *Mangifera indica* were collected from the local area of Sangli, Maharashtra. Healthy and disease-free leaves were selected for the study. The collected leaves were washed thoroughly with distilled water to remove dust, dirt, and other impurities. [21]

### 2.2.2 Authentication of Plant Material

The collected plant material was authenticated by a qualified botanist at Yashwantrao Chavan Warana Mahavidyalaya, Warananagar to confirm the identity of the plant species. After authentication, the leaves were used for further experimental work.

### 2.2.3 Drying and Powdering of Leaves

The washed mango leaves were shade dried at room temperature for about 7–10 days to avoid degradation of heat-sensitive phytoconstituents. The dried leaves were then powdered using a mechanical grinder. The powdered material was passed through sieve no. 40 to obtain uniform particle size and stored in an airtight container for further use. [22]

### 2.2.4 Preparation of Mango Leaf Extract

**Method: Soxhlet Extraction Method**

The extraction of phytoconstituents from *Mangifera indica* leaves was carried out using the Soxhlet extraction method with methanol as the solvent. [23]

**Procedure**

Fresh mango leaves were collected, washed with distilled water, and shade dried for about 7–10 days. The dried leaves were powdered using a mechanical grinder and passed through sieve no. 40 to obtain uniform powder.

About 25.5 g of dried mango leaf powder was accurately weighed and packed in a filter paper thimble. The thimble was placed inside the Soxhlet extraction chamber. A round bottom flask containing 300 mL of methanol was attached to the Soxhlet apparatus. [24]

The extraction was carried out continuously for 48 hours using a heating mantle. During extraction, methanol was heated and converted into vapors, which condensed in the condenser and passed through the powdered plant material. The solvent dissolved the active phytoconstituents present in the leaves and collected back into the round bottom flask through the siphon tube. This process continued repeatedly until complete extraction was achieved.

After completion, the methanolic extract was filtered using filter paper to remove plant particles. The solvent was then evaporated using a rotary evaporator to obtain a concentrated extract. The concentrated extract was dried to obtain a semisolid mass and stored in an airtight container under refrigerated conditions for further studies. [25]

Fig. 3 Extraction process

### 2.2.5 Preliminary Phytochemical Screening

The prepared mango leaf extract was subjected to preliminary phytochemical screening for identification of active phytoconstituents such as alkaloids, flavonoids, tannins, glycosides, saponins, and phenolic compounds using standard chemical tests. [26]

### 2.2.6 Formulation of Herbal Moisturizer

The herbal moisturizer was prepared by using the oil-in-water emulsion method.

Table 3. Composition of Herbal Moisturizer Formulations (F1, F2, and F3)

| Ingredients | F1 | F2 | F3 |
|---|---|---|---|
| **Oil Phase** | | | |
| Stearic acid | 1.0 gm | 1.0 gm | 1.0 gm |
| Cetyl alcohol | 0.5 gm | 0.5 gm | 0.5 gm |
| Glycine monostearate | 0.75 gm | 0.75 gm | 0.75 gm |
| Beeswax | 0.4 gm | 0.4 gm | 0.4 gm |
| Liquid paraffin | 2 ml | 2 ml | 2 ml |
| **Water Phase** | | | |
| Mango extract | 1 gm | 2 gm | 3 gm |
| Glycerine | 1 ml | 1 ml | 1 ml |
| Propylene glycol | 1 ml | 1 ml | 1 ml |
| Triethanolamine | 0.5 ml | 0.5 ml | 0.5 ml |
| Propyl paraben | 0.01 gm | 0.017 gm | 0.017 gm |
| Methyl paraben | 0.05 gm | 0.075 gm | 0.075 gm |
| Niacinamide | 1 gm | 1.25 gm | 1.50 gm (6%) |
| Kojic acid | 0.25 gm | 0.5 gm | 1 gm (4%) |
| Vitamin C | 1.25 gm | 2.5 gm | 3 gm (12%) |

### 2.2.7 Method of Preparation of Herbal Moisturizer

The herbal moisturizer containing Mangifera indica leaf extract was prepared by using the oil-in-water emulsion method. The formulation batches F1, F2, and F3 were prepared by varying the concentration of mango extract while keeping the remaining ingredients constant. [27]

**Procedure**

**Step 1: Preparation of Oil Phase**

Accurately weighed quantities of stearic acid, cetyl alcohol, glycine monostearate, beeswax, and liquid paraffin were transferred into a clean dry beaker. The contents were heated on a water bath at a temperature

of about 70–75°C with continuous stirring until all ingredients melted completely and a uniform oily phase was obtained.

**Step 2: Preparation of Aqueous Phase**

In another beaker, measured quantities of mango leaf extract, glycerine, propylene glycol, triethanolamine, propyl paraben, methyl paraben, niacinamide, kojic acid, and vitamin C were dissolved in a suitable quantity of distilled water. The aqueous phase was heated separately at the same temperature of 70–75°C with continuous stirring to obtain a clear and uniform solution. [28]

**Step 3: Emulsification**

The hot aqueous phase was slowly added into the oil phase with continuous stirring. Stirring was continued continuously using a mechanical stirrer until a smooth and uniform emulsion was formed. Proper mixing was maintained to obtain good consistency and homogeneity of the cream.

**Step 4: Cooling of Formulation**

After complete emulsification, the prepared cream was allowed to cool gradually at room temperature with continuous gentle stirring. Continuous stirring during cooling prevented phase separation and helped in obtaining a smooth texture. [29]

**Step 5: Filling and Storage**

The prepared herbal moisturizer formulations (F1, F2, and F3) were transferred into clean, dry, airtight containers and properly labeled. The formulations were stored at room temperature for further evaluation studies.


Fig. 4 Herbal Formulation of Moisturizer

**5.2.8 Evaluation of Herbal Moisturizer**

**A. Determination of pH**

The pH of the prepared herbal moisturizer was determined using a digital pH meter. About 1 g of the formulation was accurately weighed and dispersed in 100 mL of distilled water in a beaker. The dispersion was allowed to stand for about 2 hours at room temperature to obtain uniform mixing. Before measurement, the pH meter was calibrated using standard buffer solutions. The electrode of the pH meter was immersed into the cream dispersion and the pH value was recorded. The determination of pH is important to ensure compatibility of the formulation with the skin and to avoid skin irritation during application. [30]

**B. Organoleptic Properties**

The prepared moisturizer was evaluated for organoleptic characteristics by visual inspection and touch. The parameters observed included color, odor, appearance, texture, smoothness, consistency, and feel upon application. The formulation was checked for any signs of grittiness, phase separation, or unpleasant

odor. Organoleptic evaluation helps determine the overall acceptability and aesthetic quality of the formulation. [31]

**C. Centrifugation Test**

The centrifugation test was carried out to evaluate the physical stability of the prepared moisturizer. A definite quantity of formulation was transferred into centrifuge tubes and subjected to centrifugation at 3000 rpm for 30 minutes using a centrifuge machine. After centrifugation, the formulation was visually examined for any signs of phase separation, creaming, cracking, or sedimentation. This test helps determine the stability of the emulsion system during storage and handling. [32]

**D. Mechanical Vibration Test**

The mechanical vibration test was performed to study the physical stability of the formulation under mechanical stress conditions. The prepared moisturizer was placed on a mechanical shaker or vibration apparatus and subjected to continuous vibration for a specified period of time. After completion of the test, the formulation was examined for changes in consistency, texture, homogeneity, or phase separation. This study indicates the ability of the formulation to withstand transportation and handling conditions. [33]

**E. Spreadability**

Spreadability of the herbal moisturizer was evaluated to determine the ease of application on the skin surface. A small quantity of cream was placed between two clean glass slides. A suitable weight was placed over the upper slide to form a thin uniform film of cream between the slides. The upper slide was then allowed to move under the influence of weight and the time required for movement was noted. The spreadability study indicates the extent to which the formulation spreads easily on the skin and provides uniform application. [34]

**F. Saponification Value**

The saponification value of the formulation was determined to evaluate the amount of free and combined fatty acids present in the formulation. About 1 g of moisturizer was accurately weighed and refluxed with alcoholic potassium hydroxide solution for about 30 minutes. After completion of refluxing, the excess alkali was titrated against standard hydrochloric acid solution using phenolphthalein as an indicator. The endpoint was observed by disappearance of pink color. The saponification value helps determine the quality and purity of fats and oils used in the formulation. [35]

**G. Density Determination**

Density determination was carried out to evaluate the compactness and consistency of the prepared moisturizer. A clean and dry measuring cylinder was weighed accurately. A known volume of formulation was transferred into the cylinder and weighed again. The density of the formulation was then determined based on the mass and volume of the sample. Density determination is useful for maintaining batch uniformity and product consistency. [36]

**H. Acid Value**

The acid value of the prepared moisturizer was determined to evaluate the presence of free fatty acids in the formulation. Accurately weighed cream sample was dissolved in a mixture of ethanol and ether. The prepared solution was titrated against standard potassium hydroxide solution using phenolphthalein as indicator until a pale pink color persisted. Acid value determination is important for assessing the quality, purity, and stability of the formulation. [37]

**I. Viscosity**

The viscosity of the herbal moisturizer was measured using a Brookfield viscometer at room temperature. The cream sample was placed in the sample container and appropriate spindle was immersed in the formulation. The instrument was operated at suitable rotational speed and the viscosity readings were

recorded. Viscosity measurement is essential to determine the flow property, consistency, and ease of application of the formulation. [38]

### J. Homogeneity

Homogeneity of the prepared moisturizer was evaluated by visual inspection and touch. A small quantity of cream was pressed between the thumb and index finger to check for uniformity and presence of coarse particles. The formulation was also visually examined for phase separation and lumps. A homogeneous cream should possess smooth texture and uniform appearance throughout the formulation. [39]

### K. Dye Test

The dye test was carried out to determine the type of emulsion present in the moisturizer formulation. A small quantity of water-soluble dye was mixed with the cream on a glass slide and observed under a microscope. If the dye was uniformly dispersed throughout the external phase, it indicated an oil-in-water type emulsion. The dye test helps identify the emulsion system of the prepared formulation. [40]

### L. Type of Smear

The type of smear produced by the formulation was evaluated by applying a small quantity of cream on the skin surface. The cream was gently spread and observed for smoothness, greasiness, and ease of application. The nature of the smear formed after application indicates the cosmetic acceptability and feel of the formulation during use. [41]

### M. Irritancy Test

The irritancy test was carried out to determine the safety of the prepared moisturizer for topical application. A small quantity of formulation was applied on the dorsal surface of the skin and left for 24 hours. The application site was observed for signs of redness, itching, swelling, irritation, or inflammation. The study helps evaluate skin compatibility and safety of the herbal moisturizer. [42]

### N. Microbial Stability Test

The microbial stability study was performed to evaluate resistance of the formulation against microbial contamination during storage. The prepared moisturizer was stored in suitable airtight containers under different storage conditions. Samples were periodically examined for changes in color, odor, texture, fungal growth, and microbial contamination using standard microbiological procedures. The microbial stability study ensures the safety and shelf life of the prepared formulation. [43]

## 3 RESULTS AND DISCUSSION

### 3.1 Phytochemical Screening

The preliminary phytochemical screening of the methanolic extract of Mangifera indica leaves revealed the presence of various bioactive phytoconstituents such as flavonoids, tannins, alkaloids, glycosides, saponins, and phenolic compounds. These phytoconstituents are responsible for antioxidant, antimicrobial, anti-inflammatory, and skin-protective activities which are beneficial in herbal cosmetic formulations.

Table 4 Results of Preliminary Phytochemical Screening

| Sr. No. | Phytoconstituent | Observation |
|---|---|---|
| 1 | Alkaloids | Present |
| 2 | Flavonoids | Present |
| 3 | Tannins | Present |
| 4 | Glycosides | Present |
| 5 | Saponins | Present |
| 6 | Phenolic compounds | Present |

**Discussion**

The presence of flavonoids and phenolic compounds indicates strong antioxidant potential of mango leaf extract which helps protect the skin from oxidative damage caused by free radicals. Tannins and glycosides contribute to antimicrobial and skin protective activities, while saponins improve cleansing and moisturizing properties. Therefore, the phytochemical screening confirmed the suitability of mango leaf extract for preparation of herbal moisturizer.

### 3.2 Evaluation of Herbal Moisturizer

Three formulation batches namely F1, F2, and F3 were prepared using different concentrations of mango leaf extract. All formulations were evaluated for physicochemical parameters such as appearance, pH, homogeneity, spreadability, viscosity, stability, irritancy, and microbial stability.

### 3.2.1 Organoleptic Evaluation

All prepared formulations were visually examined for color, odor, appearance, texture, and consistency.

Table 5 Organoleptic Evaluation of Herbal Moisturizer

| Parameter | F1 | F2 | F3 |
|---|---|---|---|
| Color | Light cream | Creamish green | Pale green |
| Odor | Pleasant | Pleasant | Pleasant |
| Appearance | Smooth | Smooth and uniform | Smooth |
| Texture | Soft | Soft and silky | Soft |
| Consistency | Good | Excellent | Good |

**Discussion:**
All formulations showed smooth texture and pleasant odor without any grittiness or phase separation. Among all batches, F2 exhibited superior texture, uniformity, and consumer acceptability due to optimized concentration of mango leaf extract and balanced excipients.

### 3.2.2 pH Determination


Fig. 5 pH determination

Table 6. pH of Formulations

| Formulation | pH |
|---|---|
| F1 | 5.68 |
| F2 | 5.59 |
| F3 | 5.56 |

**Discussion:**
All formulations were within the normal skin pH range (4.5–6.0), indicating suitability for topical application. F2 showed the most ideal skin-compatible pH, minimizing irritation risk and enhancing dermatological acceptability.

### 3.2.3 Spreadability Study

Table 7. Spreadability of Formulations

| Formulation | Spreadability (cm/sec) |
|---|---|
| F1 | 2.10 |
| F2 | 2.65 |
| F3 | 2.49 |

Fig. 6 Spreadability

**Discussion:**
Spreadability results indicated that all formulations were easy to apply. F2 exhibited the highest spreadability (2.65 cm/sec), indicating optimal viscosity and excellent uniform distribution over the skin surface.

### 3.2.4 Homogeneity Test

Table 8. Homogeneity

| Formulation | Observation |
|---|---|
| F1 | Homogeneous |
| F2 | Highly homogeneous |
| F3 | Homogeneous |

**Discussion:**
No lumps or phase separation were observed. F2 showed superior homogeneity and smooth dispersion of active ingredients, ensuring uniform therapeutic effect.

### 3.2.5 Viscosity

**Table 9. Viscosity of Formulations**

| Formulation | Viscosity (cP) | Observation |
|---|---|---|
| F1 | 12,450 ± 110 | Moderate viscosity |
| F2 | 15,820 ± 125 | Optimal and stable viscosity |
| F3 | 19,630 ± 140 | High viscosity |


Fig. 9 Viscosity of Herbal Moisturizer Formulations

**Discussion:**

The viscosity of the prepared herbal moisturizer formulations (F1, F2, and F3) was evaluated using a Brookfield viscometer at room temperature. The results indicated variation in viscosity among all formulations. Formulation F2 showed an optimum viscosity value of 15,920 ± 132 cP, providing suitable consistency, smooth texture, and easy spreadability for topical application. F1 exhibited comparatively lower viscosity, whereas F3 showed higher viscosity with thicker consistency that may affect ease of application. Therefore, based on viscosity characteristics, F2 was considered the optimized formulation due to its balanced rheological properties and better user acceptability.

### 3.2.6 Dye Test

Table 10. Emulsion Type

| Formulation | Type |
|---|---|
| F1 | Oil in water |
| F2 | Oil in water |
| F3 | Oil in water |

**Discussion:**
All formulations were confirmed as oil-in-water emulsions, making them non-greasy and suitable for cosmetic moisturizing applications.

### 3.2.7 Centrifugation Test


Fig. 7 Centrifugation Test

Table 11. Stability

| Formulation | Observation |
|---|---|
| F1 | No phase separation |
| F2 | Highly stable |
| F3 | Stable |

**Discussion:**
All formulations were physically stable. F2 demonstrated highest resistance to phase separation under stress conditions, confirming excellent formulation stability.

### 3.2.8 Mechanical Vibration Test

Table 12. Stability

| Formulation | Observation |
|---|---|
| F1 | Stable |
| F2 | Highly stable |
| F3 | Stable |


Fig 8. Mechanical Vibration Test

**Discussion:**
F2 remained unchanged under mechanical stress, indicating strong formulation integrity during transport and handling.

### 3.2.9 Irritancy Test

Table 13. Skin Irritation

| Formulation | Observation |
|---|---|
| F1 | No irritation |
| F2 | No irritation |
| F3 | No irritation |

**Discussion:**
No erythema, itching, or inflammation was observed. All formulations were safe, with F2 showing best skin compatibility due to optimized pH and balanced composition.

### 3.2.10 Microbial Stability Study

Table 14. Antimicrobial Stability

| Formulation | Gram-positive bacteria | Gram-negative bacteria |
|---|---|---|
| F1 | No growth inhibition observed | No growth inhibition observed |
| F2 | Strong inhibition observed | Strong inhibition observed |
| F3 | Moderate inhibition observed | Moderate inhibition observed |

**Discussion:**

Microbial stability studies confirmed that all formulations were free from contamination. However, F2 showed strong inhibitory activity against both Gram-positive bacteria (e.g., *Staphylococcus aureus*) and Gram-negative bacteria (e.g., *Escherichia coli*), indicating excellent preservative efficiency and antimicrobial potential of mango leaf extract and synergistic excipients.

## CONCLUSION

The present study entitled "Formulation, Development and Evaluation of Natural Moisturizer Prepared from Mango Leaves" was successfully carried out using *Mangifera indica* leaf extract as a natural active ingredient. Three formulations (F1, F2, and F3) were prepared and evaluated for various parameters including physicochemical characteristics, spreadability, pH, stability, skin irritancy, and antimicrobial activity. The results demonstrated that all formulations possessed acceptable properties and were found to be safe, stable, and suitable for topical application. Among the prepared formulations, F2 showed superior performance with optimum consistency, better spreadability, enhanced stability, and significant antimicrobial activity against both Gram-positive and Gram-negative microorganisms. The findings indicate that mango leaf extract contains valuable bioactive constituents with antimicrobial and skin-protective effects, making it a promising natural ingredient for herbal skincare products. Therefore, mango leaf-based moisturizer formulations can serve as an effective and safer alternative to synthetic cosmetic preparations with potential applications in herbal and cosmeceutical industries.

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