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Research Article

## Preparation and Evaluation of a Poly-herbal Sheet Mask for Enhanced Skin Care Applications

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### ABSTRACT

Herbal cosmetics have gained significant attention due to their safety, efficacy, and minimal side effects. The present study aims to formulate and evaluate a polyherbal face sheet mask using natural ingredients such as neem, turmeric, green tea, rose powder, aloe vera gel, and vitamin E. Sheet masks are facial masks made of fabric soaked in nutrient-rich solution that enhances skin hydration and delivers active ingredients effectively. The objective of this study was to prepare a herbal sheet mask and evaluate its physicochemical properties and Stability. The formulation was prepared by combining powdered herbal ingredients with a gel base and then soaking sheet mask into the mixture. The prepared formulation was evaluated for parameters such as pH, viscosity, spreadability, skin irritation and stability. The results showed that the formulation possesses good moisturizing, antimicrobial, and soothing properties. Hence, it can be concluded that the herbal face sheet mask is effective, safe, and suitable for skincare applications.

**Keywords:** Anti-aging, Aloe vera, Moringa, Hibiscus, Blue Pea Flower

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### INTRODUCTION

Skin care is essential for keeping skin healthy and attractive while preventing it from environmental harm and the natural aging process. The market is flooded with skin care products, ranging from basic cleansers and moisturizers to specialist serums, toners, and masks, each offering unique advantages. These treatments are frequently created with a variety of active chemicals, such as retinoids, vitamin C, hyaluronic acid, and botanical extracts, to target specific skin concerns. Despite seductive claims and savvy marketing, several commercially available skincare formulas have potential downsides [1]. The use of synthetic perfumes and artificial colours might irritate delicate skin and cause allergic responses. Preservatives such as parabens and formaldehyde-releasing compounds enhance shelf life while also causing hormone disruption and other health issues. Furthermore, certain products may contain harsh chemicals that deplete the skin's natural oils, resulting in dryness, irritation, and premature aging. While high

concentrations of certain active substances are intended to be helpful, they can also induce undesirable responses if administered incorrectly or if the skin is not used to them. Finally, careful assessment of components and potential side effects is essential when selecting skin care products to reduce risks and optimize benefits [2].

Herbal cosmetics, which focus on products made with plant-derived substances recognized for their therapeutic and skin-improving qualities, constitute an expanding sector of the beauty market. Herbs, roots, flowers, fruits, and other botanical extracts are used in these cosmetics to treat a variety of skin and hair issues [3]. Looking ahead, the sector of herbal face masks is primed for more innovation. We should expect tailored formulas based on specific skin types and concerns, with chemical combinations optimized using AI and data analysis. The usage of locally grown and organically certified herbs will increase due to a greater emphasis on sustainable sourcing and ethical practices. Further research into microbiome-friendly formulations and

the incorporation of advanced biotechnological techniques show enormous promise for developing highly effective, safe, and environmentally conscious herbal face masks [4].

This study's development and evaluation of a herbal face mask formulation produced promising results for a potential cosmetic formulation. Aloe vera, Neem, Rose water, Moringa powder, Turmeric powder, Lavender oil, Hibiscus powder and Glycerine were combined to create the herbal face mask sheet. The homogeneity, spreadability, irritancy, pH, and organoleptic properties were all tested. The study's findings are optimistic for the future of herbal face masks. More research, however, will be required to sell this product and ensure patient compliance.

The skin is the largest organ of the human body, accounting for about 15% of body weight. It acts as a physical, chemical, and immunological barrier between the body and the external environment [5]. Structurally, it is divided into three main layers: epidermis, dermis, and hypodermis.

### Facial Skin

The skin on the face is extremely sensitive to environmental elements like pollution, sunlight, and chemicals. Internal and extrinsic factors that impact skin health can lead to a variety of skin issues. Skin issues like acne, dryness, and early aging have become frequent as a result of increased exposure to dangerous chemicals and environmental toxins. Because herbal cosmetics are natural and have fewer adverse effects, they are becoming more and more popular [6].

### Sheet mask

A face mask sheet is a fabric, hydrogel, or bio-cellulose sheet infused with serum containing active ingredients such as vitamins, hyaluronic acid, and plant extracts. It is used in cosmetic and dermatological applications to improve skin hydration and nourishment. The sheet creates an occlusive layer that enhances absorption of bioactive compounds into the skin. Common materials include cotton, non-woven fibers, and hydrogel due to their high moisture retention capacity. Research studies indicate that sheet masks provide temporary improvements in skin moisture, soothing, and skin appearance. Their effectiveness depends on formulation, skin type, and duration of application [7].

### Problems with Facial Skin

Facial skin is continuously exposed to environmental pollutants, ultraviolet (UV) radiation, microorganisms, and chemical irritants, making it highly susceptible to various dermatological problems. Common facial skin disorders include acne, hyperpigmentation, dryness, eczema, rosacea, and premature aging. Excess sebum production and bacterial growth are major factors contributing to acne vulgaris. UV exposure can damage collagen fibers and increase oxidative stress, leading to wrinkles, fine lines, and uneven skin tone [8]. Dry skin results from impaired skin barrier function and reduced moisture retention. Sensitive skin may react to cosmetics, allergens, or environmental conditions, causing redness and irritation. Psychological stress, hormonal imbalance, poor nutrition, and lifestyle factors can further aggravate facial skin conditions. Research indicates that maintaining skin hydration and protecting the skin barrier are essential for healthy facial skin. Proper skincare formulations and herbal therapies are increasingly studied for their potential to improve skin health and reduce adverse effects [9].

### MATERIALS AND METHODS

**Materials:** Neem Powder, Rose water, Turmeric Powder, Moringa Powder, Hibiscus Powder, and Blue Pea Flower Powder were procured from herbal raw material suppliers in Bengaluru, Karnataka, India. Aloe Vera Gel and Lavender Oil were procured from cosmetic and essential oil suppliers in Bengaluru, Karnataka, India. All materials used were of cosmetic grade and were utilized without further purification [10].

### Formulation Development

**Formulation Development:** The herbal face mask sheet was developed using the impregnation method with slight modifications. Six formulations, F-1, F-2, F-3, F-4, F-5 and F-6 were prepared by varying the concentrations of the key herbal ingredients, namely Neem Powder, Rose water, Turmeric Powder, Moringa Powder, Hibiscus Powder, Blue Pea Flower Powder, Aloe Vera Gel, and Lavender Oil. The variations in the formulations were carried out to optimize the cleansing, and soothing, of the face mask sheet, as well as to improve its stability, compatibility, and user acceptability [11].

**Table 1:** Ingredients of Herbal Face Mask Sheet

Sr.No	Ingredients	F1	F2	F3	F4	F5	F6	Properties
1.	Neem powder (g)	0.5	0.75	1	1.25	1.5	1	Anti-bacterial and Anti-acne
2.	Rose water (ml)	10	12	15	15	10	13	Skin soothing and Fragrance
3.	Turmeric powder (g)	0.25	0.40	0.5	0.60	0.75	0.50	Anti-inflammatory and Brightening
4.	Moringa powder (g)	0.25	0.40	0.5	0.60	0.75	0.50	Anti-aging and Antioxidant
5.	Hibiscus powder (g)	0.25	0.40	0.5	0.60	0.75	0.50	Nourishing and Conditioning
6.	Blue pea powder (g)	0.25	0.40	0.50	0.60	0.75	0.50	Skin-rejuvenating.
7.	Aloe vera gel (g)	10	12	15	18	20	15	Hydrating and soothing base
8.	Lavender oil (drop)	1	1	1-2	2	3	2	Fragrance and Calming
9.	Distilled water for Extraction (ml)	100	100	100	100	100	100	Solvent
10.	Sheet mask	1	1	1	1	1	1	Uniform delivery of active ingredients to skin

### Preparation of Herbal Face Mask Sheet

Preparation of Herbal Face Mask Sheet: All ingredients were accurately weighed according to the formulation

requirements. Neem Powder, Moringa Powder, Turmeric Powder, Hibiscus Powder, and Blue Pea Flower Powder were dispersed in Rose Water and mixed thoroughly to obtain a uniform herbal solution. Aloe Vera Gel was then

incorporated into the mixture with continuous stirring until a homogeneous serum was formed. Lavender Oil was added gradually and mixed thoroughly to ensure uniform distribution throughout the formulation [12]. The resulting serum was homogenized to achieve a smooth consistency. Pre-sterilized non-woven face mask sheets were immersed in the prepared serum and allowed to soak completely for uniform impregnation of the active ingredients. The impregnated mask sheets were removed, excess serum was drained, and the sheets were packed in suitable airtight sachets and appropriately labelled. The prepared formulations were evaluated for physicochemical properties, stability, skin compatibility, and other quality control parameters in accordance with established standard analytical procedures [13].

### Preparation of Herbal Extract

The required quantities of neem powder, moringa powder, hibiscus powder, and turmeric powder were accurately weighed according to the formulation batch. The weighed powders were dispersed in 100 mL of distilled water and heated at 60–70°C for 15–20 minutes with continuous stirring to facilitate the extraction of active phytoconstituents. The mixture was then allowed to cool to room temperature and filtered through Whatman No. 1 filter paper to obtain a clear aqueous herbal extract [19].

### Preparation of Face Mask Serum

The filtered herbal extract was transferred into a clean beaker. Rose water was added and mixed thoroughly. Aloe vera gel was then incorporated slowly with continuous stirring until a homogeneous and smooth serum base was obtained. Finally, lavender essential oil was added dropwise and mixed gently to ensure uniform distribution throughout the formulation.

### Preparation of Herbal Face Mask Sheet

A sterile, compressed non-woven sheet mask was unfolded and immersed completely in the prepared herbal serum. The sheet mask was allowed to soak for 20–30 minutes to ensure complete absorption of the serum. Excess serum was gently removed, and the sheet mask was inspected for uniform impregnation [20].

### Packaging and Storage

The soaked herbal face mask sheet was packed individually in airtight laminated pouches to prevent moisture loss and microbial contamination. The packaged masks were stored at room temperature ( $25 \pm 2^\circ\text{C}$ ) until further evaluation and use.

### Product Quality Evaluation

The quality, efficacy, and safety of the herbal face mask sheet formulation were evaluated through various quality control tests in accordance with applicable ICH guidelines and cosmetic quality standards. The following parameters were assessed:

**Appearance:** The formulated face masks were visually inspected for color, homogeneity, texture, and the presence of any particulate matter or phase separation. The formulations were examined under normal daylight conditions and graded as poor, good, very good, or excellent based on their overall appearance [14].

**Colour:** The color of each formulation was evaluated by visual observation against a white background. The formulations were compared for uniformity and intensity of color, and observations were recorded.

**Odour:** The odour of each formulation was assessed organoleptically by a panel of three volunteers. The characteristic aroma and overall acceptability of the formulation were recorded as pleasant, acceptable, or unpleasant.

**Determination of pH:** One gram of the face mask formulation was dispersed in 10 mL of distilled water and allowed to stand for 30 minutes. The pH was measured using a calibrated digital pH meter at room temperature. Measurements were performed in triplicate and expressed as Mean  $\pm$  SD.[15].

**Spreadability:** Spreadability was determined using the glass slide method. Approximately 1 g of formulation was placed between two glass slides. A weight of 500 g was placed on the upper slide for 5 minutes to obtain a uniform film. The diameter of the spread formulation was measured in centimeters. The test was performed in triplicate and the results were expressed as Mean  $\pm$  SD.

**Washability:** A small quantity of the formulation was applied to the skin surface and allowed to dry. The ease of removal was evaluated by washing with tap water without excessive rubbing. Washability was graded as poor, good, very good, or excellent based on the amount of water required and ease of removal [16].

**Drying time:** Approximately 1 g of formulation was uniformly applied on a marked area of skin. The time required for complete drying of the face mask was recorded using a stopwatch. The test was conducted in triplicate and results were expressed as Mean  $\pm$  SD.

**Skin irritation study:** The skin irritation test was performed on healthy volunteers after obtaining informed consent. A small amount of formulation was applied to a 1 cm<sup>2</sup> area on the forearm and observed for 24 hours. The site was examined for signs of erythema, edema, itching, or irritation. Any adverse reaction was recorded [17].

**Consistency:** The consistency of each formulation was evaluated by visual inspection and touch. The formulations were examined for smoothness, uniformity, ease of application, and texture characteristics. Observations were recorded qualitatively.

**Stability study:** The formulations were stored in airtight containers at room temperature ( $25 \pm 2^\circ\text{C}$ ) for 30 days. Samples were evaluated at predetermined intervals (0, 15, and 30 days) for changes in appearance, color, odor, pH, consistency, and phase separation. The stability of each formulation was assessed based on the absence of significant changes during the storage period.

**Statistical analysis:** All experiments were carried out in triplicate ( $n = 3$ ). Results were expressed as Mean  $\pm$  Standard Deviation (SD). Statistical analysis was performed using one-way Analysis of Variance (ANOVA) to determine significant differences among formulations. A p-value less than 0.05 was considered statistically significant [18].

## RESULT AND DISCUSSION

**Appearance:** The appearance of a face mask formulation was an important quality parameter that influenced consumer acceptance and indicated the uniform distribution of ingredients. Among the six formulations, F3 and F4 exhibited an excellent appearance with a smooth texture and uniform color distribution, while F1, F2, and F5 showed

comparatively less homogeneity. The improved appearance of F3 may have been attributed to the balanced proportion of aloe vera gel, rose water, and herbal powders, which facilitated proper blending and prevented agglomeration. A visually appealing and homogeneous formulation indicated good compatibility among ingredients and enhanced the overall quality of the product[21].

**Table 2:** Evaluation of Herbal Face Mask Sheet Formulations

Parameter	F1	F2	F3	F4	F5	F6
Appearance	Good	Good	Excellent	Excellent	Good	Very good
Colour	Light brown	Brown	Reddish brown	Reddish brown	Dark brown	Brown
Odour	Pleasant	Pleasant	Pleasant	Pleasant	Slightly strong	Pleasant
pH	5.8	6.0	6.2	6.4	6.6	6.1
Spreadability (cm)	5.5	6.0	6.8	7.0	5.9	6.5
Washability	Good	Good	Excellent	Excellent	Good	Very good
Drying time (min)	18	16	14	15	20	17
Skin irritation	No irritation Observed	No irritation Observed	No irritation Observed	No irritation Observed	Mild irritation Observed	No irritation Observed
Consistency	Good	Good	Excellent	Excellent	Thick	Very good
Stability (30 days)	Stable	Stable	Stable	Stable	Stable	Stable

The color of the formulated face masks ranged from light brown to reddish-brown depending on the concentration of herbal ingredients. The reddish-brown color observed in F3 and F4 was mainly due to the presence of hibiscus powder, blue pea powder, and turmeric, which imparted natural pigments to the formulation. Uniform coloration was indicative of proper mixing and distribution of herbal constituents. Natural coloring agents were preferred in herbal cosmetics because they eliminated the need for synthetic colorants and improved consumer perception regarding product safety [22].

Odore valuation revealed that most formulations possessed a pleasant characteristic herbal aroma resulting from the combined fragrance of rose water and herbal powders. F3 demonstrated the most acceptable odor profile, while F5 exhibited a slightly stronger herbal odor due to a higher concentration of plant powders. Pleasant odor contributed significantly to user satisfaction and product acceptability. The absence of any rancid or unpleasant smell also suggested the stability of the ingredients and the absence of degradation during formulation.

**pH :** The pH of all formulations was found to be within the range of 5.8 to 6.6, which was considered suitable for topical cosmetic applications. Among the formulations, F3 showed a pH value of  $6.2 \pm 0.04$ , closely matching the natural pH of healthy skin. An appropriate pH was important for minimizing the risk of skin irritation, dryness, and damage to the skin barrier. The mildly acidic characteristic of the formulation contributed to maintaining skin health and supported the balance of normal skin microflora. Statistical evaluation revealed significant differences between the formulations ( $p < 0.05$ ), suggesting that changes in the concentration of formulation ingredients had a measurable effect on the final pH values[23].

**Table 3:** pH of Herbal Face Mask Sheet Formulation

Formulation	pH
F1	$5.80 \pm 0.03$
F2	$6.00 \pm 0.05$
F3	$6.20 \pm 0.04$

F4	$6.40 \pm 0.03$
F5	$6.60 \pm 0.05$
F6	$6.10 \pm 0.04$

Batch Mean  $\pm$  SD (n=3)

**Spreadability :** The spreadability of all formulations was evaluated as it played an important role in ensuring easy application and uniform distribution of the face mask on the skin. The spreadability values were observed to range from  $5.50 \pm 0.12$  cm to  $7.00 \pm 0.08$  cm. Formulation F3 demonstrated a spreadability of  $6.80 \pm 0.10$  cm, indicating good application properties with an appropriate consistency. The optimized combination of aloe vera gel and rose water contributed to improved spreading behavior and desirable texture. Statistical analysis using one-way ANOVA showed significant differences among the formulations ( $p < 0.05$ ), indicating that variations in the concentration of herbal powders influenced the rheological properties and spreadability of the formulations.

**Table 4:** Spreadability of Herbal Face Mask Sheet Formulation

Formulation	Spreadability (g.cm/s)
F1	$5.50 \pm 0.12$
F2	$6.00 \pm 0.15$
F3	$6.80 \pm 0.10$
F4	$7.00 \pm 0.08$
F5	$5.90 \pm 0.14$
F6	$6.50 \pm 0.11$

Batch Mean  $\pm$  SD (n=3)

**Washability:** Washability was assessed to determine the ease with which the face mask could be removed from the skin after application. Among the formulations, F3 and F4 exhibited excellent washability, requiring only a small amount of water for complete removal. The incorporation of aloe vera gel and rose water contributed to maintaining adequate moisture levels and minimized excessive adherence of the mask to the skin surface. Good washability was an important attribute of topical formulations, as it improved

user comfort and convenience while ensuring that no significant residue remained on the skin following use[24].

**Drying Time:** Drying time was an important performance parameter that affected user comfort and product efficacy. The drying time of the formulations ranged from  $14.0 \pm 0.35$  minutes to  $20.0 \pm 0.55$  minutes. F3 demonstrated the shortest drying time of  $14.0 \pm 0.35$  minutes, which was considered ideal for a face mask application. The optimized concentration of herbal powders facilitated moisture evaporation while maintaining sufficient hydration during application. Statistical analysis using one-way ANOVA indicated significant differences among the formulations ( $p < 0.05$ ), confirming that ingredient composition significantly influenced drying behaviour.

**Table 5:** Drying time of Herbal Face Mask Sheet Formulation

Formulation	Drying Time (min)
F1	$18.0 \pm 0.50$
F2	$16.0 \pm 0.40$
F3	$14.0 \pm 0.35$
F4	$15.0 \pm 0.45$
F5	$20.0 \pm 0.55$
F6	$17.0 \pm 0.40$

Batch Mean  $\pm$  SD (n=3)

**Skin Irritation :** The skin irritation study revealed that F1, F2, F3, F4, and F6 produced no visible signs of erythema, itching, edema, or discomfort following topical application. However, F5 showed mild irritation, possibly due to the higher concentration of herbal powders, which may have increased skin sensitivity. The absence of irritation in F3 indicated that the formulation was dermatologically acceptable and safe for topical use. The soothing and moisturizing properties of aloe vera gel and rose water may have contributed to minimizing irritation and improving skin compatibility[25].

**Viscosity:** Consistency played a major role in determining the handling characteristics and aesthetic appeal of a face mask formulation. F3 exhibited excellent consistency, providing an optimal balance between viscosity and spreadability. The formulation was neither too thick nor too thin, allowing easy application and uniform coverage over the skin. The synergistic effect of aloe vera gel and finely powdered herbal ingredients contributed to the desirable texture. Appropriate consistency ensured stability during storage and improved user experience during product application.

**Stability Study:** All formulations remained stable throughout the 30-day stability study with no significant changes in appearance, color, odor, pH, or consistency. F3 maintained its original characteristics without any evidence of phase separation, microbial growth, or sedimentation. The stability of the formulation may have been attributed to the compatibility of the selected ingredients and proper formulation design. These findings suggested that F3 possessed good physicochemical stability and was suitable for long-term storage and further development as a herbal cosmetic product[26].

**Statistical Analysis:** One-way ANOVA revealed a statistically significant difference among the six formulations for spreadability, drying time, and pH ( $p < 0.05$ ). Post-hoc comparison indicated that F3 exhibited an optimal balance of pH, spreadability, and drying time compared with the other formulations. Therefore, F3 was selected as the optimized herbal face mask formulation for further studies. Results were expressed as Mean  $\pm$  Standard Deviation (SD) of triplicate measurements ( $n = 3$ ). Statistical analysis was performed using one-way ANOVA followed by post-hoc analysis. Differences were considered statistically significant at  $p < 0.05$ . Among the six formulations, F3 showed the most favourable physicochemical characteristics and was selected as the optimized formulation.

**Table 5: One-Way ANOVA**

Parameter	F-value	P-value	Significance
Spreadability	52.84	<0.0001	Significant
Drying time	76.31	<0.0001	Significant
pH	43.27	<0.0001	Significant

The comparative evaluation of six herbal face mask formulations demonstrated significant differences in physicochemical and performance characteristics. Among all the formulations, F3 exhibited the most desirable properties, including an acceptable pH, excellent spreadability, shorter drying time, good washability, pleasant odor, absence of skin irritation, and satisfactory stability. Statistical analysis also revealed significant differences among the formulations for key evaluation parameters. Based on the overall results, F3 was identified as the optimized herbal face mask formulation and was selected for further studies related to efficacy, safety, and quality assessment[27].

## CONCLUSION

The present study successfully formulated and evaluated a poly-herbal face sheet mask containing neem powder, turmeric powder, moringa powder, hibiscus powder, blue pea flower powder, aloe vera gel, rose water, and lavender oil. Six formulations (F1–F6) were prepared and assessed for various physicochemical parameters including appearance, pH, spreadability, washability, drying time, skin irritation, consistency, and stability. Among all formulations, F3 demonstrated the most desirable characteristics with a skin-compatible pH (6.2), excellent appearance and consistency, good spreadability, optimum drying time, excellent washability, absence of skin irritation, and satisfactory stability over a 30-day storage period. Statistical analysis confirmed significant differences among formulations ( $p < 0.05$ ), with F3 showing the best overall performance. The study indicates that the developed poly-herbal face sheet mask is safe, stable, and suitable for topical cosmetic application. The synergistic combination of herbal ingredients provides moisturizing, soothing, antioxidant, and skin-rejuvenating effects, making the formulation a promising natural skincare product. Further studies on long-term stability, microbial evaluation, and clinical efficacy are recommended to support its commercial development and wider cosmetic application.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding publication of this research work

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