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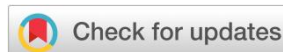
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Research Article

Development and Evaluation of Herbal Cosmeceutical Face Mask Containing Extracts of Amla, Neem and Turmeric

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Abstract

Background- There is growing demand for safe, effective cosmeceutical products that combine cosmetic and therapeutic benefits while minimizing the risks associated with synthetic ingredients. This study aimed to formulate and evaluate a semisolid polyherbal face mask containing extracts of neem (*Azadirachta indica*), amla (*Phyllanthus emblica*), and turmeric (*Curcuma longa*), together with natural additives (multani mitti, rice powder, and chandan powder), for potential anti-acne, antioxidant, anti-inflammatory, cleansing, and skin-rejuvenating effects. **Methods:-**Neem leaves, amla fruits, and turmeric rhizomes were extracted by maceration (hydro-alcoholic or PEG systems) and concentrated under controlled temperature. A gel base was prepared with polyvinyl alcohol; the herbal extracts were incorporated along with glycerin, polyethylene glycol, rose water, benzoic acid, and the powdered natural ingredients. The final formulation (100 g) was evaluated for organoleptic properties, pH, viscosity (Brookfield viscometer), spreadability (glass-slide method), washability, homogeneity, consistency, irritancy (preliminary skin test), and short-term physical stability (room temperature and $40 \pm 2^\circ\text{C}$ for 1 month). **Results:-**The mask was a homogeneous, pale yellowish-brown semisolid with a pleasant herbal odour, smooth texture, and no grittiness or phase separation. Mean pH was 6.1 (near the skin-compatible range), viscosity approximately 28 867 cP, and average spreadability 8.87 g-cm/s. It was easily washable, left no sticky residue, and produced no visible irritation (redness, itching, or swelling). Physical parameters remained stable over one month with only a minor pH shift ($6.1 \rightarrow 6.0$). **Conclusion:-**The developed polyherbal face mask demonstrated acceptable physicochemical, organoleptic, and preliminary safety characteristics, supporting its potential as a stable, skin-compatible herbal cosmeceutical for cleansing, oil control, and supportive anti-acne use. Further clinical, antimicrobial, and long-term stability studies are warranted.

Keywords: Polyherbal face mask, cosmeceuticals, Neem extract, Amla extract, Turmeric extract, Multani mitti, Antioxidant activity.

1. Introduction

Human civilization has always been striving towards looking beautiful and having healthy skin. Today, the demand for skincare products that do more than just enhance appearance but also treat specific skin conditions is increasing. One of the types of skincare products that have gained widespread popularity in recent years is cosmeceuticals, that is, products that fall somewhere in-between cosmetics and pharmaceutical products.¹ Contrary to regular cosmetics that tend to cover up skin defects, cosmeceuticals are formulated to deliver active ingredients that impact the physiological functioning of the skin in terms of providing anti-aging, anti-inflammatory, antioxidant, or antimicrobial effects.²

At present, a significant portion of the skincare products available on the market consists of synthetic components that carry a range of negative consequences from minor irritations to endocrine disruptions and even long-term illnesses like cancer. As a result, there is

a trend towards using natural or herbal alternatives that would be safer and still as efficient. Such a shift towards herbal products is reflected in the rapid growth of the herbal beauty products market that is expected to increase considerably thanks to rising disposable incomes, greater concern about wellbeing, and the desire to consume sustainable products.^{3,4}

India is home to Ayurveda, an ancient medicine system that uses a variety of herbs for treating various diseases. Historically, Indian culture has always placed great importance on the connection between body, mind, and skin and considered herbs essential for achieving harmony within this system. The project entitled "Development and Evaluation of Herbal Cosmeceutical Face Mask Containing Extracts of Amla, Neem and Turmeric" seeks to develop a face mask made from powerful herbs that possess anti-inflammatory, antimicrobial, anti-aging, skin brightening, and skin protecting properties needed to address problems like acne, pigmentation, dullness wrinkles, etc.⁵



Figure 1: Face pack

2. Materials and Methods:

2.1. Materials

The materials used in the preparation of semisolid polyherbal face mask were purchased from herbal and chemical vendors. All ingredients used were of analytical/pharmaceutical grade.

Table 1: List of Materials

Sr.No.	Material	Category	Function
1	Neem leaves	Herbal ingredient	Antibacterial, anti-acne
2	Amla fruit	Herbal ingredient	Antioxidant, rejuvenating
3	Turmeric rhizome	Herbal ingredient	Anti-inflammatory
4	Multani Mitti	Natural clay	Cleansing, oil absorption
5	Rice Powder	Natural ingredient	Exfoliating agent
6	Chandan Powder	Herbal powder	Cooling and soothing
7	Rose Water	Vehicle	Refreshing and fragrance
8	Polyvinyl alcohol	Polymer	Gelling agent
9	Polyvinyl alcohol	Polymer	Gelling agent
10	Glycerin	Excipient	Humectant and moisturizer
11	Polyethylene glycol	Excipient	Solvent and moisturizer
12	Distilled Water	Vehicle	Preparation medium

2.3. Equipment and Instruments:

The following are the instruments and laboratory equipment used during formulation and evaluation experiments.

Table 2: List of Equipments

Sr.no.	Equipment	Use
1	Electronic Balance	Accurate weighing
2	Beakers and Conical Flasks	Preparation and mixing
3	Measuring Cylinder	Volume measurement
4	Glass Rod	Manual stirring
5	Magnetic Stirrer	Uniform mixing
6	Hot Plate	Heating
7	Water Bath	Solvent evaporation
8	pH Meter	Determination of pH
9	Brookfield Viscometer	Viscosity measurement
10	Muslin Cloth	Filtration
11	Whatman Filter Paper	Fine Filtration
12	Mortar and Pestle	Powder grinding
13	Sieve No. 80	Particle size reduction
14	Airtight Containers	Storage of formulation

2.4. Extraction procedure

2.4.1. Preparation of Aqueous Neem Leaf Extract

Leaves of *Azadirachta indica* (Neem) were picked and cleaned with distilled water to get rid of dust and other contaminants found on the surface. Leaves were then shade dried at room temperature for several days until they are dried. The dried leaves were then ground to a fine powder in a clean mortar and pestle. The powdered neem leaves were accurately weighed and transferred to a clean conical flask to be used in the extraction process (50g). The amount of water used to extract the material was 250 mL of distilled water. The mixture was then left to stand for 72 hours at room temperature with intermittent stirring to facilitate extraction of water-soluble bioactive compounds from the plant. This was filtered first through a muslin cloth to remove bigger plant debris and then through Whatman Filter paper to get a comparatively clear filtrate after extraction. The extract was then concentrated by using water bath process at temperature below 50°C to reduce the degradation of heat sensitive phytochemical constituents of the extract. The extract of neem leaves was collected and stored in a clean container in proper condition for future use.⁶

2.4.2. Preparation of Amla Fruit Extract

The fresh fruits of *Phyllanthus emblica* (amla) were picked and were washed with distilled water to remove the surface impurities. The fruits were then cut into small pieces, shade dried at room temperature for several days till it becomes dry. The dried pieces of amla

were then ground to a fine powder using an appropriate grinding device. 50 g of dried amla powder was taken and weighed accurately in a clean conical flask for the extraction process. The powdered material was mixed with 250 mL of the solvent selected. The bioactive constituents were extracted by macerating for 72 hours at room temperature with occasional stirring. Following the maceration the extract was filtered in order to remove the plant material from the solution. The resulting filtrate was concentrated by water bath with a temperature below 50°C to ensure the minimum degradation of the components sensitive to heat. The concentrated extract was gathered in the form of a semi-solid product and stored as such for future use.⁷

2.4.3. Preparation of Turmeric Extract

The rhizomes of turmeric (*Curcuma longa*) were finely ground by using an appropriate grinding machine to obtain the dried powdered rhizomes. About 50 g of the turmeric powder was carefully weighed and placed in a clean extraction vessel with the medium of extraction polyethylene glycol (PEG). The mixture was left for maceration for 48-72 hours at room temperature to help in extracting the active constituents of the turmeric powder. The mixture was allowed to macerate and then filtered through Whatman filter paper to remove the insoluble plant material. This was filtered and the filtrate was concentrated by carefully evaporating off the solvent at temperatures below 50°C in a water bath. The extracted material was concentrated and collected and stored accordingly for further use.⁸

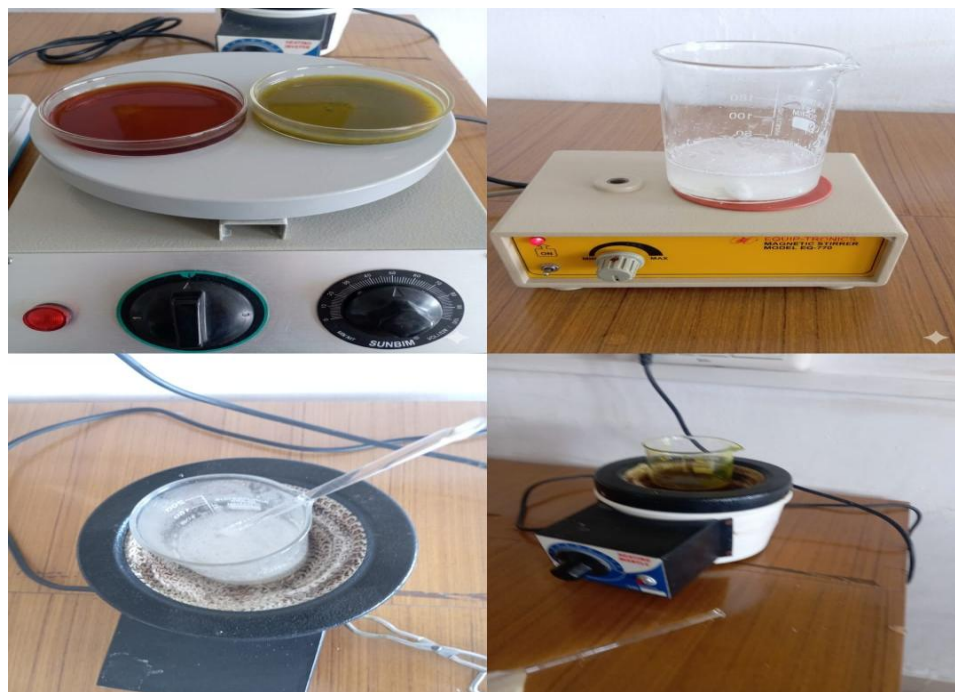


Figure 2: Neem Leaf, Amla Fruit, Turmeric Extract and cream preparation

3. Formulation Table

Table 3: Composition of Semisolid Polyherbal Face Mask (100 g)

Sr.No.	Material	Given Quantity
1	Neem extract	2g
2	Amla extract	2g
3	Turmeric rhizome extract	0.5-1g
4	Multani Mitti	10g
5	Rice Powder	5g
6	Chandan Powder	3g
7	Rose Water	10-15ml
8	Glycerin	5ml
9	Polyethylene Glycol	3ml
10	Polyethylene Alcohol	0.2g
11	Benzoic Acid	0.03g
12	Distilled water	q.s. to 100g

3.1. Method of Preparation:

Preparation of Semisolid Polyherbal Face Mask

The herbal extracts of Neem, Amla and Turmeric were added to the gel based formulation of natural and cosmetic ingredients to prepare the semisolid poly herbal face mask.(Table No.3) The preparation was performed in various steps, such as the gel base, herbal phase, powder phase, combining ingredients, adding preservative, and finally preparing the formulation. Precise weighings of all ingredients were used and all apparatus was clean and dry for all preparation.

Step 1: Preparation of Gel Base

The desired amount of distilled water was removed from a clean beaker and added to the beaker as an aqueous phase for the preparation of the gel base. Then, slowly polyvinyl alcohol (PVA) was added to distilled water with stirring to prevent the formation of lumps and to disperse it evenly. This dispersion, which was obtained, was left to stand for about 1-2 hours, to allow good hydration of the polymer. As the water was added, the PVA slowly absorbed the water and became a uniform polymer dispersion that could be used to incorporate the formulation components.

Step 2: Preparation of Herbal Phase

The required amount of the extracts made from Neem, Amla and Turmeric was precisely measured and mixed in a clean container. The mixture was then moistened with glycerin as a humectant to assure moisture retention and spreadability of the formulation. A preservative, benzoic acid, was incorporated. The mixture was stirred with continuous stirring until the components were evenly distributed, thus forming a homogeneous herbal phase. Great care was taken to make sure that there were no visible lumps or undispersed material left in the mixture.

Step 3: Preparation of Powder Phase

Multani mitti, rice powder and chandan powder in required quantity were accurately weighed separately. Coarse particles were removed from each powder by passing it through sieve no. 80 to get fine and uniform powder. The sieved powders were then mixed together and thoroughly mixed to form a uniform powder blend. The powders were uniformly mixed to provide even distribution of individual ingredients throughout the finished formulation of a face mask.

Step 4: Combination of Ingredients

Herbal phase was prepared by appropriate hydration before incorporation into the hydrated polymer base in a slow and continuous manner. The slow addition was carried out to ensure even distribution of herbal extracts in the gel and to avoid the formation of lumps. Then, the powder (Multani mitti, rice powder, chandan powder) mixed with gel base was slowly added to the gel base while stirring continuously. Powders were added gradually to get a smooth and uniform semisolid.

The formulation was then gradually mixed with rose water with continuous stirring. Rose water was added to help achieve the correct consistency of a face mask and for its desired properties. The formulation was mixed thoroughly until the herbal extracts, powder ingredients and gel base was uniformly distributed and a smooth semisolid consistency was obtained.

Step 5: Incorporation of Preservative

A small amount of warm polyethylene glycol (PEG) was used to dissolve the required amount of benzoic acid for its uniform dispersion in the formulation. The prepared preservative solution was then slowly introduced into the formulation, which was already prepared, in the process of which continuous stirring was used. Appropriate mixing was done to spread the preservative evenly throughout the face mask and to reduce the potential for preservative to be concentrated in small areas.

Step 6: Final Preparation and Storage

Then the desired amount of distilled water was slowly added to achieve the required number of grams and consistency of the formulation. The entire formulation was shaken well to achieve a uniform, smooth and homogeneous semisolid polyherbal face mask. The formulated product was carefully dispensed into clean, dry, air-tight containers to avoid contamination and

moisture loss. The containers were properly labelled with the name of the formulation and relevant preparation details. The prepared semi-solid poly herbal face mask was kept at room temperature under proper conditions till further evaluation. The formulation then underwent the required physicochemical evaluation and other parameters for assessing the quality, stability and suitability of the formulation.

4 Evaluation Tests

The prepared semisolid polyherbal face mask was analyzed for the following characteristics.

4.1 Organoleptic Properties Analysis

The prepared polyherbal face mask formulation was evaluated for its organoleptic properties by visual and sensory examination. The evaluation was carried out to determine the physical characteristics and overall acceptability of the formulation. The formulation was examined for colour, odour, appearance, texture, and homogeneity under suitable conditions.

Colour: The colour of the formulation was observed visually and recorded to assess its uniformity and general appearance.

Odour: The formulation was examined for its characteristic odour to determine whether it possessed a pleasant or acceptable smell and to identify any undesirable or abnormal odour.

Appearance: The overall physical appearance of the formulation was observed for uniformity, smoothness, and the presence of any visible foreign particles or aggregates.

Texture: The texture of the formulation was assessed by observing its consistency and smoothness. Particular attention was given to whether the formulation was smooth and free from coarse or gritty particles.

Homogeneity: The formulation was examined for uniform distribution of all ingredients. It was checked for the presence of lumps, aggregates, or phase separation to ensure that the formulation was homogeneous and uniform throughout. The observations obtained from the organoleptic evaluation were recorded and used to assess the overall physical quality and acceptability of the prepared polyherbal face mask formulation.⁹

4.2 Measurement of pH

The pH of the prepared polyherbal face mask formulation was determined to assess its suitability for topical application and to ensure that the formulation possessed a skin-compatible pH. Approximately 1 g of the formulation was accurately weighed and dispersed in a suitable quantity of distilled water to obtain a uniform dispersion. The dispersion was mixed thoroughly to ensure proper distribution of the formulation before measurement. The pH was determined using a previously calibrated digital pH meter. Before measurement, the pH meter was calibrated using appropriate standard buffer solutions according to the manufacturer's instructions. The

electrode was then immersed into the prepared formulation dispersion, and the pH reading was allowed to stabilize before being recorded. The pH measurement was performed in triplicate, and the individual readings were recorded. The mean pH value was calculated from the three measurements and compared with the desired pH range of 5.5–6.0, which was selected to provide a formulation suitable for application to the skin.¹⁰

4.3 Spreadability Test:

The spreadability of the prepared semisolid polyherbal face mask formulation was evaluated using the glass slide technique. This test was performed to determine the ease with which the formulation could be uniformly spread over a surface. A suitable quantity of the prepared formulation was placed between two clean and dry glass slides. The slides were carefully arranged one over the other so that the formulation was uniformly distributed between them.

A known weight was attached to the upper slide, causing it to move over the lower slide. The distance travelled by the upper slide and the time required for the slide to move through the specified distance were recorded. The spreadability of the formulation was calculated using the following equation:

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

Where:

S = Spreadability of the formulation

M = Weight tied to the upper slide (g)

L = Distance moved by the slide (cm)

T = Time taken by the slide to move the specified distance (s)

The spreadability was expressed in g·cm/s. A higher spreadability value indicates that the formulation can be spread more easily and uniformly over the skin.¹¹

4.4 Washability Test

The washability of the prepared polyherbal face mask formulation was evaluated to determine the ease with which the formulation could be removed from the skin after application. A small quantity of the formulation was applied uniformly onto a suitable area of the skin and allowed to remain for a specified period. The applied formulation was then washed with water using gentle rubbing. The ease of removal of the formulation was observed and recorded. The formulation was considered to possess good washability if it could be removed easily without leaving excessive residue on the skin.

4.5 Viscosity Testing

The viscosity of the prepared polyherbal face mask formulation was determined using a Brookfield viscometer. The formulation was transferred into a suitable container, ensuring that the sample was free from air bubbles and uniformly mixed before measurement. The appropriate spindle was immersed into the formulation according to the instrument requirements, and the viscosity was measured under

suitable operating conditions. The viscosity reading was recorded after the value had stabilized. The test was performed to assess the flow characteristics and consistency of the semisolid formulation.

4.6 Irritation Test

The irritation potential of the prepared polyherbal face mask formulation was evaluated by applying a small quantity of the formulation to a limited area of the skin. The treated area was observed for any visible or subjective signs of irritation, including redness, itching, swelling, burning, or discomfort. The observations were recorded over a period of 24 hours. The absence or presence of any adverse skin reaction was noted to assess the preliminary skin tolerability of the formulation.

4.7 Stability Test

A stability study was carried out to evaluate the physical stability of the prepared polyherbal face mask formulation under different storage conditions. Samples of the formulation were stored at room temperature and at an elevated temperature of $40 \pm 2^\circ\text{C}$ for a period of one month. The stored samples were periodically examined for changes in their physical and chemical characteristics.

The stability of the formulation was assessed based on changes in colour, odour, pH, consistency, and phase separation. The observations obtained during the study period were recorded and compared with the initial characteristics of the formulation. Any noticeable changes in these parameters were considered during the assessment of the stability of the prepared formulation.

4.8 Homogeneity Test

The homogeneity of the prepared polyherbal face mask formulation was evaluated by visual inspection. The formulation was examined for uniform distribution of its ingredients and for the presence of any lumps, aggregates, coarse particles, or signs of phase separation. The formulation was considered homogeneous when it exhibited a uniform appearance and consistency throughout, without visible separation or aggregation of the ingredients.

4.9 Consistency Test

The consistency of the prepared semisolid polyherbal face mask formulation was evaluated manually to assess its physical characteristics and ease of application. A small quantity of the formulation was examined for its semisolid nature, smoothness, firmness, and ease of handling. The formulation was assessed for whether it could be easily picked up, applied, and spread uniformly over the skin without excessive stiffness or excessive fluidity. The observations were recorded to determine whether the formulation possessed a suitable consistency for topical application.

5. Results

The formulated semisolid polyherbal face mask containing neem, amla, and turmeric extracts was evaluated for its physicochemical, organoleptic, and performance characteristics. The formulation was assessed for colour, odour, appearance, texture, homogeneity, consistency, grittiness, phase separation, pH, viscosity, spreadability, washability, skin irritancy, and stability. The results obtained indicated that the formulated polyherbal face mask possessed satisfactory physical characteristics, suitable consistency, acceptable spreadability, good washability, and preliminary skin compatibility. The formulation also remained physically stable during the one-month stability study.

5.1 Organoleptic Evaluation

The formulated polyherbal face mask was evaluated for its organoleptic characteristics by visual and sensory examination. The formulation was assessed for colour, odour, appearance, texture, homogeneity, consistency, grittiness, and phase separation. The observations are presented in Table 5.1.

Table 5.1. Organoleptic Characteristics of the Polyherbal Face Mask

Sr. No.	Parameter	Observation
1	Colour	Pale yellowish brown
2	Odour	Pleasant herbal odour
3	Appearance	Smooth semisolid paste
4	Texture	Soft and smooth
5	Homogeneity	Homogeneous
6	Consistency	Good semisolid consistency
7	Grittiness	Absent
8	Phase separation	Not observed

The formulation exhibited a pale yellowish-brown colour with a pleasant herbal odour and a smooth semisolid appearance. The texture was soft and smooth, with no noticeable grittiness. The formulation was homogeneous and showed good consistency without any visible phase separation. These observations indicated satisfactory physical and organoleptic characteristics of the prepared polyherbal face mask.

5.2 Determination of pH

The pH of the formulated polyherbal face mask was determined using a calibrated digital pH meter. The measurement was performed in triplicate, and the individual values were recorded. The results are presented in Table 5.2.

The average pH of the formulation was found to be 6.1. The observed pH was within the predetermined acceptable range of 5.5–6.0 used for the formulation, with only a slight deviation above the upper target value. The measured value was also close to the

generally reported mildly acidic range of healthy skin. Therefore, the formulation was considered suitable for further topical evaluation, although optimization may be considered if a strict target range of 5.5–6.0 is required.

Table 5.2. pH of the Polyherbal Face Mask

Trial	pH Value
1	6.1
2	6.0
3	6.2
Average	6.1

5.3 Determination of Viscosity

The viscosity of the formulated polyherbal face mask was determined using a Brookfield viscometer at room temperature. Three measurements were obtained, and the mean viscosity was calculated. The results are presented in Table 5.3.

Table 5.3. Viscosity of the Polyherbal Face Mask

Trial	Viscosity (cP)
1	28,500
2	29,200
3	28,900
Average	28,866.7

The average viscosity of the formulation was found to be 28,866.7 cP (approximately 28,867 cP). The obtained viscosity indicated that the formulation possessed a suitable semisolid consistency. The formulation was sufficiently viscous to maintain its semisolid nature while remaining suitable for application and spreading over the skin.

5.4 Spreadability Test

The spreadability of the formulation was evaluated using the glass-slide method. The time required for the slide to move through the specified distance was recorded, and spreadability was calculated using the appropriate equation. The results obtained from three trials are presented in Table 5.4.

Table 5.4. Spreadability of the Polyherbal Face Mask

Trial	Time Taken (s)	Spreadability (g·cm/s)
1	6	8.3
2	5	10.0
3	6	8.3
Average	—	8.87

The average spreadability of the formulation was found to be 8.87 g-cm/s. The formulation demonstrated adequate spreadability, indicating that it could be applied and distributed relatively easily over the skin. Good spreadability is desirable for a topical face mask because it facilitates uniform application and helps ensure consistent contact of the formulation with the skin surface.

5.5 Washability Test

The washability of the formulated polyherbal face mask was evaluated by applying the formulation to the skin surface and subsequently washing it with water. The ease of removal, residual effect, and skin feel after washing were observed and recorded.

Table 5.5. Washability Evaluation of the Polyherbal Face Mask

Parameter	Observation
Ease of washing	Easily washable
Residual effect	No sticky residue
Skin feel after washing	Smooth and refreshed

The formulation was found to be easily washable with water and did not leave any noticeable sticky or oily residue after removal. The skin was reported to have a smooth and refreshed feel following washing. These findings indicated satisfactory washability and acceptable user characteristics of the formulation.

5.6 Irritancy Test

Table 5.7. Stability Study of the Polyherbal Face Mask

Parameter	Initial	After 15 Days	After 30 Days
Colour	No change	No change	No change
Odour	Pleasant	Pleasant	Pleasant
pH	6.1	6.1	6.0
Consistency	Good	Good	Good
Homogeneity	Maintained	Maintained	Maintained
Phase separation	Absent	Absent	Absent

The formulation showed no appreciable change in colour or odour during the one-month observation period. The pH showed only a slight change from 6.1 initially to 6.0 after 30 days. The consistency and homogeneity of the formulation were maintained

The preliminary skin irritation potential of the formulated polyherbal face mask was evaluated by observing the treated skin area for visible signs of irritation over the specified observation period. The parameters assessed included redness, itching, swelling, and general irritation.

Table 5.6. Irritancy Study of the Polyherbal Face Mask

Parameter	Observation
Redness	Absent
Itching	Absent
Swelling	Absent
Irritation	Absent

No visible redness, itching, swelling, or irritation was observed during the observation period. The absence of these reactions suggested that the formulation did not produce observable irritation under the conditions of the preliminary test. However, this finding should be interpreted as a preliminary indication of skin compatibility rather than definitive evidence of clinical safety.

5.7 Stability Study

The stability of the formulated polyherbal face mask was evaluated over a period of one month under the selected storage conditions. The formulation was examined initially and after 15 and 30 days for changes in colour, odour, pH, consistency, homogeneity, and phase separation. The results are presented in Table 5.7.

throughout the study, and no phase separation was observed. These findings indicated that the formulation remained physically stable under the tested storage conditions during the study period.

5.8 Overall Evaluation Summary

The overall evaluation results of the formulated polyherbal face mask are summarized in Table 5.8.

Table 5.8. Summary of Evaluation Parameters of the Polyherbal Face Mask

Parameter	Result
Appearance	Smooth semisolid
Homogeneity	Good
pH	6.1
Viscosity	28,866.7 cP
Spreadability	8.87 g-cm/s
Washability	Easily washable
Irritancy	No irritation observed
Stability	Physically stable for one month

Overall, the formulated semisolid polyherbal face mask exhibited satisfactory organoleptic and physicochemical characteristics. The formulation showed a smooth semisolid appearance, good homogeneity, suitable viscosity, and adequate spreadability. It was easily washable and did not produce observable signs of irritation during the preliminary irritancy assessment. The formulation also maintained its physical characteristics during the one-month stability study, with only a minor variation in pH. These results suggest that the developed polyherbal face mask possesses promising physical and preliminary topical characteristics and may be considered suitable for further formulation optimization and evaluation.

6. Discussion

In the current investigation, a semi-solid polyherbal face mask has been developed using natural ingredients such as extracts of neem, amla, and turmeric with various natural bases like multani mitti, rice powder, milk powder, and chandan powder. The formulation prepared had an ideal semisolid consistency that was even and free from grittiness and phase separation. Acceptable organoleptic characteristics like yellowish color and pleasant herbal odor enhanced compliance to the product.

The pH of the formulation (6.1) was suitable according to skin pH (5.5-6.5). Good spreadability and viscosity of the formulation helped to apply the mask effectively on the skin. Washability ensured easy removal after application, thus avoiding accumulation of the formulation on the skin surface. Safety of the formulation was tested by performing an irritancy test that proved the absence of any symptoms like redness, swelling, and itching. No significant variation in the physical properties of the formulation was observed after stability studies during the experimental period, showing that the formulation has proper compatibility of the ingredients and good stability.

Antibacterial and anti-inflammatory activity was provided by neem, antioxidants and skin rejuvenation through curcumin content were contributed by turmeric while vitamin C as an antioxidant agent was added from amla. Other natural ingredients included multani mitti, rice powder, milk powder, and chandan powder.

7. Conclusion

A semisolid polyherbal face mask containing extracts of neem, amla and turmeric, combined with multani mitti, rice powder and chandan powder, was successfully developed and evaluated. The formulation showed a homogeneous, smooth semisolid texture with a pleasant herbal odour and pale yellowish-brown colour, free from grittiness or phase separation. Its pH (average 6.1) remained close to the natural skin range, while viscosity ($\approx 28\,867$ cP) and spreadability (8.87 g-cm/s) supported easy application and uniform coverage. The mask was readily washable, left no sticky residue and produced no visible signs of irritation such as redness, itching or swelling in the preliminary skin test. Short-term stability studies under room temperature and elevated conditions confirmed that colour, odour, consistency, homogeneity and pH remained essentially unchanged over one month.

The synergistic actions of the selected herbs antibacterial and anti-acne effects of neem, antioxidant and rejuvenating properties of amla, and anti-inflammatory plus antioxidant benefits of turmeric together with the cleansing, oil-absorbing, exfoliating and soothing contributions of the natural powders, provide a sound rationale for the product's intended cosmeceutical use. Overall, the developed face mask is stable, skin-compatible, economical and promising for cleansing, oil control, acne prevention and skin nourishment. Further clinical, antimicrobial, antioxidant and long-term stability studies are recommended to fully establish its therapeutic potential and commercial viability.

8. Future Scope of the Study

The present formulation provides a basis for further research and development of polyherbal topical preparations. The following studies may be undertaken to establish the therapeutic efficacy, safety, stability, and commercial potential of the developed formulation.¹²

8.1 Clinical Evaluation of Anti-Acne Activity

Controlled clinical studies involving appropriately recruited human volunteers may be conducted to evaluate the anti-acne efficacy of the formulated face mask. Clinical parameters such as reduction in acne lesions, skin condition, tolerability, and overall improvement in the appearance of acne-prone skin may be assessed using validated methods. Appropriate ethical approval and informed consent would be required for studies involving human participants.

8.2 Comparative Evaluation with Marketed Formulations

A comparative study may be conducted between the developed polyherbal face mask and selected marketed

face-mask or anti-acne formulations. Parameters such as physicochemical properties, ease of application, spreadability, washability, stability, efficacy, and consumer acceptability may be evaluated to determine the relative performance of the developed formulation.

8.3 Extended and Accelerated Stability Studies

Further stability studies may be performed under long-term and accelerated storage conditions to determine the stability profile and estimated shelf life of the formulation. Changes in parameters such as appearance, colour, odour, pH, viscosity, consistency, microbial quality, and phase separation may be monitored at predetermined intervals according to appropriate stability-testing guidelines.

8.4 Antimicrobial Activity Studies

The antimicrobial potential of the individual herbal extracts and the final formulation may be investigated using suitable microbiological methods. Studies may include evaluation against microorganisms relevant to skin health, such as *Staphylococcus aureus* and *Cutibacterium acnes* (formerly known as *Propionibacterium acnes*). Appropriate antimicrobial assays and validated laboratory procedures may be used to determine the inhibitory activity of the formulation.¹³

8.5 Phytochemical Analysis and Standardization

Detailed phytochemical investigations may be conducted to identify and quantify the major bioactive constituents present in the neem, amla, and turmeric extracts. Suitable analytical techniques may be employed for characterization and standardization of the extracts. Establishing appropriate quality-control markers could improve batch-to-batch consistency and support reproducibility of the formulation.

8.6 In Vitro Antioxidant Studies

The antioxidant potential of the individual extracts and the final polyherbal formulation may be investigated using suitable in vitro assays. Methods such as the DPPH radical-scavenging assay and FRAP assay may be employed to estimate antioxidant activity. The results could provide additional information regarding the potential antioxidant properties of the formulation.

8.7 Skin Permeation and Penetration Studies

Further investigations may be carried out to understand the interaction of the formulation with the skin and the penetration or permeation characteristics of relevant active constituents. Appropriate in vitro or ex vivo skin models may be employed to determine the extent and distribution of selected constituents within the skin layers.

8.8 Formulation Optimization

Optimization studies may be conducted by systematically varying the concentrations of herbal extracts, polymer, humectants, powders, and other excipients. The effect of these variables on important formulation characteristics such as pH, viscosity, spreadability, consistency, stability, and overall acceptability may be investigated. Statistical

experimental-design approaches may also be considered to identify an optimized formulation.¹⁴

8.9 Development of Reduced-Preservative or Preservative-Free Formulations

Further research may explore the development of formulations with reduced synthetic preservative content or suitable preservative-free systems, where scientifically and microbiologically feasible. Naturally derived preservation strategies and appropriate packaging systems may be investigated. Such formulations would require comprehensive microbial quality and preservative-effectiveness assessment before being considered suitable for use.

8.10 Industrial Scale-Up and Commercial Development

Scale-up studies may be undertaken to determine the feasibility of manufacturing the optimized formulation on an industrial scale. Manufacturing parameters, process reproducibility, quality-control requirements, packaging, storage conditions, regulatory considerations, and product stability may be evaluated. These studies could support the potential commercial development and marketing of the polyherbal face mask.

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Ethics Approval: The study involved only preliminary physicochemical evaluation and a limited skin irritancy assessment on healthy volunteers. All procedures were

conducted in accordance with institutional ethical guidelines. Formal institutional ethics committee approval was obtained prior to the irritancy testing, and the study adhered to the principles of the Declaration of Helsinki.

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