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Research Article

Development And Evaluation of A Polyherbal Multipurpose Hair Mask for Enhanced Hair Health

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ABSTRACT

Hair plays a significant role in the physical appearance and psychological confidence of individuals. Increasing exposure to pollution, stress, unhealthy dietary habits, and excessive use of synthetic cosmetic products has resulted in several hair-related problems such as dandruff, hair fall, dryness, scalp irritation, split ends, and premature greying. Herbal cosmetics have gained considerable attention due to their safety, effectiveness, eco-friendly nature, and minimal side effects compared to synthetic products. The present research work focuses on the development and evaluation of a polyherbal multipurpose hair mask prepared using natural herbal ingredients, including shikakai, reetha powder, amla powder, hibiscus, flaxseed, aloe vera, curry leaves, brahmi powder, and neem powder. The formulation was prepared by shade drying, pulverizing, sieving, and blending the herbal ingredients in suitable proportions. The prepared hair mask was evaluated for organoleptic properties, pH, spreadability, washability, stability, skin irritation, and overall performance. The results demonstrated that the formulation possessed acceptable physicochemical properties and showed beneficial effects such as improved hair texture, reduction in dandruff, scalp nourishment, conditioning, and strengthening of hair follicles. The study concluded that the prepared polyherbal hair mask is safe, economical, stable, and effective for maintaining healthy hair and scalp conditions. The herbal ingredients exhibited synergistic activity, making the formulation a promising alternative to synthetic hair care products.

INTRODUCTION

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Hair is considered an important part of human appearance and personality [1]. Healthy hair enhances confidence and contributes significantly to aesthetic appeal. In recent years, hair-related problems such as dandruff, hair fall, dryness, premature greying, split ends, and scalp infections have increased due to pollution, stress, poor nutrition, and excessive use of synthetic cosmetic products. Herbal cosmetics have gained tremendous popularity because of their natural origin, minimal side effects, and therapeutic value [2]. Polyherbal formulations are preparations containing multiple herbs that act synergistically to provide enhanced therapeutic effects [3]. Herbal hair masks are one such innovative cosmetic preparation designed to nourish the scalp, strengthen hair roots, improve hair texture, and promote healthy hair growth. A hair mask is a thick, nutrient-rich treatment applied to the hair and scalp for deep conditioning and nourishment [4,5]. Polyherbal hair masks offer several benefits such as cleansing, conditioning, dandruff reduction, scalp hydration, and improvement in hair shine and softness. The present investigation was designed to formulate and evaluate a polyherbal multipurpose hair mask prepared from selected medicinal herbs including shikakai, reetha, amla, hibiscus, flaxseed, aloe vera, curry leaves, brahmi, and neem. These herbs were selected on the basis of their traditional use in Ayurvedic hair care systems and their scientifically reported benefits for scalp nourishment, cleansing, conditioning, and hair strengthening. These herbs are traditionally known for their beneficial effects on hair and scalp health. cosmetics have gained tremendous popularity because of their natural origin, minimal side effects, and therapeutic value [2]. Polyherbal formulations are preparations containing multiple herbs that act synergistically to provide enhanced therapeutic effects [3]. Herbal hair masks are one such innovative cosmetic preparation designed to

nourish the scalp, strengthen hair roots, improve hair texture, and promote healthy hair growth. A hair mask is a thick, nutrient-rich treatment applied to the hair and scalp for deep conditioning and nourishment [4]. Polyherbal hair masks offer several benefits such as cleansing, conditioning, dandruff reduction, scalp hydration, and improvement in hair shine and softness. The present investigation was designed to formulate and evaluate a polyherbal multipurpose hair mask prepared from selected medicinal herbs including shikakai, reetha, amla, hibiscus, flaxseed, aloe vera, curry leaves, brahmi, and neem. These herbs were selected on the basis of their traditional use in Ayurvedic hair care systems and their scientifically reported benefits for scalp nourishment, cleansing, conditioning, and hair strengthening. These herbs are traditionally known for their beneficial effects on hair and scalp health.

1.1 Advantages of Polyherbal Hair Masks

Free from harmful synthetic chemicals.

Economical and environmentally friendly.

Provides nourishment to the scalp.

Improves hair texture and shine.

Reduces dandruff and scalp irritation.

Helps in strengthening hair follicles.

1.2 Role of Herbal Ingredients:

Amla (*Phyllanthus emblica*): Rich source of vitamin C, tannins, and antioxidants that strengthen hair follicles, improve scalp circulation, and prevent premature greying. [6]

Neem (*Azadirachta indica*): Possesses potent antifungal, antibacterial, and anti-inflammatory



properties effective against dandruff and scalp infections. [7]

Hibiscus (Hibiscus rosa-sinensis): Helps stimulate hair growth, improves hair softness, and reduces hair breakage. [8]

Shikakai (Acacia concinna): Acts as a natural cleanser and conditioner due to the presence of saponins.

Reetha (Sapindus mukorossi): Produces natural foam and effectively removes dirt and excess oil from the scalp. [4]

Flaxseed (Linum usitatissimum): Rich in omega-3 fatty acids and proteins that improve hair hydration and reduce hair dryness. [9]

Brahmi (Bacopa monnieri): Strengthens hair roots, reduces stress-induced hair fall, and nourishes the scalp. [7]

Aloe Vera (Aloe barbadensis): Provides moisturization, a cooling effect, and scalp soothing properties. [10]

The increasing demand for herbal cosmetics and awareness regarding the harmful effects of synthetic products have encouraged researchers to develop safer and more effective herbal formulations. Therefore, the present study was undertaken to formulate and evaluate a polyherbal multipurpose hair mask for enhanced hair health.

1. Methodology

2.1 Materials Used

The following herbal ingredients were used for the preparation of the polyherbal hair mask:

| Sr. No. | Ingredient | Biological Name | Role in Formulation |
|---------|------------------|------------------------|-----------------------------|
| 1. | Amla Powder | Phyllanthus emblica | Hair strengthening |
| 2. | Hibiscus Powder | Hibiscus rosa-sinensis | Hair growth promoter |
| 3. | Neem Powder | Azadirachta indica | Anti-dandruff agent |
| 4. | Shikakai Powder | Acacia concinna | Natural cleanser |
| 5. | Reetha Powder | Sapindus mukorossi | Foaming and cleansing agent |
| 6. | Flaxseed Powder | Linum usitatissimum | Conditioning agent |
| 7. | Aloe Vera powder | Aloe barbadensis | Provides moisturization |
| 8. | Brahmi Powder | Bacopa monnieri | Hair nourishment |

2.2 Formulation of Polyherbal Hair Mask

The required quantities of all herbal powders were accurately weighed and mixed uniformly using the geometric dilution method.

| Sr. No. | Ingredients | Batch 1 | Batch 2 | Batch 3 | Batch 4 | Batch 5 |
|---------|-----------------|---------|---------|---------|---------|---------|
| 1 | Shikakai Powder | 3gm | 3.41gm | 3.11gm | 3.11gm | 3gm |
| 2 | Reetha Powder | 2gm | 2.11gm | 2.11gm | 2.11gm | 2.76gm |
| 3 | Amla Powder | 3gm | 3.13gm | 3.20gm | 3.13gm | 3.16gm |
| 4 | Flaxseed Powder | 2gm | 1.62gm | 2gm | 0.92gm | 2gm |
| 5 | Hibiscus Powder | 3gm | 2gm | 1.47gm | 1.85gm | 2.01gm |
| 6 | Aloevera Powder | 2gm | 2.76gm | 2.47 | 1.86gm | 2.5gm |
| 7 | Bramhi Powder | 2gm | 1.92gm | 2.56 | 2.76gm | 3gm |



| | | | | | | |
|---|-------------|-----|--------|------|--------|--------|
| 8 | Neem Powder | 3gm | 3.05gm | 3.05 | 4.61gm | 1.57gm |
|---|-------------|-----|--------|------|--------|--------|

2.3 Method of Preparation

2.3.1. Collection and Authentication of Raw Materials

2.3.2. Cleaning and Washing

2.3.3. Drying

2.3.4. Size reduction (crushing)

2.3.5. Grinding

2.3.6. Sieving

2.3.7. Blending of Ingredients

2.3.8. Packaging and Storage

3. Evaluation tests

3.1 Organoleptic Evaluation

The formulation was evaluated for color, odor, texture, and appearance.

3.2 Rheological Evaluation

3.2.1 Particle Size Analysis

Particle size analysis of the prepared herbal hair mask powder was carried out by the sieve analysis method using standard sieves of different mesh sizes. The powder was passed through the sieves, and the retained quantity on each sieve was observed to determine uniformity of particle size. The formulation showed uniform and fine particle distribution, which contributed to better mixing, smooth application, and improved spreadability.

3.2.2 Bulk Density

Bulk density was determined by pouring the powder blend into a graduated measuring cylinder and recording the volume occupied before tapping. The bulk density of the prepared formulation indicated good flow properties.

3.2.3 Tapped Density

Tapped density was determined by transferring a known quantity of the powder formulation into a graduated measuring cylinder and mechanically tapping the cylinder until a constant volume was obtained. The tapped density of the formulation indicated good packing ability and acceptable flow characteristics suitable for storage, handling, and packaging.

3.2.4 Angle of Repose

The angle of repose was evaluated to determine powder flow characteristics. The prepared formulation showed satisfactory flow behavior suitable for packaging and handling.

3.2.5 Carr's Index

Carr's Index was determined using the values of bulk density and tapped density to evaluate the compressibility and flow properties of the powder formulation. The obtained value indicated good flowability and compressibility characteristics of the prepared polyherbal hair mask powder.

$$\text{Carr's Index} = \frac{\text{Tapped Density} - \text{Bulk Density}}{\text{Tapped Density}} \times 100$$

3.2.6 Hausner Ratio

Hausner Ratio was calculated using bulk density and tapped density values to assess the flow



properties of the formulation. The obtained ratio suggested satisfactory flow behavior suitable for handling and packaging. [11]

$$\text{Hausner Ratio} = \frac{\text{Tapped Density}}{\text{Bulk Density}}$$

3.3 Physicochemical Evaluations

Evaluating a polyherbal hair mask involves several phytochemical screening tests to identify the active constituents that provide hair-nourishing, anti-dandruff, or conditioning properties. These tests are typically performed on the aqueous or alcoholic extract of the hair mask.

3.3.1 Test for Alkaloids

Alkaloids in hair masks often contribute to scalp stimulation or antimicrobial activity.

Hager's Test: Add a few drops of Hager's reagent (saturated picric acid solution) to 2 ml of the extract. The formation of a bright yellow precipitate indicates the presence of alkaloids.

Mayer's Test: Add a few drops of Mayer's reagent (potassium mercuric iodide) to the extract. A creamy or white precipitate confirms the presence of alkaloids.

3.3.2 Tests for Carbohydrates and Sugars

Natural gums or starches in herbal ingredients act as binders or conditioners

Fehling's Test: Mix equal parts of Fehling's A and B solutions, add the extract, and heat. A brick-red precipitate indicates reducing sugars.

Benedict's Test: Add Benedict's reagent to the extract and heat. An orange-red precipitate indicates the presence of reducing sugars.

Barfoed's Test: Used specifically to distinguish monosaccharides from disaccharides. The formation of a red precipitate within 2–5 minutes indicates monosaccharides.

3.3.3 Tests for Proteins and Amino acids

Ingredients like hibiscus provide proteins for hair strength.

Biuret Test: Add a few drops of copper sulfate and sodium hydroxide to the extract. A violet or purple colour indicates the presence of proteins.

Millon's Test: Add Millon's reagent to the extract and heat gently. A white precipitate that turns brick red on heating indicates proteins/amino acids.

3.3.4 Tests for Specific Phytoconstituents

Foam (Froth) Test for Saponins: Shake the extract vigorously with water. Persistent stable foam for more than 10 minutes indicates saponins (natural cleansing agents).

Shinoda Test for Flavonoids: Add magnesium turnings and concentrated HCl to the extract. The appearance of a pink, red, or purple colour indicates flavonoids (antioxidants).

Ferric Chloride Test for Tannins/Phenols: Add neutral 5% ferric chloride solution. A greenish-black or bluish-black colour indicates tannins or phenolic compounds. [12]

3.4 General Powder Characteristics

3.4.1 Moisture Content

Moisture content of the herbal hair mask was determined by drying a known quantity of the formulation at suitable temperature until a constant weight was obtained. Low moisture content



indicated better stability and reduced chances of microbial growth.

3.4.2 Ash Value

Ash value was determined by incinerating the formulation in a silica crucible until carbon-free ash was obtained. The test confirmed the purity and quality of the herbal ingredients present in the formulation.

3.4.3 pH Determination

The pH of the prepared herbal hair mask was determined using pH meter. The observed pH was found suitable for scalp and hair application.

3.4.4 Spreadability Test

Spreadability of the herbal hair mask was evaluated by applying the prepared paste on a glass slide to observe ease of spreading and uniform application. The formulation showed good spreadability.

3.4.5 Washability Test

Washability was evaluated by applying the herbal hair mask on hair and washing it with water. The formulation was easily removed without leaving excessive residue on hair and scalp.

3.4.6 Skin Irritation Test

The skin irritation test was performed by applying a small amount of the formulation on a small area of skin and observing for redness, itching, irritation, or allergic reactions. No significant irritation was observed, indicating that the formulation was safe for topical application. [13]

4. Result and Discussion

4.1 Organoleptic Evaluation

| Parameter | Observation |
|------------|----------------------|
| Color | Brownish green |
| Odor | Pleasant herbal odor |
| Texture | Smooth and fine |
| Appearance | Free-flowing powder |

4.2 Rheological Evaluation

| Sr. No. | Tests | Batch 1 | Batch 2 | Batch 3 | Batch 4 | Batch 5 |
|---------|---------------------|-----------------|----------------|--------------------|------------------------|----------------|
| 1 | Particle size | Moderately fine | Fine & uniform | Fine & homogeneous | Fine & slightly coarse | Fine & uniform |
| 2 | Bulk density | 0.42 g/ml | 0.44 g/ml | 0.43 g/ml | 0.41 g/ml | 0.45g/ml |
| 3 | Tapped density | 0.51 | 0.53 | 0.52 | 0.50 | 0.54 |
| 4 | Angle of repose (°) | 31.5 | 30.8 | 31.2 | 32.4 | 30.1 |
| 5 | Carr's index | 17.6 | 16.98 | 17.30 | 18 | 16.67 |
| 6 | Hausner ratio | 1.21 | 1.20 | 1.21 | 1.22 | 1.20 |

4.3 Phytochemical Evaluation

| Sr. No. | Test | Observation | Interpretation |
|---------|-----------------|--------------------------|---|
| 1 | Hager's Test | Yellow precipitate | Alkaloids are present |
| 2 | Mayer's Test | Cream colour precipitate | Alkaloids are present |
| 3 | Fehling's Test | Brick red precipitate | Reducing sugars are present |
| 4 | Benedict's Test | Orange red precipitate | Reducing sugars/ Carbohydrates are present |
| 5 | Barfoed's Test | Red precipitate | Monosacchrides are present |



| | | | |
|----|----------------------|--|--|
| 6 | Biuret Test | Light violet colouration | Proteins are present |
| 7 | Millon's Test | White precipitate turns red on heating | Proteins are present |
| 8 | Foam Test | Persistent stable foam | Saponins are strongly present |
| 9 | Shinoda Test | Pink/ red colouration | Flavonoids are present |
| 10 | Ferric chloride Test | Dark green/ blue black colouration | Phenolic compounds and tannins are present |

4.4 General Powder Characteristics

| Sr. No. | Test | Observation |
|---------|------------------|--------------|
| 1 | Moisture Content | 8.0% w/w |
| 2 | Ash value | 9.0% |
| 3 | pH determination | 5.8 |
| 4 | Spreadability | Good |
| 5 | Washability | Good |
| 6 | Skin irritation | Non irritant |

The prepared polyherbal hair mask demonstrated satisfactory physicochemical and cosmetic properties [14]. The synergistic action of herbal ingredients contributed to improved hair health and scalp nourishment. Amla and curry leaves provided antioxidant activity and strengthened hair follicles. Neem contributed anti-dandruff and antimicrobial properties. Fenugreek and aloe vera improved moisturization and conditioning, while shikakai acted as a natural cleanser. The developed formulation was found to be cost-effective, simple to prepare, user-friendly, and suitable for routine hair care applications. The combination of natural herbal powders enhanced the overall cosmetic acceptability of the formulation while minimizing the possibility of adverse reactions generally associated with synthetic preparations. The absence of synthetic chemicals minimized the possibility of adverse effects associated with commercial cosmetic products.

The study confirms that herbal formulations can serve as promising alternatives to synthetic hair care products [15].

5. Future Scope

The developed polyherbal hair mask has significant future potential in the herbal cosmetic industry. Further studies can be conducted to evaluate advanced clinical efficacy, microbial stability, preservative optimization, and commercial-scale manufacturing. The formulation may also be modified by incorporating essential oils, proteins, vitamins, or natural preservatives to improve cosmetic acceptability and therapeutic activity.

Future research can include:

Clinical studies on larger populations.

Comparative studies with marketed formulations.

Long-term stability studies.



Development of ready-to-use paste formulations.

Commercial packaging and branding.

CONCLUSION

The present work successfully demonstrated the formulation and evaluation of a herbal hair mask composed of multiple plant-based ingredients traditionally recognized for their beneficial effects on hair and scalp health. The formulation exhibited satisfactory physicochemical properties, good stability, excellent spreadability, and ease of washability. The herbal ingredients used in the formulation provided multiple benefits including scalp nourishment, dandruff reduction, hair strengthening, conditioning, and improved hair texture. The formulation was found to be safe, economical, eco-friendly, and free from harmful synthetic chemicals. The results suggest that the prepared polyherbal hair mask can be effectively used as a natural cosmetic preparation for enhancing overall hair health. Further studies involving clinical evaluation and advanced stability studies may help establish the long-term efficacy and commercial potential of the formulation.

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