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## FORMULATION AND EVALUATION OF HERBAL HAIR MASK

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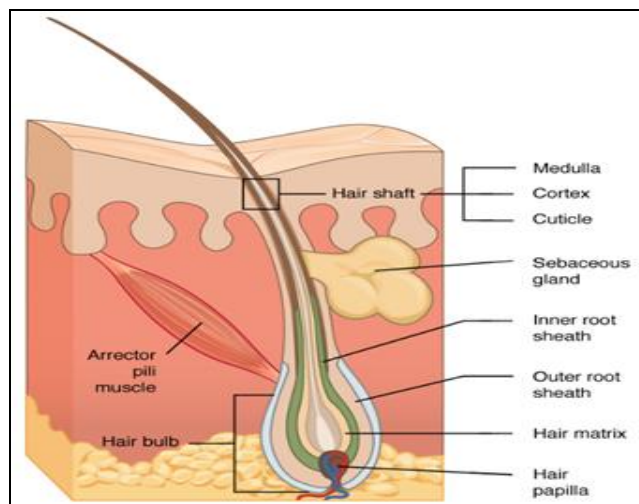
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**ABSTRACT:** The present study focuses on the formulation and evaluation of a herbal hair mask using natural ingredients as a safer alternative to synthetic hair care products. The formulation incorporates plant-based components such as flaxseed, fenugreek, aloe vera, and hibiscus, which are known for their nourishing, conditioning, and hair growth-promoting properties. The hair mask was prepared using Carbopol 940 as a gelling agent, glycerin as a humectant, sodium benzoate as a preservative, and triethanolamine for pH adjustment. Two formulations (F1 and F2) were developed and evaluated for various parameters including organoleptic properties, pH, spreadability, stability, and skin irritation. The prepared formulations exhibited a pleasant odor, smooth texture, and appropriate pH suitable for scalp application. Stability studies showed no significant changes in color, odor, texture, or pH under different storage conditions, indicating good stability. The skin irritation test confirmed that the formulation was non-irritant and safe for topical use. Overall, the herbal hair mask demonstrated effective conditioning, moisturizing, and potential anti-dandruff and hair-strengthening properties. The study concludes that the formulated herbal hair mask is a safe, stable, and effective natural alternative for maintaining healthy hair.

**INTRODUCTION:** Hair promotes well-being in people and also protects the scalp from solar radiation and mechanical abrasion. The development of hair care formulations is important for the treat and protect the hair fiber from daily external hair aggressions. The primary functions of hair care formulations improve the physical properties of the hair fiber, such as texture, strength, and combability. The secondary functions are the improve of sensory properties, such as brightness, frizz reduction and hair film formation<sup>1</sup>. Hair is simple in structure made of the root and shaft. The root is enclosed in the hair follicle, hair shaft is the part of the hair seen above tin incin Hair is made up of tough protein called keratin that forms the strength of hair.

Keratin is a large molecule made up of smaller units called amino acids, which join together to form a chain. Hair structure is made up of different layers and structures. The hair follicle is the centre of the biological activity like hair growth, pigmentation; whereas the hair shaft is considered to be dead and is mainly made of protein.

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**FIG. 1: STRUCTURE OF HAIR**

Hair grows from the follicle, or root, underneath the skin. The hair is 'fed' by blood vessels at the base of the follicle, which give it the nourishment it needs to grow. Between starting to grow and falling out years later, each hair passes through four stages: anagen, catagen, telogen and exogen. Another stage kenogen, has been recently realised. Every hair is at a different stage of the growth

cycle. Over time, the length of the anagen stage decreases. Therefore, the hair may become weaker and thinner after each cycle. That is why it is important to ensure diet rich in specific nutrients to maintain normal, healthy hair growth. If hairs enter the resting phase too early, excess shedding and noticeable thinning of the hair can occur<sup>2</sup>.



FIG. 2: STAGES OF HAIR GROWTH

### Problem Related to Hair<sup>3</sup>:

**Dandruff:** It is mainly caused by the overgrowth of a yeast-like fungus called *Malassezia* on the scalp, leading to irritation and flaking.

**Dry Hair:** Dry hair is caused by insufficient moisture or natural oils in the hair shaft due to factors like environmental damage, excessive heat styling, or reduced sebum production.

**Oily Hair:** Oily hair is caused by overactive sebaceous glands producing excess sebum on the scalp, leading to greasy hair.

**Frizzy Hair:** Frizzy hair is caused by a lack of moisture in the hair cuticle, leading it to absorb humidity from the air and swell unevenly.

**Grey Hair:** Grey hair is caused by a reduction in melanin production in hair follicles, often due to aging, genetics, or oxidative stress.

**Importance of Herbal Cosmetics and Their Demand in the Market:** In the history of cosmetics, Egyptians were known to recognize the benefits of cosmetics in the early days. Earlier natural and herbal products were predominantly used to enhance skin tone, radiance, hair growth, fragrance, and various dermatological conditions<sup>6</sup>.

Later in the 19th century, the chemical formulation known as cosmetics became popular over time since it was proven to give the same effect as that of natural products for improving beauty and appearance<sup>7</sup>.

The Discovery of hydroxyl acids used against wrinkles marked the rapid expansion of the cosmeceutical industry. Raymond Reed, the founder of the United States Society of Cosmetic chemists coined the term cosmeceuticals. Albert M Kligman in 1970, used retinoic acid in a formulation to improve the appearance of skin damaged by ultraviolet (UV) radiation and wrinkles<sup>8,9</sup>.

Although the cosmetics improved the appearance, their extensive use leads to severe side effects such as endocrine disorders, cosmetic-linked melanoma, stillbirths, birth defects, even severe lung diseases,<sup>10</sup> which led to change over from chemicals to natural or herbal extracts<sup>5</sup>. Considering these side effects, the cosmeceutical industries started working on a stable formulation containing natural and herbal extracts (ingredients) in place of chemicals that had mere side effects compared to cosmetics, hence herbal cosmeceuticals became a current trend again in the market<sup>4</sup>.

The zero or mere side effects from the herbal cosmeceuticals gained the trust of customers and hence boomed in the market <sup>11</sup>. Now the herbal cosmeceuticals used are in more demand worldwide compared to synthetic cosmeceuticals <sup>12</sup>.

**Herbal Hair Mask:** Herbal hair mask formulations are designed to cleanse, change the texture, change the colour, revitalize stressed hair, nourish hair, and give hair a healthy appearance are all considered hair cosmetics. Hair types vary from person to person and include dry hair, greasy hair, as well as normal hair. Nowadays, people don't have time to think about how they look problems relating to hair, such as split ends, dandruff, white hair, hair loss, etc. Hair issues are brought on by stress, infections of the scalp, hormone imbalances, inadequate consumption of vitamins, food, and minerals, and overuse of chemical shampoos <sup>13-14</sup>. Products that are used for cleaning, texture modification, color change, revitalizing stressed hair, nourishing hair, and giving hair a healthy appearance are referred to as hair care products. Dandruff is a significant and prevalent issue these days that is brought on by these products used in daily life. The main purposes of hair care formulas are to enhance the physical characteristics of the hair fiber, including its strength, and texture. The enhancement of sensory qualities like brightness, frizz reduction, and hair film development are the secondary purposes <sup>15</sup>.

It has cultural and aesthetic value in addition to being crucial in protecting the scalp from the elements such the sun and cold. These days, maintaining a clean scalp and hair is one of the most important parts of one's personal life. The hair is the most important part of the body. We therefore created a hair mask, hair shampoo and hair serum formula, to take care of them. The advantages of the herbal hair mask's ingredients for Hair are well-known. Vitamin E, coconut oils are also included in the hair mask, hair serum and shampoo and are applied to the hair. These herbal hair products are made without the use of any chemicals. Since it only contains natural ingredients, it doesn't harm your hair. Hair is a sign of excellent health and a sensitive organ. We might use an herbal hair mask to help hydrate our hair. They are extremely beneficial for dry and damaged

hair. Adopting a healthy lifestyle and selecting products containing these elements support the general health of hair <sup>16</sup>. Our scalp's health and the strength of our hair can both be enhanced by a hair mask. These hair products are made at home, are very beneficial, and have no side effects. Many materials can be used to create these products. These products are very beneficial for persons whose hair is severely damaged or extremely thin. Our personalities are more attractive when we have nice hair. Although there are many different types of masks available, many of them contain chemicals. Thus, we produced a product using herbs. The process of creating hair mask, shampoo and serum is very easy. Herbs are widely used as therapeutic agents due to their affordability, accessibility, and safety. The global market is seeing an increase in demand for herbal formulations. The main objective of our study was to fully resolve this difficulty. For hair care, we therefore developed a multifunctional herbal anti-dandruff, conditioning, and anti-hair fall mask <sup>17</sup>.

### Plant Profile of Ingredient:

#### Flax Seeds:



FIG. 3: FLAXSEED

**Biological Source:** *Linum usitatissimum* Linn.

**Family:** *Liliaceae*.

**Kingdom:** Plantae (Plants).

**Subkingdom:** Trophobiont (Vascular Plant).

**Subdivision:** Spermatophyta (Seed Plant).

**Division:** Magnoliophyta.

**Class:** Magnoliopsida (Dicotyledons).

**Subclass:** Rosidae.

**Genus:** *Linum* L.

**Species:** *Usitatissimum* L.

**Constituents:** The flax seeds contain 35-45% oil which contain 9-10% of saturated fatty acids (palmitic and steric) about 20% monosaturated fatty acids (mainly oleic acid), and more than 70% alpha-linolenic acid fatty acid. The protein content in the seed of flax varies from 20-30.

**Uses:** Flax seeds is the power house of nutrients, vitamins and healthy fats, all of which may help to:

**Teart:** The Scalp

**Prevent:** The Hair Loss

**Promote:** Hair Growth<sup>18, 19</sup>

**Aloe Vera:**



FIG. 4: ALOE VERA

**Family:** *Asphodelaceae*

**Biological Source:** *Aloe perryi*

**Subfamily:** *Asphodelodeae*

**Kingdom:** *Plantae*

**Class:** *Liliopida-Monocotyledons*

**Order:** *Liliales*

**Genus:** *Aloes*

**Constituent:** The gel of Aloe vera contains polysaccharides like acemannan that provide moisturizing and healing effects. It is rich in vitamins A, C, E, and B-complex, along with enzymes such as amylase and lipase. Anthraquinones like aloin offer antimicrobial action, while saponins provide cleansing properties.

It also contains lignin for better penetration, salicylic acid for anti-inflammatory effects, and minerals like calcium, magnesium, and zinc.

**Uses:**

- ❖ Aloe vera is most beneficial for our hair.
- ❖ It helps to stop the hair fall.
- ❖ It repairs dead skin cells on the scalp.
- ❖ It gives shine to our hairs and it act as great conditioner and
- ❖ leaves our hair all smooth and shiny.
- ❖ It promotes the growth of hairs.
- ❖ Aloe vera prevents itching on the scalp and reduces dandruff and conditions our hair<sup>20</sup>.

**Hibiscus:**



FIG. 5: HIBISCUS

**Biological Source:** *Hibiscus rosa-sinensis*

**Family:** *Malvaceae*

**Kingdom:** *Plantae*

**Division:** *Tracheophyte*

**Class:** *Magnoliopisida*

**Genus:** *Hibiscus* L

**Species:** *Rosa Sinensis* L

**Constituents:** The leaves and flowers of *Hibiscus rosa-sinensis* contain flavonoids and anthocyanins with strong antioxidant activity. It is rich in mucilage, which provides moisturizing and conditioning effects. Tannins offer astringent

properties, while saponins aid in gentle cleansing. The plant also contains organic acids like citric and malic acid for pH balance, along with vitamins (C and A) and minerals such as calcium and iron that support scalp and hair health.

#### Uses:

- ❖ Promotes hair growth
- ❖ Reduces hair fall
- ❖ Prevents dandruff
- ❖ Acts as a natural hair conditioner
- ❖ Delays premature greying<sup>21</sup>

#### Fenugreek Seeds:



FIG. 6: FENUGREEK SEEDS

**Botanical Name:** *Triglmellafoenum-graecum*

**Family:** Fabaceae

**Kingdom:** Plantae

**Division:** Magnoliophyta

**Class:** Mangnoliopsida

**Family:** Fabaceae

**Genus:** Trigonella

**Species:** *Foenum-graecum* Linn

**Constituents:** Fenugreek seeds contain a rich variety of bioactive constituents, including alkaloids (trigonelline), steroidal saponins (diosgenin), flavonoids, and glycosides.

They are also high in dietary fiber, proteins, and essential amino acids like lysine and tryptophan.

The seeds contain vitamins such as vitamin A, B-complex, and C, along with minerals like iron, calcium, and phosphorus. Additionally, mucilage compounds contribute to their soothing and moisturizing properties, especially in hair and skin applications.

#### Uses:

- ❖ Promotes hair growth and strengthens hair
- ❖ Reduces dandruff and conditions dry scalp
- ❖ Helps control blood sugar levels
- ❖ Aids digestion and relieves constipation
- ❖ Lowers cholesterol levels<sup>22</sup>

#### Aim and Objective:

**Aim:** Formulation and evaluation of herbal hair mask.

**Objective:** The objective of formulating and evaluating a herbal hair mask is to develop a safe, effective, and natural alternative to synthetic hair care products using plant-based ingredients. The formulation aims to promote hair growth, reduce dandruff, nourish the scalp, and improve hair texture and strength.

Evaluation parameters include physical appearance, pH, consistency, spreadability, stability, and microbial safety. Additionally, the study assesses its effectiveness in conditioning, and enhancing overall hair health, ensuring the product is stable, user-friendly, and suitable for regular use without adverse effects.

#### MATERIALS AND METHOD:

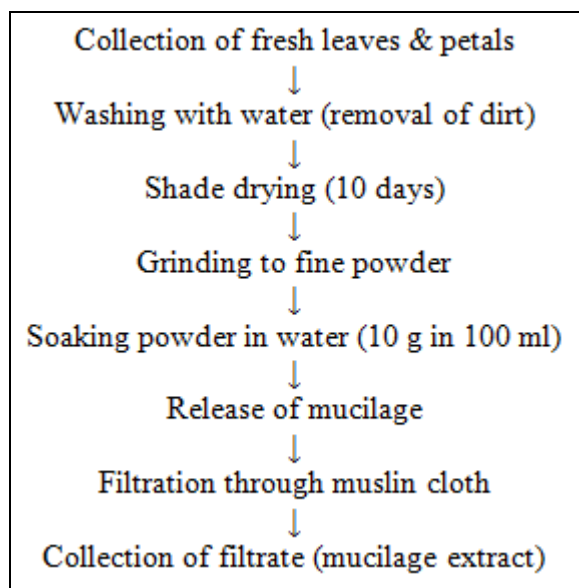
TABLE 1: THE INGREDIENT USED IN HERBAL HAIR MASK

Sr. no.	Ingredient	Uses
1.	Flaxseed Mucilage	Conditioning
2.	Fenugreek Seed Mucilage	Strengthening
3.	Aloe Vera Gel	Moisturizing
4.	Hibiscus Mucilage	Nourishing
5.	Carbopol 940	Thickening
6.	Sodium Benzoate	Preservative
7.	TEA(Triethanolamine)	Neutralizer/pH Adjuster
8.	Glycerin	Hydrating
9.	Lavender Oil	Fragrance
10.	Distilled Water	Solvent



FIG. 7: CHEMICALS

**Extraction of Hibiscus Mucilage:** Flow Chart:  
Extraction of Mucilage from *Hibiscus rosa-sinensis*.



#### Preparation of Flaxseed Mucilage:

- ❖ Added the flaxseeds to the water.
- ❖ Boiled this water for around 10 min. and keep stirring to avoid flaxseeds from sticking to the base.
- ❖ Let the gel cooled down.
- ❖ Put the muslin cloth in a glass measuring cylinder to strain it.

#### Preparation of Fenugreek Mucilage:

- ❖ Soak the fenugreek seeds in hot water.
- ❖ Allow to soak for 3-4 hours or overnight.
- ❖ Heat the soaked mixture gently for 5-10 minutes to enhance mucilage release.
- ❖ Grind the soaked fenugreek seeds into a smooth paste.
- ❖ Filter through muslin cloth to extract smooth mucilage, if a clearer gel is desired.

TABLE 2: LIST OF INSTRUMENT USED

Sr. no.	Instruments
1	Electric pH Meter
2	Homogenizer
3	Auto Clave
4	Incubator
5	Hot air oven
6	Weighing Balance

TABLE 3: LIST OF APPARATUS USED

Sr. no.	Apparatus
1	Beakers
2	Glass rod
3	Tripod stand
4	Water bath
5	Mortar & pestel
6	Pair of tongs
7	Measuring cylinder
8	Glass slides
9	Petriplates
10	Weight Box
11	Spatula

**TABLE 4: COMPOSITION OF BATCHS**

Sr. no.	Ingredients	F1	F2	F3	F4	F5
1	Flaxseed Mucilage	20g	25g	22 g	24 g	23 g
2	Fenugreek Seed Mucilage	15g	15g	16 g	14 g	15 g
3	Aloe Vera Gel	20g	20g	22 g	21 g	19 g
4	Hibiscus Mucilage	10g	10g	11 g	9 g	10 g
5	Carbopol 940	1g	1g	1 g	1 g	1 g
6	Sodium Benzoate	0.5g	0.5g	0.5 g	0.5 g	0.5 g
7	TEA (Triethanolamine)	2-3 drops	2-3 drops	2-3 drops	2-3 drops	2-3 drops
8	Glycerin	5g	5g	5g	5g	5g
9	Distilled Water	q.s	q.s	q.s	q.s	q.s

**Formulation Method of Herbal hair Mask:****Step 1: Preparation of Gel Base<sup>24</sup>:**

- ❖ Take a required quantity of distilled water in a clean beaker.
- ❖ Add Carbopol 940 (0.5–1%) slowly with continuous stirring using a glass rod to avoid lump formation.
- ❖ Allow it to hydrate for 1–2 hours until a uniform dispersion is obtained.

**Step 2: Addition of Humectant and Preservative<sup>23</sup>:**

- ❖ Add glycerin (5–10%) to the hydrated Carbopol dispersion and mix thoroughly.
- ❖ Dissolve sodium benzoate (0.2–0.5%) in a small amount of distilled water and add to the mixture with continuous stirring.

**Step 3: Incorporation of Herbal Mucilage<sup>23</sup>:**

Add the following gels one by one with continuous stirring:

- ❖ Flaxseed mucilage
- ❖ Fenugreek seed mucilage
- ❖ Aloe vera gel
- ❖ Hibiscus mucilage
- ❖ Mix using a homogenizer to obtain a smooth and uniform consistency.

**FIG. 8: HOMOGENIZER****Step 4: Neutralization and Gel Formation<sup>23</sup>:**

- ❖ Add Triethanolamine (TEA) dropwise while stirring.
- ❖ Continue until the formulation thickens and forms a clear gel.
- ❖ Adjust pH to 5.5–6.5 using a pH meter.

**Step 5: Final Mixing:**

- ❖ Stir the formulation continuously to ensure uniform distribution of all ingredients.
- ❖ Remove any entrapped air by allowing the gel to stand undisturbed.

**Step 6: Filling and Storage:**

- ❖ Transfer the prepared gel into clean, airtight containers.
- ❖ Store at room temperature away from direct sunlight.

**Evaluation Parameters:**

**Organoleptic Properties:** In this test, the hair mask was observed for colour, odour, texture, etc.

**Colour:** Reddish

**Odour:** Pleasant, characteristic lavender odour

**Appearance:** Gel

**pH test:** The pH of the herbal hair mask formulations was measured using a calibrated digital pH meter.

A 1% aqueous solution of each formulation was prepared using distilled water, and the pH was recorded at room temperature. The pH values were found within the range of 5.5–6.5, which is suitable for scalp application and helps maintain the natural balance of hair and scalp.



FIG. 9: pH METER

**Spreadability Test:** The Spreadability was expressed in terms of time in seconds taken by two glass plates to slip off from the formulation, placed in between the plates, under certain load lesser the time taken for separation of the two glass plates better the Spreadability. Two sets of glass plates of standard dimension were taken. Then one plates of suitable dimension was taken and the formulation was placed on that plate. Then other plate was placed on the top of the formulation. Then a weigh of 20g was placed on the upper plate so that the formulation between the two plates was pressed uniformly to form a thin layer.

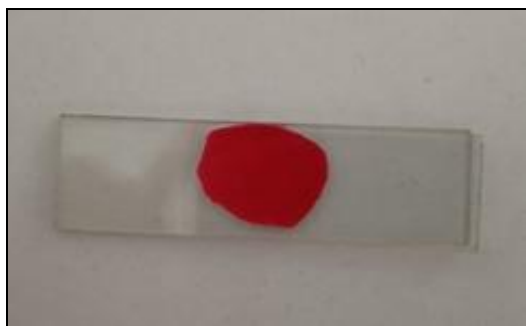


FIG. 10: SPREADABILITY TEST

**Stability Studies:** The formulation was stored for some time under different temperatures (35°C to 40°C) and humidity conditions and the change in the physical properties was not observed.

TABLE 5: STABILITY STUDIES

Sr. no.	Parameter	Result
1	Change in colour	No change
2	Change in odor	No change
3	Change in texture	No change
4	Change in pH	No change

TABLE 6: COMPARATIVE STUDY OF FORMULATION BATCHES

Evaluation Parameters	F1	F2	F3	F4	F5
Color	Light reddish brown	Reddish brown	Brownish red	Dark reddish brown	Reddish brown
Texture	Smooth	Smooth & uniform	Smooth	Slightly thick	Smooth

**Skin Irritation Test:** Mark the area (1cm) on left hand surface, then the mask was applied to the area and the time was noted. This is checked for irritancy, erema if any for an interval up to 24 hr and reported.



FIG. 11: SKIN IRRITATION TEST

**Comparative Study of Formulation Batches:** A comparative evaluation of all formulation batches (F1–F5) was carried out to identify the optimized herbal hair mask formulation. Variations in the concentration of flaxseed mucilage, fenugreek mucilage, aloe vera gel, and hibiscus mucilage influenced the physicochemical characteristics of the formulations.

F1 showed good stability and acceptable performance but comparatively lower spreadability and consistency than F2. F3 demonstrated very good texture and overall performance; however, its spreadability and acceptability were slightly lower than F2.

F4 exhibited a thicker consistency and moderate spreadability, which affected ease of application and overall acceptability. F5 showed satisfactory stability and performance but did not match the uniform texture and ideal consistency observed in F2.

Among all batches, F2 demonstrated the most balanced formulation with excellent spreadability, smooth and uniform texture, ideal pH, superior stability, pleasant odor, and better washability. Therefore, F2 was selected as the optimized formulation for the herbal hair mask preparation.

Odor	Pleasant	Pleasant	Pleasant	Slightly strong	Pleasant
pH	5.7	5.9	6.0	6.1	6.3
Spreadability	Good	Excellent	Very good	Moderate	Good
Stability	Stable	Highly stable	Stable	Stable	Stable
Skin Irritation	Not observed	Not observed	Not observed	Mild redness	Not observed
Consistency	Good	Excellent	Very good	Thick	Good
Washability	Good	Excellent	Good	Moderate	Good
Overall Performance	Stable & effective	Highly stable & effective	Stable & effective	Effective	Stable & effective
Overall Acceptability	Good	Excellent	Very good	Good	Very good

## RESULT AND DISCUSSION:

**Result:** All five formulations (F1–F5) of the polyherbal hair mask were successfully prepared and evaluated for various physicochemical parameters such as color, texture, odor, pH, spreadability, stability, consistency, washability, skin irritation, overall performance, and acceptability. The formulations showed satisfactory characteristics with no significant irritation or instability observed during evaluation. Among all formulations, F2 exhibited the best overall performance. It showed a reddish-brown appearance with a smooth and uniform texture, pleasant odor, ideal pH (5.9), excellent spreadability, good consistency, superior washability, and high stability. No skin irritation was observed with F2, indicating its safety for topical application. The formulation also demonstrated better overall acceptability compared to the other formulations. Hence, based on the evaluation parameters, F2 was considered the optimized and ideal formulation for the herbal hair mask preparation due to its superior physicochemical properties, stability, ease of application, and user acceptability.

**DISCUSSION:** The results of the present study demonstrate that the formulated herbal hair mask is effective, stable, and safe for topical application. The use of natural ingredients such as flaxseed, fenugreek, aloe vera, and hibiscus plays a significant role in improving the overall quality and performance of the formulation. These ingredients are known for their moisturizing, conditioning, and hair-strengthening properties, which contribute to better hair health. The pH range of 5.5–6.5 ensures compatibility with the scalp, minimizing the risk of irritation and maintaining the natural balance of hair. Good spreadability of the formulation enhances ease of application and uniform distribution. Stability studies confirm that the

formulation retains its physical characteristics under varying conditions, indicating good shelf life. The absence of skin irritation further supports its safety for regular use. Overall, the study highlights that herbal formulations can serve as effective alternatives to synthetic products with minimal side effects and improved consumer acceptability.

**CONCLUSION:** The present study focused on the formulation and evaluation of a herbal hair mask using natural ingredients as a safe and effective alternative to synthetic hair care products. The formulation was developed using flaxseed, fenugreek, aloe vera, and hibiscus, which are well known for their nourishing, conditioning, and hair growth-promoting properties. Two formulations (F1 and F2) were prepared and evaluated for various parameters such as organoleptic characteristics, pH, spreadability, stability, and skin irritation. The results indicated that both formulations possessed desirable properties, including appropriate pH, good consistency, and ease of application. Stability studies confirmed that the formulations remained stable under different temperature conditions without significant changes in physical properties. The skin irritation test showed that the herbal hair mask is safe and non-irritant for topical use. Overall, the study concludes that the formulated herbal hair mask is an effective, stable, and economical product that can improve hair health by providing conditioning, moisturizing, and protective effects, making it a suitable alternative to conventional synthetic hair care products.

**CONCLUSION:** The present study concludes that the formulated herbal hair mask is a safe, stable, and effective alternative to synthetic hair care products. The use of natural ingredients such as flaxseed, fenugreek, aloe vera, and hibiscus provides multiple benefits, including nourishment,

conditioning, reduction of dandruff, and improvement in overall hair texture and strength. The evaluation parameters confirmed that the formulation possesses suitable pH, good spreadability, stability under varying conditions, and is non-irritant to the skin, ensuring its suitability for regular use. The significance of this formulation lies in its reliance on herbal components, which minimizes the risk of harmful side effects commonly associated with chemical-based products. It also offers an economical and easily accessible solution for maintaining healthy hair. The potential applications of this herbal hair mask include its use as a natural conditioning agent, anti-dandruff treatment, and hair-strengthening product in both personal and commercial hair care sectors. Future scope of the study includes further clinical evaluation on a larger population, long-term stability studies, and incorporation of additional herbal extracts to enhance efficacy and broaden its therapeutic applications.

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**CONFLICT OF INTEREST:** Nil

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