



# International Journal of Research Publication and Reviews

Journal homepage: [www.ijrpr.com](http://www.ijrpr.com) ISSN 2582-7421

## Formulation and Evaluation of Hair Mask Gel

**Dr.D.Nirmala\*, Gopagoni Akshitha, Gunnam Laxmi Rushita, Gonepally Rakshitha**

Gummididi Jahnvi Sai Sreya, Jatavath Swarnalatha Malla Reddy college of pharmacy, Secunderabad, affiliated to Osmania University, Hyderabad-500100  
Mail Id:[dasarinnirmala1980@gmail.com](mailto:dasarinnirmala1980@gmail.com)

### ABSTRACT

The present study focuses on the formulation of a herbal hair mask gel using a synergistic blend of natural ingredients that offer multiple therapeutic benefits for hair and scalp health. The gel was enriched with fenugreek extract, which is known for its high protein and flavonoid content that strengthens hair follicles, prevents dandruff, and promotes hair growth. Hibiscus extract was incorporated for its hair-conditioning properties, as it nourishes the scalp, improves hair thickness, and delays premature greying. Flaxseed extract, rich in omega-3 fatty acids and mucilage, acts as a natural conditioner, adding shine and smoothness to the hair while reducing frizz. Aloe vera gel, well-known for its soothing and moisturizing properties, helps maintain scalp hydration, reduces irritation, and supports healthy hair growth. The base of the formulation included Carbopol 940 as the gelling agent to achieve the desired consistency, triethanolamine (TEA) for pH adjustment, glycerin as a humectant to lock in moisture, vitamin E as an antioxidant to protect hair from oxidative stress, and distilled water as the solvent. Among the prepared batches, Formulation F2 was selected as the optimized formulation based on its favorable evaluation results. It exhibited ideal pH (compatible with the scalp), excellent viscosity, smooth texture, good spreadability, easy washability, and stable appearance without phase separation. The formulation was also homogeneous, with no signs of clumping or instability over the observation period. These evaluation parameters confirm that F2 possesses desirable physicochemical and aesthetic qualities. Overall, the F2 herbal hair mask gel is a stable, effective, and safe formulation that utilizes the benefits of natural herbal extracts for holistic hair care, offering a promising alternative to synthetic hair care products.

### INTRODUCTION

Hair is an integral part of human identity, playing a vital role in both appearance and self-esteem. In today's world, factors such as environmental pollution, chemical treatments, poor dietary habits, and excessive use of synthetic hair care products contribute to a wide range of hair-related issues, including hair fall, dandruff, dryness, split ends, and thinning. (Singh & Kumar, 2020;

Sharma et al., 2019) To address these concerns, modern cosmetic science is increasingly turning to natural, herbal solutions that are both effective and safe. Among these, hair mask gels have emerged as a highly beneficial formulation for deep conditioning and scalp nourishment. (Gupta & Thakur, 2021).

A hair mask gel is a semi-solid, rinse-off treatment designed to deliver intense hydration and nourishment to the hair and scalp. Unlike regular conditioners or oils, hair masks are intended to remain on the hair for a longer duration, typically 15 to 30 minutes, to allow active ingredients to penetrate the cuticle and reach the deeper layers of the hair shaft and follicles. (Rathi & Pandey, 2020) Gels offer significant advantages over other formulations due to their non-greasy texture, easy spreadability, aesthetic appeal, and ease of removal. Herbal hair mask gels, in particular, combine traditional medicinal knowledge with the stability and elegance of pharmaceutical gels, offering a natural and holistic approach to hair care. (Bhatia et al., 2021).

This project focuses on the formulation and evaluation of a polyherbal hair mask gel using a carefully selected combination of plant-based ingredients. Fenugreek (*Trigonella foenum-graecum*) is used for its rich protein content and ability to reduce dandruff and strengthen hair roots. Hibiscus (*Hibiscus rosa-sinensis*) promotes hair growth and adds volume and shine. (Mishra et al., 2018). Flaxseed (*Linum usitatissimum*) is an excellent source of omega-3 fatty acids, which nourish the scalp and improve hair elasticity. Aloe vera (*Aloe barbadensis*) provides moisturizing and anti-inflammatory benefits, soothing the scalp and enhancing hair smoothness. (Kumar et al., 2020). Vitamin E (tocopherol) is a potent antioxidant that improves scalp circulation and protects hair follicles from oxidative damage. (Gupta & Sharma, 2021) These herbal components are incorporated into a stable gel base using carbopol 940 as the gelling agent, glycerin as the humectant, and triethanolamine (TEA) as the pH adjuster and gel neutralizer. (Rao et al., 2022).

To understand the function and impact of hair care formulations, it is essential to consider the anatomy of hair. Hair consists of two main parts: the hair shaft and the hair root. The hair shaft is the visible part of the hair and is composed of three layers—cuticle, cortex, and medulla. The cuticle is the outermost layer, made up of overlapping cells that protect the inner structure. The cortex forms the bulk of the hair strand and contains melanin and keratin, determining the strength and color of the hair. The medulla, found only in coarse hair, is the innermost layer composed of loosely packed cells. (Robbins, 2012) Beneath the scalp lies the hair root, which is housed in the hair follicle. At the base of the follicle is the hair bulb, containing the

dermal papilla and matrix cells, which are responsible for hair production and growth. The sebaceous glands associated with the follicle secrete sebum, a natural oil that lubricates and protects the hair and scalp.(Wolfram, 2003)

The health of the hair is intrinsically linked to the nourishment and condition of both the hair shaft and the follicular environment. Effective hair care products should therefore support both structural integrity and biological activity. Herbal hair mask gels, with their water-based gel systems and botanical actives, offer a unique opportunity to provide intensive care without the drawbacks of synthetic formulations. (Bhatia et al., 2021) This study aims to develop a natural, stable, and effective herbal hair mask gel that can provide therapeutic and cosmetic benefits to the hair and scalp through a scientifically informed approach grounded in traditional herbal wisdom.

### **Anatomy and Physiology of Hair**

Hair is a specialized, keratinized structure of the integumentary system. It is found almost all over the human body except on the palms, soles, lips, and certain external genitalia.(Robbins, 2012). Hair plays various roles such as protection, regulation of body temperature, and sensation. It also holds aesthetic and social significance in humans.(Wolfram, 2003)

The anatomy of hair can be broadly classified into two main parts: the hair shaft (the visible part) and the hair follicle (the part beneath the skin). Together, these structures support hair growth, pigmentation, and the hair cycle. (Patel & Sharma, 2021).

#### **Hair Shaft**

The hair shaft is the portion of hair that projects above the surface of the skin. It is composed of dead, keratinized cells, which are arranged in a three-layered structure:(Robbins, 2012)

##### **1. Cuticle:**

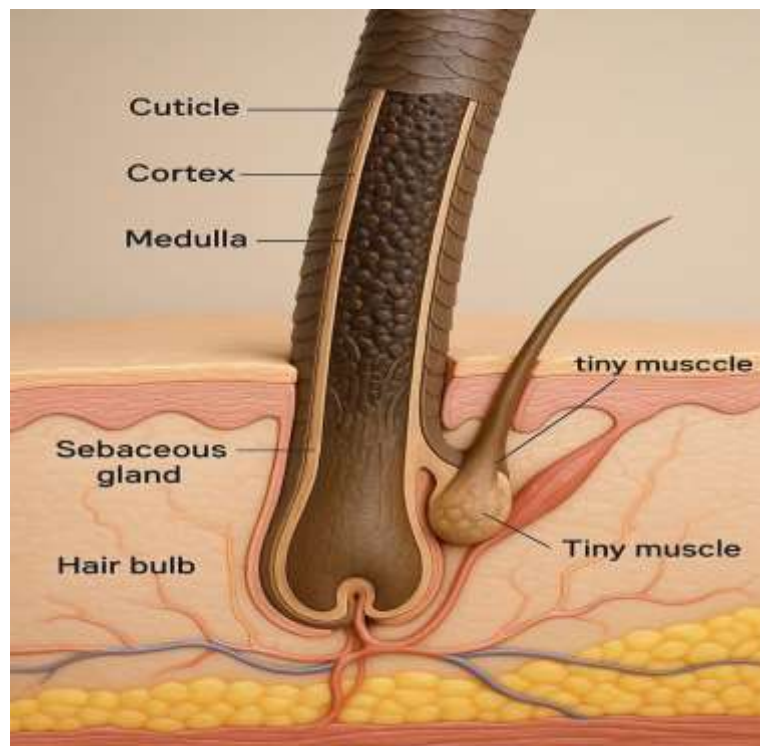
The cuticle is the outermost layer of the hair shaft. It consists of flat, overlapping scale-like cells that are tightly packed. These cells are transparent and act as a protective barrier for the inner layers. A healthy cuticle gives the hair its shine and smooth texture. Damage to the cuticle leads to dullness, frizz, and breakage. (Wolfram, 2003)

##### **2. Cortex:**

Beneath the cuticle lies the cortex, the thickest and most important structural component of the hair shaft. It contains long chains of keratin proteins that provide strength, elasticity, and flexibility to the hair. The cortex also houses melanin granules, which determine the color of the hair. The shape of the cortex (round, oval, or flat) influences the texture of the hair (straight, wavy, or curly). (Robbins, 2012; Patel & Sharma, 2021)

##### **3. Medulla:**

The medulla is the innermost layer and is composed of loosely packed, soft keratinized cells. It is not always present in all hair types, especially in fine hair. Its function is still not entirely understood, but it is believed to contribute to the hair's strength and insulation. (Wolfram, 2003)



**Fig no : 1 Anatomy of Hair**

## Hair Follicle

The hair follicle is a tunnel-like segment of the epidermis that extends deep into the dermis and sometimes the subcutaneous tissue. It anchors the hair shaft into the skin and plays a vital role in the growth and nourishment of hair. (Robbins, 2012; Paus & Cotsarelis, 1999).

### 1. Hair Bulb:

Located at the base of the hair follicle, the bulb is the rounded, club-shaped structure from which the hair grows. It contains actively dividing basal cells (called matrix cells) that produce the hair shaft. The hair bulb surrounds the dermal papilla, a structure rich in blood vessels that supplies nutrients and oxygen necessary for hair growth. (Wolfram, 2003)

### 2. Dermal Papilla:

The dermal papilla is a cone-shaped structure at the base of the follicle. It contains capillaries and connective tissue. It is responsible for delivering nutrients to the growing hair and sending chemical signals that regulate hair growth and the hair cycle. (Paus & Foitzik, 2004)

### 3. Inner and Outer Root Sheath:

These sheaths are protective layers that surround the growing hair shaft within the follicle.

- Inner Root Sheath (IRS) supports and molds the hair as it grows upward.
- Outer Root Sheath (ORS) is a continuation of the epidermis and provides structural support.

Both sheaths protect and guide the hair shaft as it pushes up through the skin. (Robbins, 2012)

### 4. Sebaceous Gland:

Associated with the hair follicle, the sebaceous gland produces sebum, an oily substance that moisturizes the hair and scalp. Sebum prevents the hair from becoming dry and brittle, and also offers some antibacterial protection. (Wolfram, 2003)

### 5. Arrector Pili Muscle:

Each hair follicle is attached to a small bundle of smooth muscle called the arrector pili muscle. When this muscle contracts (as a response to cold or emotional stimuli), it causes the hair to stand upright, a phenomenon known as goosebumps. This action helps in thermoregulation and makes the body appear larger during moments of fear (a remnant of evolutionary behavior). (Paus & Cotsarelis, 1999)

## Hair Growth Cycle

Hair growth is not continuous but occurs in cycles. There are three main phases in the hair growth cycle: (Paus & Foitzik, 2004)

### 1. Anagen Phase (Growth Phase)

This is the active growth phase, lasting 2 to 7 years, during which cells in the hair bulb rapidly divide. Approximately 85-90% of scalp hairs are in this phase at any given time.

### 2. Catagen Phase (Transition Phase)

This short transitional phase lasts about 2-3 weeks. During catagen, hair growth ceases, the follicle shrinks, and the lower part of the hair is cut off from its blood supply.

### 3. Telogen Phase (Resting Phase)

In this resting phase, which lasts around 3 months, the hair does not grow but stays attached to the follicle. Eventually, the hair is shed, and the follicle re-enters the anagen phase, starting the cycle anew.



Fig no : 2 Growth of Hair Follicle

## FUNCTIONS OF INGREDIENTS

### 1. FENUGREEK EXTRACT



Fig no : 3 Fenugreek Extract

#### General description:

Fenugreek, known as *Trigonella foenum-graecum*, is a traditional medicinal herb widely used in Ayurvedic practices. The seeds are rich in nutrients and bioactive compounds that are beneficial for both scalp and hair health.

**Synonyms:** Methi, Greek Hay

**Biological source:** Seeds of *Trigonella foenum-graecum*

**Family:** Fabaceae or Leguminosae

**Chemical constituents:** Alkaloids, flavonoids, saponins, proteins, nicotinic acid, and diosgenin

**Geographical source:** Native to Southern Europe, cultivated widely in India, North Africa, and Western Asia

**Uses:**

- Controls hair fall and strengthens roots
- Helps in reducing dandruff and scalp irritation
- Promotes thicker hair growth and smoothness

**Properties:**

- Anti-inflammatory and antifungal activity
- Nourishing effect due to protein and vitamin content [Verma et al., 2022; Thorat et al., 2020].

## 2. HIBISCUS EXTRACT



**Fig no : 4 Hibiscus Extract**

**General description:**

*Hibiscus rosa-sinensis* is a flowering shrub whose petals and leaves are rich in mucilage, vitamins, and antioxidants. It is traditionally used for hair conditioning and stimulating hair growth.

**Synonyms:** Shoe flower, Jaswand, China Rose **Biological source:** Flowers of *Hibiscus rosa-sinensis* **Family:** Malvaceae

**Chemical constituents:** Anthocyanins, flavonoids, mucilage, vitamin C, calcium, iron

**Geographical source:** Widely grown in tropical and subtropical regions of Asia and Africa

**Uses:**

- Stimulates hair growth and prevents thinning
- Delays premature greying of hair
- Conditions and softens hair naturally

**Properties:**

- Antioxidant and emollient properties
- Improves hair texture and shine [Deshmukh et al., 2021; Bhavsar & Trivedi, 2020].

## 3. FLAXSEED EXTRACT





**Fig no : 5 Flaxseed Extract**

**General description:**

Flaxseed or linseed is extracted from the seeds of the flax plant and is known for its high content of mucilage and essential fatty acids that promote hair hydration and shine.

**Synonyms:** Linseed

**Biological source:** Seeds of *Linum usitatissimum*

**Family:** Linaceae

**Chemical constituents:** Omega-3 fatty acids, lignans, mucilage, proteins, and vitamin E

**Geographical source:** Native to the Mediterranean, cultivated in India, Canada, China, and parts of Europe

**Uses:**

- Reduces frizz and dryness in hair
- Strengthens hair strands and prevents breakage
- Provides shine and manageability

**Properties:**

- Emollient and anti-inflammatory actions
- Supports scalp hydration and smooth gel formation [Patil et al., 2024; Jujgar et al., 2024].

**4. ALOE VERA GEL**



**Fig no : 6 Aloe Vera Gel**

**General description:**

Aloe vera is a succulent plant widely used for its clear, soothing gel. It contains a rich blend of vitamins, amino acids, and polysaccharides that promote scalp and hair health.

**Synonyms:** Ghritkumari

**Biological source:** Gel from the leaves of *Aloe barbadensis* miller

**Family:** Liliaceae

**Chemical constituents:** Aloin, aloesin, acemannan, vitamins A, C, E, amino acids, enzymes

**Geographical source:** Native to North Africa; cultivated globally, especially in India and tropical regions

**Uses:**

- Soothes irritated scalp and controls dandruff
- Provides deep hydration and reduces hair dryness Supports hair growth and improves shine

**Properties:**

- Antibacterial and anti-inflammatory
- Acts as a natural moisturizing base [Patil et al., 2024; Thorat et al., 2020].

## 5. GLYCERIN

**General description:**

Glycerin is a colorless, odorless, sweet-tasting liquid that acts as a natural humectant, drawing moisture into the hair and skin.

**Synonyms:** Glycerol

**Biological source:** Derived from vegetable oils (like soybean, coconut) or synthesized

**Family:** Not applicable (chemical compound)

**Chemical constituents:**  $C_3H_8O_3$  – A trihydroxy alcohol

**Geographical source:** Commercially produced globally from plant sources or petroleum

**Uses:**

- Hydrates and softens hair

- Prevents scalp dryness and itchiness
- Improves hair elasticity and smoothness

**Properties:**

- Humectant and emollient
- Improves texture and spreadability of gel [Shukla et al., 2018].

**6. VITAMIN E**

**Fig no : 7 Vitamin E Capsules**

**General description:**

Vitamin E is a fat-soluble antioxidant known for protecting cells from oxidative damage. It plays a vital role in hair growth and scalp nourishment.

**Synonyms:** Tocopherol

**Biological source:** Naturally found in oils like sunflower, wheat germ, and almonds; also synthesized

**Family:** Not applicable (vitamin compound)

**Chemical constituents:** Tocopherols and tocotrienols

**Geographical source:** Extracted or synthesized in pharmaceutical industries worldwide

**Uses:**

- Protects hair from damage caused by pollution and heat
- Nourishes hair follicles and improves scalp blood flow
- Enhances shine and reduces split ends

**Properties:**

- Antioxidant and cell-regenerating properties
- Supports healthy and strong hair [Shah et al., 2016].

**7. CARBOPOL 940****General description:**

Carbopol 940 is a synthetic high molecular weight polymer used widely as a gelling agent. It forms smooth, stable gels when neutralized with a base like TEA.

**Synonyms:** Carbomer 940

**Biological source:** Synthetic (petrochemical derivative)



**Family:** Polyacrylic acid polymer

**Chemical constituents:** Cross-linked polyacrylic acid

**Geographical source:** Manufactured synthetically across pharmaceutical industries worldwide

**Uses:**

- Provides thick, smooth gel consistency
- Stabilizes the hair mask formulation
- Allows for uniform distribution of ingredients

**Properties:**

- Non-toxic, safe for topical use
- Good rheological modifier and suspending agent [Kshirsagar et al., 2019].

## 8. TRIETHANOLAMINE (TEA)

**General description:**

TEA is an organic compound used to adjust pH and assist in the formation of clear, stable gels. It helps in neutralizing Carbopol and making the formulation cosmetically elegant.

**Synonyms:** TEA

**Biological source:** Synthetic compound derived from ethylene oxide and ammonia

**Family:** Alkanolamines

**Chemical constituents:**  $C_6H_{15}NO_3$  – Trihydroxy tertiary amine

**Geographical source:** Industrially synthesized and globally used in cosmetic and pharma products

**Uses:**

- Adjusts the pH of the formulation
- Helps in the formation of a smooth, thick gel with Carbopol
- Enhances spreadability and feel of the product

**Properties:**

- Stabilizing and emulsifying agent
- Improves texture and shelf-life of gel-based products [Kshirsagar et al., 2019].

## 9. METHYL PARABEN

**General description:** Methyl paraben is a preservative used in various products including cosmetics, food, and pharmaceuticals. It helps prevent the growth of mold and harmful bacteria, thereby extending the shelf life of the products. It is the methyl ester of p-hydroxybenzoic acid. Which is absorbed through the skin and gastrointestinal tract.

**Uses:**

- Antimicrobial preservative, antifungal agent, neuroprotective agent.
- Allergenic testing agent
- Hair care products
- Moisturisers
- Lubricant [Verma et al., 2022].

---

## LITERATURE REVIEW

### 1. Shukla et al. (2018):

Shukla and colleagues developed a herbal hair gel formulation using Aloe vera and Hibiscus extracts. The formulation aimed to provide a natural, safe alternative to conventional hair gels. The gel was evaluated for physicochemical parameters including pH, consistency, spreadability, and homogeneity. The results confirmed that the gel had an appropriate pH compatible with the scalp, smooth texture, and uniform consistency. Moreover, it was non-irritant to the skin and provided enhanced hair softness and manageability. The study concluded that this herbal gel can serve as an effective and stable cosmetic product for regular hair care use, showing both conditioning and mild therapeutic properties.

## **2. Thorat et al. (2020):**

Thorat et al. prepared a polyherbal hair mask incorporating Aloe vera, Fenugreek, and Amla extracts, which are known for their hair-strengthening, antifungal, and antioxidant properties. The formulation underwent evaluation for critical quality parameters including pH, spreadability, microbial stability, and user acceptability. It was found to be stable, with no signs of microbial contamination over time. The user feedback suggested a reduction in hair fall, improvement in hair texture, and enhanced natural shine. The formulation was appreciated for its cosmetic appeal and ease of application, making it a suitable herbal substitute for chemical-based hair masks.

## **3. Deshmukh et al. (2021):**

Deshmukh et al. focused on the development of a gel-based herbal hair mask using Hibiscus and Bhingraj extracts. These ingredients were chosen due to their traditional usage in promoting hair growth and scalp health. The formulation was tested for its viscosity, spreadability, antifungal activity, and overall user satisfaction. The results demonstrated excellent conditioning effects, improvement in scalp hydration, and positive sensory attributes like smooth texture and pleasant fragrance. The formulation showed potential to reduce dandruff and irritation while enhancing scalp health, confirming its effectiveness as a natural hair treatment.

## **4. Kshirsagar et al. (2019):**

Kshirsagar and co-researchers designed a polyherbal hair mask gel utilizing Henna, Neem, and Fenugreek (Methi) extracts. These herbs are traditionally used for their antimicrobial, anti-inflammatory, and conditioning properties. The mask was tested for physical stability, skin irritation, and consumer perception. The results indicated the formulation was non-irritant, stable under storage, and received favorable feedback from users. It improved hair manageability, reduced frizz, and acted as a mild scalp cleanser. The study strongly recommended herbal masks as sustainable and eco-friendly alternatives to synthetic conditioners and serums.

## **5. Bhavsar et al. (2020):**

This study involved the preparation of a herbal hair gel using Hibiscus and Amla, aimed at treating dandruff and improving hair texture. The formulation was evaluated for pH, viscosity, texture, spreadability, and its conditioning potential. During the trial period, users reported a noticeable improvement in hair softness, shine, and dandruff control. The formulation exhibited good aesthetic appeal, ease of application, and stable characteristics. The combination of Hibiscus and Amla provided both antioxidant and anti-inflammatory benefits, making it an effective component in natural hair care formulations.

## **6. Shah et al. (2016):**

Shah et al. developed a conditioning herbal gel by incorporating extracts of Bhingraj, Amla, and Tulsi—ingredients known for their rejuvenating and restorative properties on hair. The gel formulation underwent a thorough evaluation, including pH, microbial testing, antioxidant capacity, and viscosity. The findings suggested that the gel had excellent conditioning effects, increased hair shine, and improved hair volume. Additionally, it demonstrated strong antioxidant properties that help reduce oxidative stress on the scalp. The gel was well-received in terms of spreadability and user satisfaction, making it a suitable herbal alternative to synthetic hair products.

## **7. Prachi R. Patil et al. (2024):**

Prachi R. Patil and team developed a herbal hair gel formulation incorporating Aloe vera and Flaxseed extract, aiming to deliver natural scalp hydration and hair conditioning. The gel was evaluated for its physicochemical parameters including viscosity, pH, texture, microbial stability, and ease of application. The optimized formulation showed excellent spreadability, neutral pH compatible with scalp, and good microbial resistance, indicating a long shelf life. Aloe vera was found to soothe scalp inflammation and add moisture, while flaxseed extract—rich in omega-3 fatty acids—helped in reducing hair breakage and enhancing shine. The study concluded that the combination is effective in improving scalp health and strengthening hair, making it suitable for regular cosmetic use.

## **8. Gauri S. Jujgar et al. (2024):**

Gauri and co-researchers designed a complex multipurpose herbal hair mask containing Flaxseed, Aloe vera, Hibiscus, Amla, Curry leaf, Bhingraj oil, Coconut oil, Castor oil, and Multani mitti. The formulation was prepared in gel form and was evaluated for parameters like pH, viscosity, skin compatibility, and post-wash effects. The results showed that the herbal mask provided excellent conditioning, detangling, and scalp soothing effects without causing any irritation. The combination of extracts offered antioxidant, anti-inflammatory, and antimicrobial benefits. Regular application resulted in reduced dandruff, smoother hair texture, and enhanced hair strength. This study highlighted the synergistic effect of multiple herbs in achieving a balanced and effective hair care product.

## **9. Anamika Verma, Dharmendra Ahuja & Shilpa Thakur (2022):**

This study aimed at formulating an antifungal herbal hair gel using Fenugreek, Neem, and Hibiscus extracts in a Carbopol 934 gel base. The formulation was evaluated for pH, viscosity, extrudability, homogeneity, and antifungal activity. Among several batches, one optimized formulation showed significant antifungal effects against common scalp pathogens. Fenugreek contributed to antifungal and anti-inflammatory action, while Neem and Hibiscus enhanced antimicrobial properties and conditioning. The formulation was found to be smooth, easy to apply, and non-irritant, demonstrating a combination of therapeutic and cosmetic benefits.

#### INGREDIENTS AND EXCIPIENTS WITH THEIR ROLE

S.No	INGREDIENTS	ROLE
1.	Carbopol	Gelling agent
2.	Triethanolamine	pH adjuster, Thickening agent
3.	Fenugreek extract	Anti-dandruff, Conditioner
4.	Flax seeds gel	Moisturiser
5.	Vitamin E Capsules	Antioxidant, Scalp nourisher
6.	Hibiscus flowers extract	Shine enhancer, Hair growth
7.	Alovera Gel	Scalp soother, Moisturiser
8.	Glycerin	Humectant, Moisturiser retainer
9.	Methylparaben	Antibacterial preservative

Table no : 1 Ingredients with their Role EXTRACTION PROCESS

##### 1. Extraction of Fenugreek Seed Extract



Fig no : 8 Extraction of Fenugreek

5 grams of fenugreek seeds were taken in a beaker, mixed with 50 ml of distilled water, heated on a water bath for 10 minutes, and filtered using muslin cloth to obtain the aqueous extract. (Patel & Rajput, 2020)

##### 2. Extraction of Flaxseed Gel



**Fig no : 9 Extraction of Flaxseed Gel**

5 grams of flax seeds were soaked in 60 ml of distilled water and then heated for 10 minutes until mucilage (gel) formed. The gel was filtered using muslin cloth to separate the flaxseed residue from the gel.(Sharma & Mehta, 2019)

### **3. Extraction of Hibiscus Flower Extract**



**Fig no : 10 Extraction of Hibiscus**

Few dried hibiscus flowers were taken in a beaker, combined with 50 ml of distilled water, heated for 10 minutes, and filtered to collect the reddish-purple aqueous extract.(Mishra et al., 2018).

## FORMULATION OF HAIR MASK GEL

### 1. Preparation of Carbopol Gel Base:

Take 40 ml of distilled water in a clean beaker and slowly sprinkle 1 gram of Carbopol 940 into it while stirring gently to avoid lumps. Stir for about 10–15 minutes until the powder is evenly dispersed. Cover the beaker and let the mixture soak undisturbed for 8 hours to allow full hydration. After soaking, stir the mixture gently and add Triethanolamine (TEA) drop by drop while checking the pH. Continue adding TEA until the pH reaches between 6.0 and 6.5. The gel will become thick and clear.

### 2. Incorporation of Herbal Extracts and Additives:

After the Carbopol gel base is prepared and neutralized, the herbal extracts are added to complete the formulation. Measured quantities of fenugreek extract, flaxseed extract, hibiscus extract, and aloe vera gel are added one by one with gentle stirring to ensure uniform mixing. Following this, glycerine is incorporated as a humectant to retain moisture and enhance the conditioning effect of the gel. The mixture is stirred slowly to avoid air entrapment and to achieve a smooth, uniform consistency. Finally, Vitamin E is added to act as an antioxidant and provide nourishment to the scalp. The resulting product is a natural, herbal hair mask gel ready for application.



Fig no : 11 Hair Mask Gel

## FORMULATION TABLE

S.No	INGREDIENTS	FORMULATION 1	FORMULATION 2	FORMULATION 3
1.	Carbopol	0.5 g	0.8g	0.7g
2.	Triethanolamine	0.2ml	0.4ml	0.3ml
3.	Fenugreek extract	1.5ml	2.0ml	1.8 ml
4.	Flax seeds gel	2.0ml	2.5ml	2.0ml
5.	VitaminE Capsules	1 capsule	2 capsules	2 capsules
6.	Hibiscus flowers extract	1.5ml	2.0ml	2.5ml
7.	Alovera Gel	2.0ml	3.0ml	2.5ml
8.	Glycerin	1.0ml	1.5ml	1.0ml
9.	Methylparaben	0.1 g	0.2g	0.3g
10.	Distilled Water	q.s	q.s	q.s

Table no : 2 Formulation of Hair Mask Gel EVALUATION OF HAIR MASK GEL

### ● Physical evaluation



In this test, the gel was observed for color, odor, texture, state

- A. Color:** The color of the gel was examined visually
- B. Odor:** The odor of the gel was examined by smelling
- C. State:** The appearance of the gel was evaluated through visual inspection. **D.Consistency:** The consistency of the formulation was assessed by manually rubbing the gel on the hand

- **pH Determination:**

A 0.5 g sample of the gel was dispersed in 50 ml of distilled water, and its pH was measured using a digital pH meter.

- **Viscosity:**

The viscosity of the formulation was measured using a Brookfield viscometer at 15 rpm with spindle No.62.

- **Washability:**

The washability test involved applying a small amount of gel to the hair strands and washing it after 30 mins. All three formulations were easily washable.

- **Spreadability:**

Spreadability was measured based on the time (in seconds) required for two glass slides to separate when a gel sample was placed between them under a specific load. A shorter separation time indicated better spreadability. To conduct the test, two sets of glass slides of standard dimensions were used. A suitable glass slide was taken, and a small amount of the gel formulation was placed on it. Another slide was positioned on top of the formulation, and a set weight was applied to ensure uniform spreading into a thin layer. After removing the weight, any excess formulation adhering to the slides was scraped off. The upper slide was then allowed to slip off freely under the influence of a tied weight, and the time taken for it to separate was recorded. Spreadability was calculated using the formula:

$$\text{Spreadability} = (m \times l) / t$$

where,

m = Standard weight applied to the upper slide l = Length of the glass slide

t = Time taken for the upper slide to slip off

- **Greasiness:**

This test determines whether the gel is oily or greasy. To evaluate the greasiness of a gel, apply a small amount to clean skin and rub it in, then assess the residual feel. Observe whether it leaves an oily or greasy film by visually inspecting the area.

- **Irritancy:**

This test assesses the quality of materials or chemicals to determine if they are harmful to the skin or mucous membranes. A specific area on the dorsal surface of the left hand is marked, and the cream formulation is applied. The time of application is recorded, and the formulation is left for a few minutes to observe any signs of irritation.

## RESULTS AND DISCUSSIONS

S.no	Parameters	F1	F2	F3
1.	Colour	Light brown	Dark green (glossy)	Bright Yellow
2.	Odor	Pleasant	Pleasant	Pleasant
3.	Consistency	Creamy	Slightly sticky	Smooth Liquid
4.	State	Semi solid	Thick Gel	Semi Liquid

Table no: 3 Evaluation of Physical Parameters



Fig no : 12 Formulations of Hair Mask Gel

The physical parameters of three hair mask formulations (F1, F2, F3) were evaluated. F1 appeared light brown, creamy, and semi-solid with a pleasant odor. F2 was dark green and glossy, slightly sticky, and formed a thick gel. F3 showed a bright yellow color, smooth liquid consistency, and was semi-liquid in state. All formulations maintained a pleasant fragrance.

#### pH Meter :

S.no	Formulation	pH
1.	F1	6.3
2.	F2	6.5
3.	F3	6.8

Table no: 4 Evaluation of pH



Fig no : 13 pH Meter

According to the results, the PH of all the three formulations that is F1, F2, F3 were found to be nearer to skin PH so it can be safely used on the skin.

#### Viscosity :

S.no	Formulation	Spindle no.	RPM	K Factor	Dial reading	Viscosity (CPS)
1.	F1	62	0.5	500	13	6500
2.	F2	62	0.5	500	14	7000
3.	F3	62	0.5	500	12	6000

Table no: 5 Evaluation of Viscosity

According to the results all the three formulations showed adequate viscosity.



Fig no: 14 Viscometer

**Washability :**

S.no	Formulation	Washability
1.	F1	Easily washable
2.	F2	Easily washable
3.	F3	Easily washable

Table no: 6 Washability

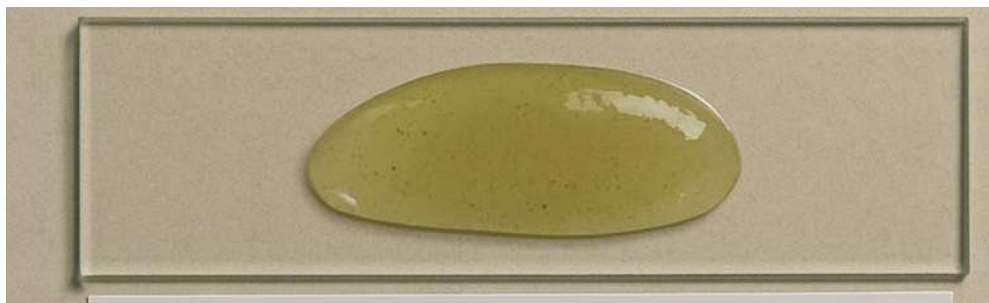
The formulations F1, F2, and F3 were found to be easily washable, indicating good removability and user convenience.

**Spreadability:**

S.no	Formulation	Time (sec)	Spreadability
1.	F1	7	2.2
2.	F2	5	3
3.	F3	6	2.5

Table no: 7 Spreadability

The spreadability of the three formulations that is F1, F2, F3 was carried out and out of that for F2 the time taken by the 2 slides to separate is less so as said in the description of evaluation test lesser the time taken for separation of the two slides better the spread ability so according to this statement F2 showed better spreadability.

**Fig no : 15 Spreadability****Greasiness :**

S.no	Formulation	Greasiness
1.	F1	Slightly greasy
2.	F2	Slightly greasy
3.	F3	Slightly greasy

**Table no: 8 Greasiness**

The result of the above data indicates that all three formulations (F1, F2, and F3) exhibit slightly greasy characteristics. There is no variation in greasiness among the formulations.

**Irritancy test :**

S.no	Formulation	Irritant effect	Erythema	Edema
1.	F1	Nil	Nil	Nil
2.	F2	Nil	Nil	Nil
3	F3	Nil	Nil	Nil

**Table no: 9 Irritancy test**

The formulations F1, F2, and F3 showed no irritant effect, indicating that they are non irritating and well-tolerated.

---

**CONCLUSION**

The current research work was focused on the formulation and evaluation of a herbal hair mask gel using a combination of traditional herbal ingredients known for their beneficial effects on hair and scalp health. The main aim was to develop a natural, cost-effective, and safe alternative to synthetic hair care products that often contain harsh chemicals.

A stable gel formulation was successfully developed using Carbopol 940 as the gelling agent, triethanolamine (TEA) as the neutralizer and pH adjuster, and glycerin as a moisturizing agent. The aqueous extracts of fenugreek seeds (*Trigonella foenum-graecum*), hibiscus petals (*Hibiscus rosa-sinensis*), flaxseeds (*Linum usitatissimum*), aloe vera gel, and vitamin E (tocopherol) were incorporated into the formulation due to their well-documented medicinal and cosmetic properties.

The formulated hair mask gel showed desirable organoleptic properties (color, odor, appearance), good homogeneity, spreadability, and an appropriate pH range (6.0–6.5) suitable for scalp application. No phase separation or microbial contamination was observed during the short-term stability testing, indicating a physically stable formulation.

Each herbal component in the formulation contributed specific benefits: Fenugreek extract enhanced hair strength and reduced hair fall due to its protein and nicotinic acid content.

Hibiscus extract promoted hair growth and added natural shine.

Flaxseed extract, rich in omega-3 fatty acids, contributed to scalp hydration and reduced dandruff. Aloe vera gel soothed the scalp, provided hydration, and supported hair regeneration. Vitamin E acted as a powerful antioxidant, protecting the hair from oxidative stress and environmental damage.

The overall performance of the hair mask gel indicates that it can serve as a promising natural alternative to synthetic hair treatments. Its formulation is not only simple and feasible for small-scale production but also scalable for commercial manufacturing with minimal cost and high consumer demand potential, especially among users seeking plant-based personal care products.

In conclusion, the herbal hair mask gel prepared in this study fulfills the essential criteria for an ideal hair care formulation—safety, efficacy, stability, ease of application, and natural origin.

## REFERENCES

- Bhavsar, S. A., & Trivedi, P. H. (2020). Formulation and evaluation of herbal hair gel containing Hibiscus and Amla for dandruff control and hair conditioning. *Journal of Pharmacognosy and Phytochemistry*, 9(6), 1258–1263.
- Bhatia, R., Jain, A., & Choudhary, A. (2021). Herbal cosmetics: An overview. *International Journal of Pharmaceutical Sciences and Research*, 12(5), 2520–2527.
- Deshmukh, V. P., Chaudhari, S. P., & Kale, A. A. (2021). Herbal hair mask gel containing Hibiscus and Bhringraj extracts: Formulation and evaluation. *World Journal of Pharmaceutical Research*, 10(5), 214–223.
- Gupta, P., & Thakur, N. (2021). Hair mask: A new approach in hair care. *Journal of Cosmetic Science*, 72(2), 135–142.
- Gupta, R., & Sharma, V. (2021). Role of vitamin E in dermatology. *International Journal of Research in Dermatology*, 7(3), 352–356.
- Jujgar, G. S., Kadam, R. A., & Kale, S. P. (2024). Development of a multipurpose herbal hair mask. *Journal of Natural Remedies*, 24(1), 40–47.
- Kshirsagar, R. V., Kulkarni, S. S., & Dighe, S. N. (2019). Polyherbal formulation of hair mask gel using Henna, Neem, and Fenugreek extracts and its cosmetic evaluation. *International Journal of Green Pharmacy*, 13(1), 44–49.
- Kumar, A., Sharma, N., & Tiwari, S. (2022). Formulation and evaluation of herbal hair gel. *International Journal of Pharmaceutical Sciences Review and Research*, 72(1), 101–106.
- Kumar, S., Gupta, M., & Yadav, V. (2020). Aloe vera and its role in hair care. *Journal of Ethnopharmacology*, 250, 112487.
- Mishra, A., Srivastava, S., & Shukla, S. (2018). Medicinal importance of Hibiscus rosa-sinensis: A review. *International Journal of Pharmacognosy and Phytochemical Research*, 10(1), 77–81.
- Patel, D., & Sharma, P. (2021). Structural and functional aspects of human hair: A review. *International Journal of Trichology*, 13(1), 45–50.
- Patel, K., & Rajput, D. (2020). Trigonella foenum-graecum (fenugreek) in hair disorders. *Journal of Pharmacognosy and Phytotherapy*, 12(2), 25–30.
- Patil, P. R., Kulkarni, R. A., & More, R. Y. (2024). Formulation and evaluation of herbal hair conditioning gel using Flaxseed and Aloe vera. *International Journal of Pharmaceutical Sciences Invention*, 13(2), 20–26.
- Paus, R., & Cotsarelis, G. (1999). The biology of hair follicles. *New England Journal of Medicine*, 341(7), 491–497.
- Paus, R., & Foitzik, K. (2004). In search of the "hair cycle clock": A guided tour. *Differentiation*, 72(9–10), 489–511.
- Rao, K. S., Deshmukh, M., & Kale, R. (2022). Pharmaceutical applications of carbopol polymers. *International Journal of Research in Pharmaceutical Sciences*, 13(4), 2567–2573.
- Rathi, S., & Pandey, V. (2020). Comparative study of hair conditioners and hair masks. *International Journal of Cosmetic Science*, 42(4), 398–405.
- Robbins, C. R. (2012). *Chemical and physical behavior of human hair* (5th ed.). Springer.
- Shah, V. R., Patel, H. R., & Vyas, B. A. (2016). Herbal hair gel from Bhringraj, Amla, and Tulsi: Formulation and antioxidant activity. *International Journal of Pharmaceutical Sciences Review and Research*, 38(1), 144–149.
- Sharma, R., & Mehta, M. (2019). Flaxseed in dermatology and hair care. *Journal of Natural Remedies*, 19(3), 101–107.
- Sharma, V., Singh, A., & Kaur, G. (2019). Impact of synthetic hair products on hair health: A review. *International Journal of Trichology*, 11(4), 159–164.
- Shukla, A., Patel, R., & Sharma, P. (2018). Formulation and evaluation of herbal hair gel containing Aloe vera and Hibiscus extracts. *International Journal of Pharmaceutical Sciences and Research*, 9(3), 1125–1130.
- Singh, S., & Kumar, R. (2020). Hair and scalp disorders due to lifestyle and pollution: An emerging concern. *Indian Journal of Dermatology*, 65(2), 88–93.
- Thorat, A. R., Desai, M. S., & Pawar, S. S. (2020). Preparation and characterization of polyherbal hair mask using Aloe vera, Fenugreek, and Amla extracts. *Asian Journal of Pharmaceutics*, 14(2), 157–162.



---

Verma, A., Ahuja, D., & Thakur, S. (2022). Development of antifungal herbal hair gel containing Fenugreek, Neem, and Hibiscus in Carbopol base. *Indian Journal of Pharmaceutical Education and Research*, 56(4), 321–328.

Wolfram, L. J. (2003). Human hair: From the inside out. *Journal of Investigative Dermatology Symposium Proceedings*, 8(1), 2–5.