# "FORMULATION AND EVALUATION OF HIBISCUS FLAXSEED HERBAL HAIR GEL"

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## ABSTRACT

Hair loss is the common problems of today's generation for men and women both. Due to increase in pollution and chemicals which are directly or indirectly used in the form of shampoos, hair gels and other hair care products. Hair loss, hair thinning, dandruff and early whitening of hair are the most common problems faced by people. There are a variety of herbal plants which can be used to promote hair growth which provide natural minerals and oils to our hair in comparison to chemical-based products. The present work is done by formulating and evaluating Hibiscus and flaxseed herbal hair gel. The present study focuses on preparation and evaluation of herbal gel which is full of benefits as compared to other gel. Rich in fatty acids and antioxidants, flaxseed, sometimes referred to as linseed, aids in the removal of pollutants and dead cells from the scalp. Applying flaxseed gel to the scalp and hair as a moisturizer can help to promote hair growth and strengthen existing hair. Hibiscus rosa-sinensis is a medicinal plant member belonging to the family Malvaceae. Hibiscus rosa-sinensis is used for the treatment of various diseases including alopecia. Herbal hair gels help to overcome the various damages caused by chemical agents in various marketed products.

**Keywords:** Aqueous extract, Hibiscus, Flaxseed, Hair Gel and Herbal.

## 1. INTRODUCTION

Hair is an important part of human appearance and plays a significant role in boosting confidence and personality. However, due to factors such as pollution, stress, unhealthy lifestyle, and excessive use of chemical-based cosmetic products, various hair problems like hair fall, dandruff, dryness, and alopecia are increasing rapidly. Conventional hair care products often contain synthetic polymers alcohols, and preservatives that may cause long-term damage to the scalp and hair structure.

Medicinal plants have been traditionally used in hair care due to their therapeutic properties. Hibiscus (Hibiscus rosa-sinensis) is a well-known natural ingredient used for promoting hair growth, strengthening hair follicles, and preventing dandruff. It is rich in flavonoids, amino acids, vitamins, and antioxidants, which nourish the scalp and improve hair quality. Flaxseed (Linum usitatissimum) is another important herbal ingredient containing omega-3 fatty acids, lignans, and mucilage. The mucilage present in flaxseed acts as a natural gelling agent, making it highly suitable for the formulation of herbal hair gels, also providing moisturizing and conditioning effects.

The combination of hibiscus and flaxseed provides a synergistic effect, offering both cosmetic and therapeutic benefits. The formulated herbal hair gel not only acts as a styling agent with acceptable holding capacity but also helps in reducing hair fall, improving hair texture, and maintains scalp health. Such as formulation are particularly useful for individuals seeking natural alternatives to synthetic hair care products.

## 1.1 HAIR

Hair is a keratinized structure that emerges from hair follicles located in the dermis. It serves various functions, including thermoregulation, protection, sensory perception, and social or aesthetic significance. Structurally, hair consists of three main layers: the ***medulla, cortex,*** and ***cuticle.*** The hair follicle, a complex mini-organ, undergoes cyclic phases of growth, including anagen (growth phase), catagen (regression phase), and telogen (resting phase), which are regulated by genetic, hormonal, and environmental factors.

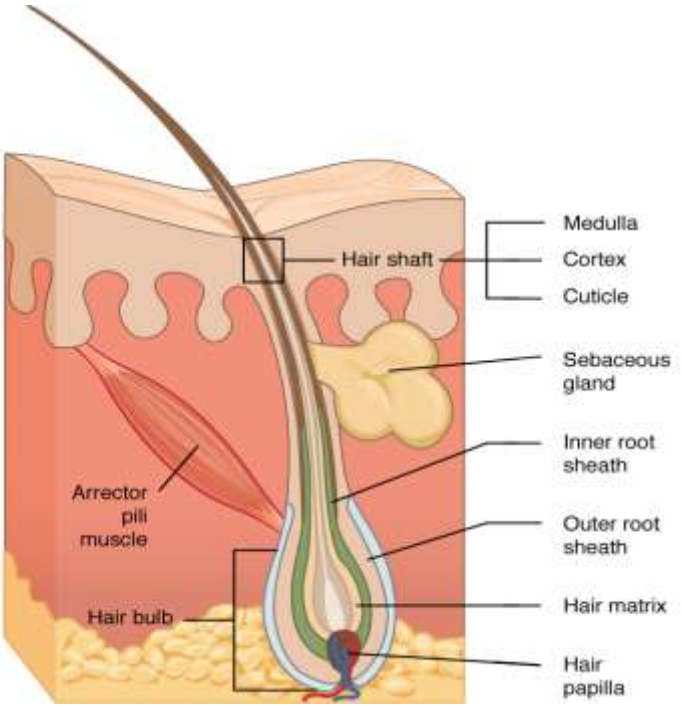



**Fig No: 1 Structure of Hair.**

## 1.2 ANATOMY OF HAIR

Hair consists of two main parts:

1) Hair Shaft
2) Hair Follicle

1. **Hair Shaft:** The hair shaft is the visible part of the hair that extends above the surface of the skin. It is composed of dead, keratinized cells and does not have any blood supply or nerve endings, non-living portion of the hair. It is composed of three distinct layers:

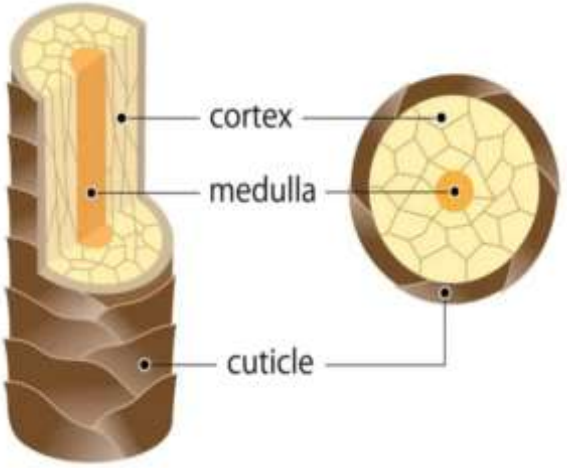



**Fig No.: 2 Hair Shaft.**

**Cuticle:** The outermost layer composed of overlapping scale-like cells that protect the hair shaft from damage.

**Cortex:** The thickest layer made of densely packed keratinized cells, responsible for the hair's strength, elasticity and color (due to melanin).
**Medulla:** The innermost layer, found mainly in thick terminal hairs, composed of loosely connected keratinized cells.

**2. Hair follicle:** The hair follicle is a tube-like invagination of the epidermis into the dermis that surrounds the hair root and is responsible for hair growth and development. Hair follicle is a dynamic, living structure embedded within the dermis. It consists of the following components:

Hair Bulb
Matrix cells
Outer and Inner Root Sheaths
Sebaceous Gland
Arrector Pili Muscle

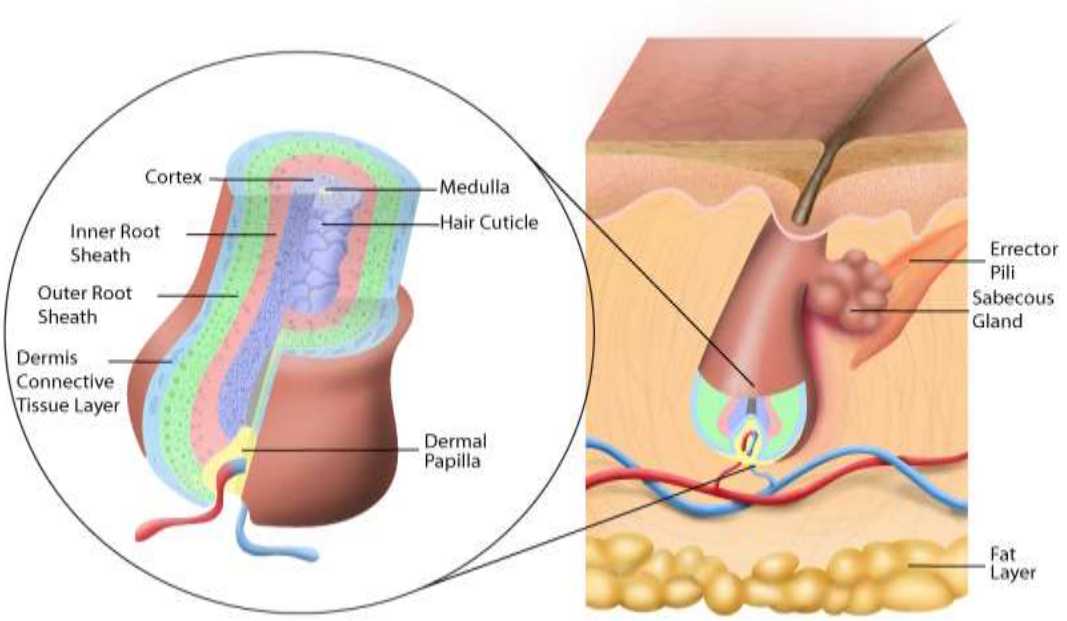



**Fig No. 3: Hair follicle**

**Hair Bulb:** The base of the follicle, housing the dermal papilla, which supplies nutrients and growth signals via capillaries.
**Matrix cells:** Located within the bulb, these rapidly dividing cells generate new hair. Melanocytes in these areas provide pigmentation.
**Outer and Inner Root Sheaths:** Protective layers surrounding the hair shaft, guiding its growth.
**Sebaceous Gland:** Secretes sebum (oils) into the follicle, providing moisture and preventing dryness.
**Arrector Pili Muscle:** A small, smooth muscle attached to the follicle that contracts in response to cold or fear, causing "Goosebumps".

## 1.3 HAIR GROWTH CYCLE

The hair growth cycle is the natural process through which hair grows, rests, and sheds. Each hair follicle works independently, so different hairs are in different phases at any time.

Hair growth cycle comprises of 4 phases

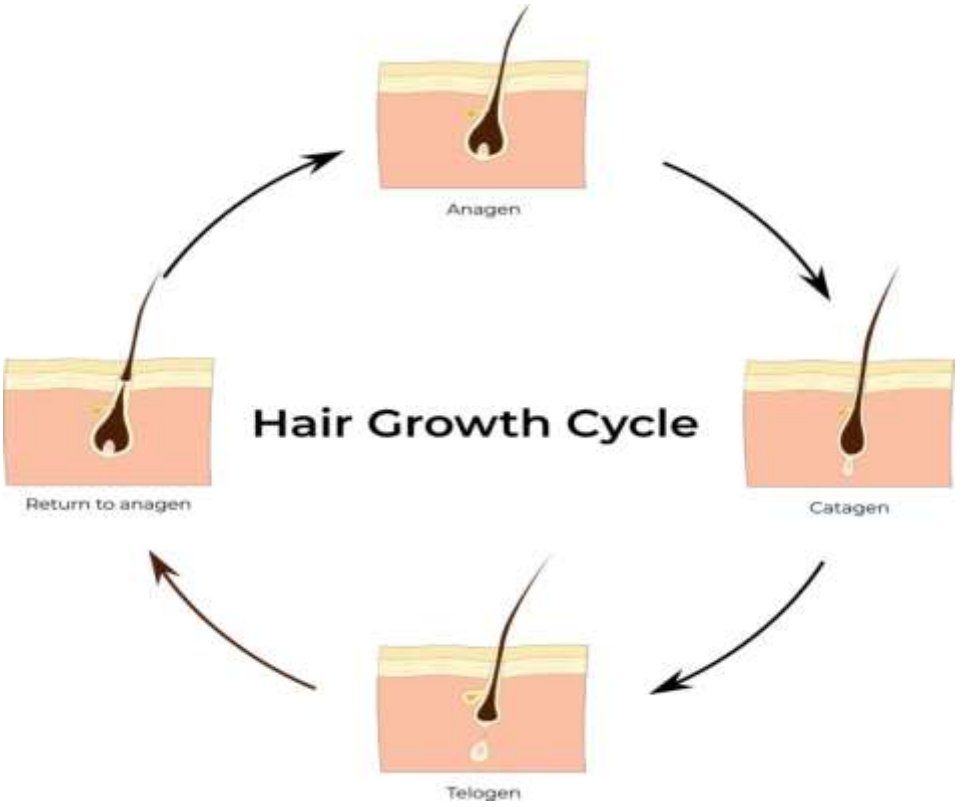



**Fig No.:4 Hair growth cycle.**

### 1.3.1 Anagen (Growth Phase)

The longest phase (lasting 2-7 years) active cell proliferation occurs in the matrix. On average, hair grows 1 cm/month. The duration of anagen determines hair length, varying among individuals.

### 1.3.2 Catagen (Transition Phase)

A short phase (2-3 weeks). Where hair growth slows and the follicle shrinks. The hair detaches from the dermal papilla, ceasing nutrient supply.

### 1.3.3 Telogen (Resting Phase)

Last about 3 months, during which the hair remains in place but is no longer growing. Shedding occurs naturally, with 50-100 hairs lost per day. A new anagen phase begins, and the cycle repeats.

### 1.3.4 Exogen Phase (Shedding Phase)

The Exogen phase is the final stage of the hair growth cycle where old hair sheds from the scalp and new hair begins to grow.


**Fig No.:5 Stages of Hair Growth**

## 1.4 FUNCTION OF HAIR

Hair protects various parts of the body from external damage**:**

**1.4.1 Protection:** Scalp hair protects the head from sunlight (UV radiation) and heat. Eyelashes prevent dust, dirt, and foreign particles from entering the eyes.

**1.4.2 Thermoregulation:** Hair helps in maintaining body temperature. The Scalp hair reduces heat loss, and body hair aids in temperature regulation.

**1.4.3 Sensory Function:** Hair follicles have mechanoreceptors that detect touch stimuli. Hair follicles are connected to nerve endings. They help detect slight movements, touch, and environmental changes.

**1.4.4 Social and psychological impact:** Hair plays a significant role in self-identify, cultural expression, and psychological well-being.

## 1.5 CAUSES OF HAIR PROBLELM

- Nutritional Deficiency
- Hormonal Imbalance
- Stress and Lifestyle Factors
- Environmental Factors
- Improper Hair Care
- Scalp Infections
- Heat Styling Tools
- Childbirth

## 1.6 PROBLEM RELATED TO HAIR

- Hair Fall
- Dandruff
- Dry and Frizzy Hair
- Split Ends
- Oily Scalp
- Hair Thinning
- Scalp Infections

## 1.7 GEL

A gel is a semi-solid system in which a liquid phase is trapped within a three-dimensional cross-linked network of polymers or colloidal particles. Gel exhibits both solid-like and liquid-like properties making then useful in various applications, including pharmaceuticals, cosmetics, food and materials science.

## 1.8 APPLICATIONS OF GELS

Gels are widely used in different industries.

- **Pharmaceuticals:** Drug delivery systems (e.g., transdermal gels, hydrogels for wound healing). Topical drug delivery, Oral gels.
- **Cosmetics:** Skin care products such as moisturizers and face masks. Hair care products use as hair gels for styling, conditioning and nourishment
- **Food Industry:** Thickening agents in products like jellies and yogurts.
- **Biomedical Engineering:** Tissue engineering scaffolds and biosensors.

# 2. HIBISCUS FLAXSEED HERBAL HAIR GEL

Hibiscus flaxseed hair gel is a natural herbal hair care formulation that combines the nutritional properties of hibiscus with the natural gelling and conditioning properties of flaxseed. This combination provides multiple benefits for scalp health and hair quality.

The hibiscus flaxseed gel mainly acts as a

1) Natural Hair Styling Agent with Conditioning
2) Nourishing properties
3) Providing Hold
4) Reducing Frizz
5) Promoting Hair Growth
6) Protecting Hair from damage

## 2.1 Benefits of hibiscus flaxseed gel for hair:

2.1.1 **Promote Hair Growth: -** Hibiscus is rich in *vitamin C, amino acids, and antioxidants,* which nourish hair follicles and stimulate hair growth. These nutrients improve keratin production, an essential protein for hair structure. Flaxseeds contain *omega-3 fatty acids,* which enhance scalp health and improve blood circulation. As a result, regular use of the gel leads to stronger thicker and healthier hair growth.

2.1.2 **Reduces Hair Fall:** - Hair fall is often caused by weak roots, dryness, or scalp imbalance. Hibiscus strengthens the hair roots and follicles, while flaxseed forms a protective layer around hair shaft. This reduces hair breakage, split ends and shedding, making the hair more resistant to damage. Continuous use helps in maintaining hair density and volume.

2.1.3 **Act as a Natural Conditioner:** - Flaxseed gel has a mucilage content, which gives it a slippery texture. This acts as a natural conditioner by coating the hair shaft and reducing roughness. Hibiscus further softens the hair making it silky, smooth.

2.1.4 **Provides Natural Shine and Luster: -** Flaxseed gel forms a thin, transparent film on the hair surface, which reflects light and gives a natural shine. Hibiscus improves the internal health of the hair, resulting in long-lasting luster and vitality.

2.1.5 **Reduces Dandruff and Scalp Irritation: -** Hibiscus has anti-inflammatory and antimicrobial properties, which help in reducing dandruff and scalp infections. Flaxseed hydrates the scalp and prevents dryness, which is a major cause of dandruff. This combination soothes itching and keeps the scalp clean and healthy.

2.1.6 **Deep Moisturization and Hydration: -** Flaxseed is rich in essential fatty acids, which deeply moisturize both hair and scalp. Proper hydration, prevent dryness, improves elasticity, Reduces brittleness and breakage.

# 3. INGREDIENTS AND THEIR ROLE

| Sr. No. | Ingredients | Role |
|---|---|---|
| 1 | Hibiscus | Hair growth promoter, Conditioner |
| 2 | Flaxseed | Natural Gelling agent, Moisturizer |
| 3 | Aloe Vera | Hydration, soothing agent, conditioner |
| 4 | Rose Water | Fragrance Enhancer, vehicle, PH Balancing. |
| 5 | Almond Oil | Emollient (Moisturizer), Scalp Nourishment |
| 6 | Glycerin | Humectant, (Moisture Retainer) |
| 7 | Vitamin E | Antioxidant, Promote Hair growth. |
| 8 | Water | Vehicle, Solvent |

Hibiscus (Hibiscus rosa-sinensis) extract
Flaxseed (Linum usitatissimum) gel
Aloe Vera gel
Rose Water
Almond Oil

# 4. PLANT PROFILE

## 4.1 Hibiscus:

Hibiscus is a tropical plant known for its large, showy flowers and numerous health benefits. Native to East Asia, Hibiscus has been used in traditional medicine for centuries. Its flowers, leaves, and stems are rich in vitamins, minerals and antioxidants, making it a popular ingredient in teas, jams, and skincare product. Hibiscus is also revered for its cultural and symbolic significance, being the nation flower of Haiti and Malaysia.

**Fig No 6: Hibiscus**

**Botanical Name:** Hibiscus rosa-sinensis
**Synonyms:** Rose Mallow, Shoe Flower, Hibiscus, Tropical Hibiscus.
**Family:** ***Malvaceae.***
**Biological Source:** Hibiscus derived from flowers, leaves, and steam of hibiscus rosa-sinensis. Hibiscus is a genus of flowering plant in the malvaceae family that includes several species of herbs, shrubs and trees.
**Chemical constituents:** Chemical Constituent present in hibiscus rosa-sinensis, tannins, Flavanoids, saponins, glycosides, phenolic compounds.
**Uses:** 1) its anti-inflammatory, antioxidant and antiviral properties.
2) Hibiscus extract is used in skincare products for its antioxidant and anti-aging properties.
3) Hibiscus promotes scalp health reducing inflammation and Infection.
4) It enhances hair color, adding shine and luster.
5) It reduces breakage and split ends.

## 4.2 Flaxseed:

Flaxseed, also known as linseed, is a nutrient-rich food and fiber crop that has been cultivated for thousands of years. It is a versatile crop with various uses, including food, fiber, and medicine.

**Fig No 7: Flaxseed**

**Botanical Name:** The botanical name of flaxseed is Linum usitatissimum.
**Synonyms:** Flaxseed, Linseed, Flax, Alsi, and Javas.
**Family:** Flaxseed belongs to the ***Linaceae***
**Biological Source:** The biological source of flaxseed (also known as linseed) is the dried, ripened seed of the plant Linum usitatissimum**.**
**Chemical constituents:** Its Major chemical constituent include Lignans, Omega-3 fatty acid, dietary fiber, phenolic acid, flavonoids, alkaloids and saponins, mucilage.
**Uses of Flaxseed in Hair Gel: 1)** Natural styling Gel
2) Moisturizer for Dry Hair.
3) Curl Enhancer.
4) Reduces Frizz & Adds Shine.
5) Nourishes Scalp & Reduces Dandruff.

## 4.3 Aloe Vera Pulp:

Aloe Vera gel is a multi-purpose natural remedy that can improve scalp health, strengthen hair strands and mange oiliness. It is rich in vitamins A, C, E, and B12 which support cell turnover and healthy hair follicle

**Fig No: 8 Aloe Vera Pulp**

**Synonyms:** Aloe barbadensis, Aloe Vulgaris, Aloe ferox, Aloe perryi.
**Family:** Liliaceae ( Asphodelaceae )
**Biological Source:** The biological source of aloe Vera is the dried juice or the fresh mucilaginous gel obtained from the leaves of Aloe barbadensis Miller.
**Chemical Constituent:** Saponins, Amino acids, Vitamins (A, C, E, and B11), Anthracene glycosides.
**Uses:** 1) Makes hair soft, and smooth.
2) Nourishes hair follicles and promotes healthy growth.
3) Reduces scalp irritation, itching and redness.
4) Helps control dandruff and maintain a healthy scalp.
5) Strengthens hair strands and reduces breakage.

## 4.4 Rose Water

Rose Water is a mild astringent which may help to reduce oiliness and dandruff. It is has anti-inflammatory properties, which may make it beneficial for certain scalp conditions, like psoriasis and eczema. Many women with curly hair swear by rose water's ability to calm down frizz and add shine.

**Fig No.9: Rose Water**

**Synonyms:** Rose Water, Gulab Jal, Rose Floral Water, Aqua Rosae.
**Family:** Rosaceae
**Biological Source:** Rose Water is obtained from the fresh petals of the plant Rosa damascene.
**Chemical Constituents:** Volatile oils, (Citronellol, geraniol, nerol), Phenolic compound and flavonoids.
**Uses:** 1) Hydrating and add moisture to damage dry hair.
2) Rose water mild astringent with anti-inflammatory.
3) Improve scalp health and hair texture.
4) Moisturizes dry and frizzy hair.
5) Reduce scalp Irritation and Dandruff.

## 4.5 Almond Oil

The nourishing oil can soften and strengthen your hair. It's rich in vitamin B-7, or biotin, so almond oil helps to keep hair and nails healthy and strong. It can help protect your hair from sun damage, with a natural SPF 5. You can use s almond oil as a scalp treatment.

**Fig No. 10 Almond oil**

**Synonyms:** Almond oil, Expressed Almond Oil, Badam Tail, Mandel
**Family:** Rosaceae
**Biological Source:** Almond is the fixed oil obtained by expression from the dried ripe seeds (kernels) of prunus dulcis
**Chemical Constituent:** Triglyceride esters, with major fatty acids being oleic acid (62-86%), Linoleic acid, and palmitic acid. It also contains vitamins A, B1, B2, B6, E and phytosterols.
**Uses:** 1) Reduces hair breakage & split ends.
2) Helps reduce dryness, itching and dandruff.
3) Supports better nutrient supply to hair follicles.
4) Promote hair growth and nourishes hair roots.
5) Helps to retain moisture in hair shaft.

# 5 Formulation Table of Hair Gel

| Sr. No. | Ingredients | Quantity | Function |
|---|---|---|---|
| 1 | Flaxseed gel | 15 ml | Natural gelling agent, provide viscosity and Hold |
| 2 | Hibiscus extract | 5 ml | Promote hair growth, Strengthen hair roots |
| 3 | Aloe Vera gel | 6 ml | Moisturizes scalp, soothes irritation |
| 4 | Rose Water | 2 ml | Cooling agent and Fragrance enhancer |
| 5 | Glycerin | 1 ml | Humectant, retains moisture in hair |
| 6 | Almond oil | 1 ml | Conditioning agent, improves softness and shine |
| 7 | Vitamin oil | 0.5 ml | Antioxidant, improve stability of formulation |
| 8 | Distilled water | Q.s to 30 ml ( If needed) | Solvent adjust volume and consistency |

# 5. Procedure/Method of preparation

## 5.1 Preparation of Hibiscus Extract

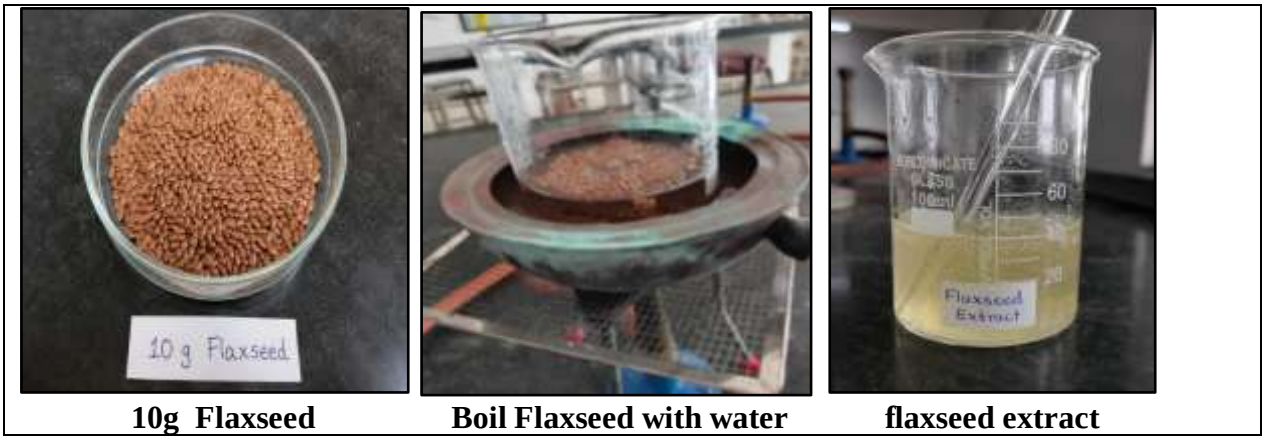
Take fresh/dried hibiscus petals, dry and make a fine powder. Add a 5 g hibiscus powder to 20-25 ml distilled water. Then heat the mixture for 10-15 minutes with continuous stirring. A reddish colored extract forms. Then filter using filter paper or a fine cloth or muslin cloth. And collect the clear extract.

**Dried Hibiscus Flower** **Powdered Hibiscus Flower** **5gm Powder+20 ml water**

Fig No. 11: Preparation of Hibiscus Extract.

## 5.2 Preparation of Flaxseed extract

Accurately Weigh 5 g flaxseeds then add 100ml distilled water in a beaker. Heat on a water bath or hot plate stirring constantly until a thick mucilage forms (usually 10-15 minutes), Filter immediately using muslin cloth or sieve.




**10g Flaxseed** **Boil Flaxseed with water** **flaxseed extract**

Fig No. 12 Preparation of Flaxseed Extract.

## 5.3 Preparation of Gel Base

The measured flaxseed gel (15 ml) was transferred into a clean, dry beaker. Aloe Vera gel (6 ml) was added slowly with continuous stirring using a glass rod until a uniform and smooth gel base was obtained.

## 5.4 Addition of Aqueous Phase

To the prepared gel base, hibiscus extract (5 ml) was added gradually with constant stirring. Glycerin (1 ml) was incorporated as a humectant, followed by the addition of rose water (2.5 ml). The mixture was stirred continuously to ensure uniform distribution.

## 5.5 Addition of Oil Phase

Almond oil (1 ml) was added dropwise with continuous stirring to ensure proper dispersion within the gel matrix. Vitamin E oil (0.5 ml) was subsequently added and mixed thoroughly.

## 5.6 Final Adjustment and homogenization

Add few drops of lemon juice to adjust the pH of the formulation. The final volume was made up to 30 ml using distilled water. The preparation was stirred continuous, smooth, and lump-free gel was obtained.

Fig No. 13: Final Formulation

### 5.7 Filling and Storage

The prepared gel was transferred into a clean, dry, airtight container, properly labeled, and stored in a cool and dry place (preferably under refrigeration).

## 6. Evaluation parameters

### 6.1 Physical Appearance

The physical appearance was visually checked for consistency, color and application of prepared herbal gel formulations.

- Color: Brownish-red coloured gel.
- Odour: Pleasant characteristic herbal odour
- Consistency: Smooth (semisolid) semi-thick gel consistency.

### 6.2 Homogeneity

After the preparation of the gel the gel was visually checked for presence of any lumps and aggregates.

### 6.3 PH determination

After the preparations of herbal hair gel formulation its pH was determined. Take a 1 gram of prepared gel in a beaker and dilute with 10 ml of distilled water and stir properly then they measure pH using PH meter or pH paper.

### 6.4 Spreadability

Take small quantity of gel between two glass slides. Apply slight pressure on upper slide and measure spreading ability.

Spreadability was calculated by using formula.

S= M.L/T

Where, S=Spreadability, M=Weight on the slide, L=Diameter of the formed circle (cm), T=time (sec)

### 6.5 Washability

The prepared hair gel formulation is applied on the skin or hair surface and then washing with normal water and observes removal of gel.

### 6.6 Stability study

The stability study was carried out for the prepared hair gel at standard room temperature 25-30 degree Celsius for 10 days and refrigerated condition for 15 days. Several parameters such as physical appearance, odour and color of prepared gel were noticed, significant changes in colour and pH of hair gel was not observed in 15 days.

### 6.7 Skin irritation test

Applied the herbal gel formulation on the skin and observe for irritation, redness or rashes.

# 7. Result and discussion

**Physiochemical evaluation of formulated herbal hair gel**

| Sr. No. | Evaluation test | Observation |
|---|---|---|
| 1 | Colour | Brownish-red |
| 2 | Odour | Pleasant herbal odour |
| 3 | Consistency | Smooth (semisolid) semi-thick gel |
| 4 | Homogeneity | Uniform |
| 5 | pH | 5.5 – 6.5 |
| 6 | Spreadability | Good |
| 7 | Washability | Easily Washable |
| 8 | Skin irritation test | No irritation |

The evaluation studies demonstrated that the prepared formulation possessed good physical characteristics such as appropriate colour, pleasant odour, smooth consistency and good homogeneity. The spreadability and washability of the gel were satisfactory, indicating ease of application and removal. The pH of the formulation was within the acceptable range for application, suggesting that the gel is safe and non-irritant. Stability studies showed no significant changes in colour, odour or consistency during storage. Overall, the prepared herbal hair gel was found to be stable, safe and suitable for hair care application.

Fig No. 14: Formulation of Hibiscus Flaxseed Herbal Hair Gel.

# 8. Discussion

The hibiscus Flaxseed herbal hair gel was prepared successfully using natural ingredients. Flaxseed gel gave good gel consistency, while hibiscus helped in hair nourishment and hair growth. Aloe Vera provides moisture and smoothness to hair. The gel showed good spreadability, washability and stability. The pH was suitable for scalp application. Overall, the prepared herbal hair gel was found to be safe, stable and useful for hair care.

# 9. Conclusion

The formulation of hibiscus flaxseed herbal hair gel provides a good base for treating the scalp and strengthens the hair thereby preventing the hair fall. The herbal ingredients used in the formulation are beneficial for hair care. Hibiscus helps in nourishing hair and promoting hair growth, while flaxseed

provides natural conditioning and moisturizing effects. The prepared hair gel was found to be safe, easy to apply, and free from harmful synthetic chemicals.

Overall, the formulated hibiscus flaxseed herbal hair gel can be considered an effective and economical herbal hair care preparation. There is a further scope for pharmacological studies in lower animals.

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