

Formulation and Evaluation of Anti Hairfall and Hair Smoothing Natural Hair Spa Gel

Dr.R.Sundhararajan¹,D.Chandrika Devi²,S.Mohamed Abudhahir³,Ak.Mohamed Anas³,
I.Mohamed Appas³,M.Mohaed Irpaan³

¹*Principal, Department Of Pharmaceutical Chemistry, Mohamed Sathak A.J. College Of
Pharmacy, Chennai, Tamilnadu*

²*Associate Professor, Department of Pharmaceutical Chemistry, Mohamed Sathak A.J. College Of
Pharmacy, Chennai, Tamilnadu*

³*B.Pharmacy, Department Of Pharmaceutical Chemistry, Mohamed Sathak A.J. College Of
Pharmacy, Chennai, Tamilnadu*

Abstract—Hair says a lot about a person, both about health and about grooming habits, and buyers today are clearly moving away from products packed with synthetic surfactants, silicones and dyes. That shift explains the steady demand for plantbased hair care. A hair spa gel sits in this space. It is a leave-on or short-contact conditioner that keeps the elegance of a gel while doing the nourishing work of a deep-conditioning spa treatment. In this work we formulated and evaluated such a gel using flaxseed mucilage (*Linum usitatissimum* Linn., Family: Linaceae) together with an aqueous extract of fenugreek seed (*Trigonella foenum-graecum* Linn., Family: Fabaceae).

Flaxseed mucilage carries arabinoxylans, alpha-linolenic acid, lignans such as secoisolariciresinol diglucoside, and vitamin E. Between them these give the hair and scalp a film-forming, humectant, anti-inflammatory and antioxidant action. Fenugreek brings a different set: galactomannan mucilage, protein rich in lysine and L-tryptophan, nicotinic acid, diosgenin, trigonelline and flavonoids, all long used in home remedies for dandruff, hair fall and dull, weak hair. Put together, the two seeds were expected to work better than either would alone.

Four batches, F1 to F4, were made by the dispersion method. Carbopol 940 served as the gelling agent, polyethylene glycol as humectant, polyvinylpyrrolidone as film former, glycerin as moisturiser, methylparaben as preservative and triethanolamine as neutraliser, with purified water as the vehicle. Each batch was then checked for organoleptic characters, homogeneity, pH, spreadability, viscosity, extrudability, washability, mucilage content, microbial limit and skin irritation, and was kept at $25 \pm 2^\circ\text{C}$ / $60 \pm 5\%$ RH for eight weeks to follow its stability

Every batch came out smooth and homogeneous, with no grittiness and no phase separation. The pH stayed between 5.8 and 6.3, which suits the scalp. F4 gave the best balance overall: spreadability 15.2 g·cm/sec, viscosity 28,200 cP, extrudability 93 %, washability 94 % and mucilage content 97.6 %. Total aerobic microbial counts stayed far below the Indian

Pharmacopoeia limit of 10^3 CFU/g, and the skin irritation study produced neither erythema nor oedema. Over the eight weeks F4 held more than 97 % of its starting viscosity, so it is physically stable as well. The work shows that flaxseed and fenugreek can be turned into a stable, safe, cosmetically pleasing and cheap hair spa gel, and that F4 is the batch worth carrying forward to clinical study.

Index Terms—Flaxseed, fenugreek, hair spa gel, Carbopol 940, herbal cosmetics, mucilage, conditioning, antidandruff.

I. INTRODUCTION OF HAIR

Each hair has a hair shaft and a hair root. The shaft is a visible part of the hair that sticks out of the skin. The hair root is in the skin and extends down to the deeper layers of the skin. It is surrounded by the hair follicle (a sheath of skin and connective tissue), which is also connected to a sebaceous gland.

Each hair follicle is attached to a tiny muscle (arrector pili) that can make the hair stand up. Many nerves at the hair follicle too. These nerves sense hair movement and are sensitive to even the slightest draft.

At the base of the hair, the hair root widens to a round hair bulb. The hair papilla, which supplies the hair root

with blood, is found inside the bottom of the hair bulb. New hair cells are constantly being made in the hair bulb, close to the papilla.

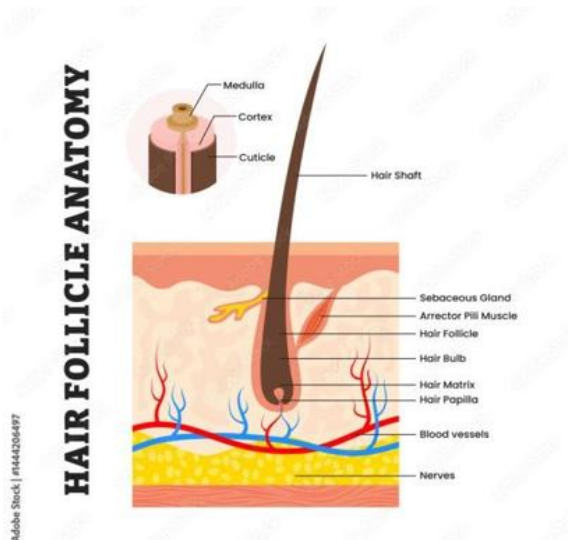
II. HAIR GROWTH CYCLE

1. Anagen (growth phase): lasts 2–6 years; about 85–90 % of scalp hair is in this phase at any time.
2. Catagen (transition phase): lasts 2–3 weeks; the follicle regresses and detaches from the dermal papilla.
3. Telogen, the resting phase: roughly 3 months, ending with the hair being shed as a fresh anagen hair starts underneath. Shedding 50–100 hairs a day is normal. Trouble starts when anagen shortens, or when too many follicles slip into telogen early; the result is **VISIBLE**

THINNING AND HAIR FALL.

III. COMMON HAIR AND SCALP PROBLEMS

- α Dryness and frizz caused by loss of moisture, excessive washing, heat styling and chemical treatments.
- α Dandruff and seborrheic dermatitis, mainly associated with the lipophilic yeast *Malassezia furfur*.
- α Hair fall and androgenetic alopecia, where dihydrotestosterone made by 5α reductase shrinks the follicle.
- α Split ends (trichoptilosis) and breakage due to cuticle damage.
- α Premature greying due to reduced melanogenesis and oxidative stress. Pollution, ultraviolet light, hard water, stress, poor diet and repeated use of harsh synthetic cosmetics make most of these problems worse. Plant-based systems that feed the scalp while staying gentle, and that carry no serious side effects, have therefore become important.



HAIRGEL

The Indian Pharmacopoeia describes a gel as a semisolid system in which either small inorganic particles or large organic molecules are interpenetrated by a liquid. A gel forms when a polymer disperses in a suitable solvent and its chains build a three-dimensional network that locks the liquid in place. This network is what makes gels thixotropic, greaseless, easy to spread, easy to wash off, emollient, non-staining, water soluble and friendly to a wide range of excipients.

IV. ADVANTAGES OF THE GEL DOSAGE FORM IN HAIRCARE

- α Non-greasy and non-sticky; leaves no oily residue on the scalp.
- α High water content, so it hydrates the hair shaft and the stratum corneum of the scalp.
- α Easy to apply, spread and wash off with plain water.
- α Thixotropy– it thins under shear while being applied and firms up again at rest, so it stays where it is put.
- α Provides a favourable environment for the delivery of both water-soluble and mucilaginous herbal actives.

PLANT MATERIALS USED IN HAIR SPA GEL FLAXSEED

Flaxseed, or linseed, comes from *Linum usitatissimum* Linn. (Family: Linaceae), an annual herb grown on a large scale in India, Canada, China and Russia for fibre and oil. The species name

usitatissimum means “most useful”, which fits a plant used for food, cloth and medicine for so long.

The seed coat holds 6–12 % of a water-soluble mucilage, mostly acidic and neutral arabinoxylans with rhamnogalacturonans and galactoglucans. Boiling the seeds releases it as a thick, slippery, clear gel, and that gel has long been used at home to set and condition hair. Besides the mucilage the seed carries 35–45 % fixed oil, half to two-thirds of which is alpha-linolenic acid, along with 20–30 % protein, lignans (chiefly secoisolariciresinol diglucoside), vitamin E, B-complex vitamins and minerals such as zinc, magnesium, copper and selenium

V. BENEFITS OF FLAXSEED FOR HAIR

The mucilage leaves a light, flexible, non-sticky film on the shaft that defines curls, holds frizz down and adds shine.

Alpha-linolenic acid feeds the follicle, calms scalp inflammation and helps keep the scalp lipid barrier intact.

Lignans such as SDG are strong antioxidants; they mop up reactive oxygen species and are reported to affect 5-alpha reductase, the enzyme tied to androgenetic alopecia.

Vitamin E and B-complex vitamins improve microcirculation of the scalp and support keratin synthesis

Linum usitatissimum

Flaxseed

Family: linaceae

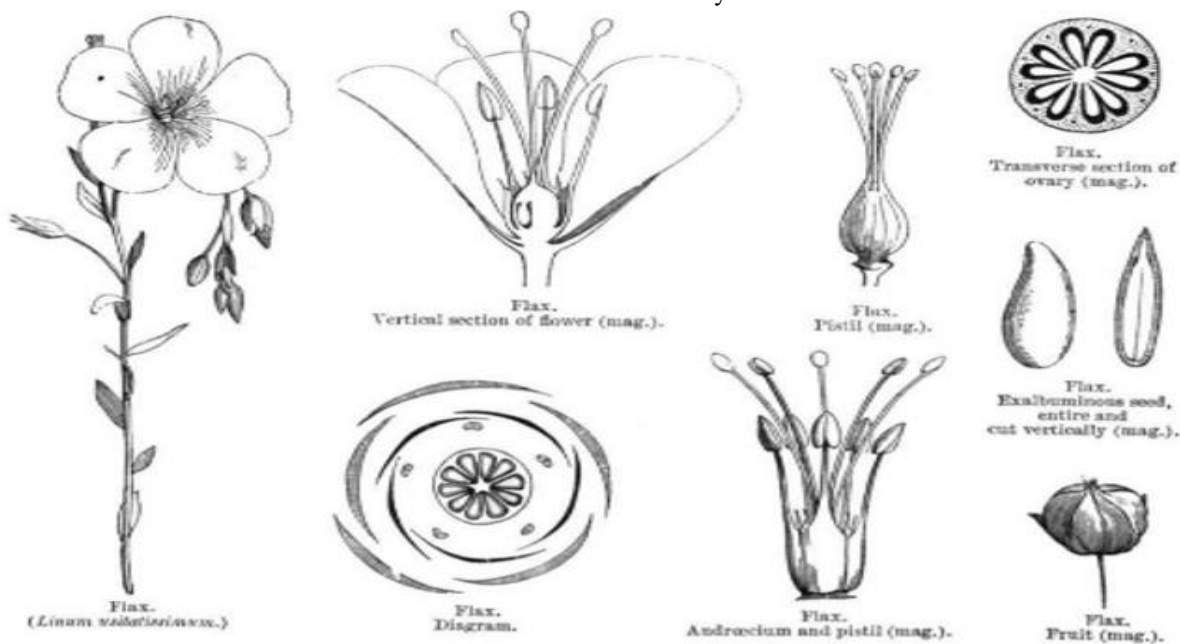


Fig.2:Flaxseed(*Linum usitatissimum*)

FENUGREEK

Fenugreek is the dried ripe seed of *Trigonella foenum-graecum* Linn. (Family:

Fabaceae/Leguminosae), an aromatic annual grown widely in India and especially in Rajasthan, Gujarat and Madhya Pradesh. Hindi calls it methi and Tamil vendhayam. Ayurveda and Siddha have used it for centuries as a hair tonic, a galactagogue and a remedy for diabetes.

VI. BENEFITS OF FENUGREEK FOR HAIR

Galactomannan mucilage conditions naturally: it coats the shaft, adds slip, makes detangling easier and cuts mechanical breakage.

Protein and amino acids, lysine and L-tryptophan above all, are what keratin is built from, and they are reported to strengthen the shaft and reduce hair fall.

Nicotinic acid, vitamin B3, widens the vessels feeding the dermal papilla and so encourages growth.

Diosgenin and the other steroidal saponins are anti-inflammatory, and they are thought to block 5-alpha reductase, which would slow DHT-driven shrinking of the follicle.



Fenugreek

Fenugreek (*Trigonella Foenum -Graecum*)

VII. FORMULATION OF HAIR SPA GEL

1. Weigh the carbopol 940 accurately and scatter it into part of the purified water While stirring;

Leave it to hydrate for 2 hours until the dispersion is even and free of Lumps

2. Pour the freshly made flaxseed mucilage slowly into the swollen carbopol Dispersion, stirring gently all the while
3. Add the fenugreek mucilage in the same manner and stir until a uniform herbal gel Base Is Obtained
4. In another beaker dissolve the methylparaben in a little warm purified water, Then Add the polyethylene glycol and polyvinyl pyrrolidone and stir until the solution turns clear.
5. Pour this solution slowly into the herbal gel base with constant stirring to avoid entrapment of air.
6. Add glycerin and mix thoroughly; Make up the volume to 100 gm with purified water
7. Add the triethanolamine drop by drop with gentle stirring until the gel is neutralized
8. Fill the finished gel into a clean wide mouthed container , label it and hold it that room temperature for evaluation.

VIII. FORMULATION OF CHART

S.no	Ingredients	F1	F2	F3	F4
1	Flax seed extract	3g	4g	5g	5g
2	Fenugreek extract	3g	4g	4g	5g
3	Carbopol 940	0.5g	0.5	1.0g	0.75g
4	Methyl paraben	0.1g	0.1g	0.1g	0.1g
5	Polyethylene glycol	2g	2g	2g	2g
6	Polyvinylpyrrolidone	1g	1.5g	2g	2g
7	Triethanolamine	0.1g	0.2g	0.6g	0.25g
8	Glycerine	3g	3g	3g	3g
9	Lavender	0.20g	0.20g	0.20g	0.20g
10	Purified water	Q.f to 100	Q.f to 100	Q.f to 100	Q.f to 100

PROCEDURE

1. Weigh Carbopol 940 and disperse it in purified water with continuous stirring. Allow it to hydrate for 2 hours.
2. Add flaxseed mucilage slowly and mix gently.
3. Add fenugreek mucilage and stir until a uniform gel base is formed.

4. In a separate beaker, dissolve methylparaben in warm purified water. Add PEG and PVP and stir until clear.

5. Add this solution slowly to the gel base with continuous stirring.

6. Add glycerin and mix well. Add purified water to make the final weight 100 g.

7. Add triethanolamine dropwise and stir until the pH reaches 5.8–6.3 and the desired gel consistency is obtained.

8. Transfer the prepared gel into a clean, wide-mouthed container, label it and store at room temperature for evaluation.



IX. EVALUATION TEST FOR HAIR SPA GEL

The prepared hair spa gel formulations (F1–F4) were evaluated for their physical, physicochemical and microbiological properties. The evaluation was carried out to determine the quality, stability, application characteristics and suitability of the formulations for hair and scalp use.

1. Physical Appearance

All four formulations produced smooth and uniform gels without visible lumps, coarse particles or phase separation. F1 showed a slightly translucent appearance, while F2 was translucent. F3 appeared slightly opaque and thicker, whereas F4 exhibited a glossy and translucent appearance with a smooth, silky texture. The formulations had a mild herbal odour, except F3, which showed a comparatively stronger fenugreek odour.

2. pH Evaluation

The pH of the formulations ranged from 5.8 to 6.3. F1 showed a pH of 5.8, F2 showed 6.0, F3 showed 6.3 and F4 showed 6.1. These values were considered appropriate for hair and scalp preparations because they fall within the mildly acidic range suitable for scalp application.

3. Spreadability

Spreadability indicates how easily the gel can be distributed over the hair and scalp. F1 showed a spreadability of 11.8 g·cm/sec, F2 showed 13.6 g·cm/sec, F3 showed 9.9 g·cm/sec, and F4 demonstrated the highest value of 15.2 g·cm/sec. Therefore, F4 was easier to spread and apply uniformly.

4. Viscosity

The viscosity of the formulations was determined using a Brookfield viscometer. F1 had a viscosity of 20,400 cP, F2 had 25,600 cP, F3 had 33,100 cP, and F4 had 28,200 cP. F3 was the thickest formulation, whereas F1 showed the lowest viscosity. F4 provided a suitable balance between thickness and ease of application.

5. Extrudability

Extrudability represents the ease with which the gel can be removed from its container or tube. The values obtained were 84% for F1, 89% for F2, 76% for F3 and 93% for F4. F4 showed excellent extrudability and required comparatively less force for dispensing.

6. Washability

Washability was assessed by determining the amount of gel that could be removed using water. F1 showed 87%, F2 91%, F3 84%, and F4 94% removal. F4 demonstrated the best washability, indicating that it could be rinsed away effectively without leaving excessive residue.

7. Microbial Evaluation

The formulations were subjected to microbial limit testing. The total aerobic microbial counts were within the specified Indian Pharmacopoeia limit of NMT 10^3 CFU/g. F1 recorded 1.1×10^2 CFU/g, F2 8.0×10^1 CFU/g, F3 1.4×10^2 CFU/g, and F4 6.0×10^1 CFU/g. Thus, all formulations complied with the microbial acceptance criteria.

8. Overall Evaluation

Among the four formulations, F4 was considered the optimized formulation. It showed the best combination of appearance, pH, spreadability, viscosity, extrudability, washability and microbial quality. F4 exhibited 15.2 g·cm/sec spreadability,

28,200 cP viscosity, 93% extrudability and 94% washability.

Therefore, F4 was selected as the most suitable flaxseed and fenugreek hair spa gel formulation for further studies.

X. CONCLUSION

The study successfully formulated a herbal hair spa gel using flaxseed and fenugreek mucilage. All formulations showed satisfactory physical properties, pH, spreadability, viscosity, washability, and microbial safety. F4 was identified as the optimized formulation, showing the best overall performance. The developed gel provides a safe, economical, and natural alternative for hair and scalp care.

REFERENCES

- [1] Nikam P., Patil M., Rathod A., Gaikwad V. A Review on Herbal Hair Spa Gel. *International Journal of Pharmaceutical Sciences*. 2025; 3(12): 2995–3006.
- [2] Goyal A., Sharma V., Upadhyay N., Gill S., Sihag M. Flax and flaxseed oil: an ancient medicine and modern functional food. *Journal of Food Science and Technology*. 2014; 51(9): 1633–1653.
- [3] Kajla P., Sharma A., Sood D. R. Flaxseed– a potential functional food source. *Journal of Food Science and Technology*. 2015; 52(4): 1857–1871.
- [4] Wanjari N., Waghmare J. Extraction and characterization of flaxseed mucilage. *International Journal of Pharmaceutical Sciences and Research*. 2015; 6(3): 1145–1151.
- [5] Wani S. A., Kumar P. Fenugreek: a review on its nutraceutical properties and utilization in [5:15 pm, 05/09/2026] Mohd Anas Clg: 14. Sharma M., Sharma S. Formulation and evaluation of herbal hair mask. *World Journal of Pharmaceutical Research*. 2019; 8(9): 1204–1213.
- [6] Kaushik R., Gupta D. Herbal cosmetics in hair care: a review. *International Journal of Green Pharmacy*. 2020; 14(1): 1–8.
- [7] Indian Pharmacopoeia. Volume I and II. Ghaziabad: Indian Pharmacopoeia Commission, Ministry of Health and Family Welfare, Government of India; 2018.
- [8] United States Pharmacopeia and National Formulary (USP 43–NF 38). Rockville: United States Pharmacopeial Convention; 2020.
- [9] Rowe R. C., Sheskey P. J., Quinn M. E. *Handbook of Pharmaceutical Excipients*. 6th Edition. London: Pharmaceutical Press; 2009: 110–114, 283–288, 441–445, 581–585, 754–757.
- [10] Lachman L., Lieberman H. A., Kanig J. L. *The Theory and Practice of Industrial Pharmacy*. 3rd Edition. Mumbai: Varghese Publishing House; 1991: 534–563.
- [11] Aulton M. E., Taylor K. M. G. *Aulton's Pharmaceutics: The Design and Manufacture of Medicines*. 5th Edition. Edinburgh: Elsevier; 2018: 435–450.