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Research Article

Formulation And Evaluation of Flaxseed Hair Serume

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ABSTRACT

In this expeditious world, cosmetics are in great demand. Cosmeceuticals in Pharmaceutical industry is booming day-by-day. Cosmetics are used on daily basis. Cosmetics are intended for skincare, hair care, nails and for teeth as well. Also, to take the note, toothpastes, hair oils, hair dyes are classified into the cosmetics that is been used by every individual on everyday basis. The synthetic or chemical products have side effects and adverse effects Of when used, thus now people have high approach towards organic, natural and herbal formulations that show no or minimum side effects. Generally herbal preparations are known for its “No side effect” property. Various problems are experienced by the people such as hair fall, split ends, dandruff, increased sebum production, hair thinning, premature hair greying etc. Thus, people are looking for ways to increase hair development, their prevention and care. A hair serum helps to lock the moisture and keep the scalp hydrated and healthy. Trigonella foenum graecum (Fenugreek) is a popular homemade remedy for hair growth and also improves hair density. Flaxseed is beneficial in treatment of dandruff and boosts hair growth. Citrus sinensis is rich in anti-oxidants that are very effective in treatment of spilt ends. Ginger has high content of gingerol which improves the blood circulation and boosts hair growth. Castor oil, Vitamin E. Hibiscus is also useful in treating dry and damaged hair, provides hydration to the scalp. Thus, preparation of the herbal formulation using natural products will help in treatment of various hair diseases.

INTRODUCTION

The word cosmetics was derived from the Greek word “kosmtikos” meaning having the power, arrange, skill in Decorating. Cosmetics, means any article intended to be rubbed, poured, sprinkled or

sprayed on or introduced into or otherwise applied to human body or any part thereof for cleansing, beautifying, promoting attractiveness or altering appearance and includes any article intended for use as a component of cosmetic. ‘Cosmeceuticals’

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can be referred to as topical cosmetic pharmaceutical hybrids intended to enhance beauty through ingredients that provide additional health related functions or benefits. Herbal cosmetics are preferred over chemically synthesized products because they typically have fewer or no harmful side effects, are considered safe for use, and are compatible with most hair types. Herbal hair serum is more preferred and it is used for healthy hair. They promote hair growth, which also hydrates and moisturizes dry and damaged hair. Reduce frizz and split ends and also protect against environmental damage. It also reduces hair fall, scalp irritation and other problems related to hair.[1] In recent years, there has been a significant shift towards the use of natural and plant-based products in the beauty and personal care industry. This change is particularly evident in hair care, where consumers are increasingly opting for products free from synthetic chemicals, preservatives, and artificial fragrances. Herbal hair serums, made from plant extracts and essential oils, have emerged as a popular alternative to traditional, chemically-laden hair treatments. These serums offer a promising solution for individuals seeking to address various hair concerns such as dryness, frizz, hair thinning, and scalp irritation and other problems related to hair. The present work was aimed to prepare and evaluate a herbal hair serum containing herbs used like flaxseed, orange peel, fenugreek, Aloe vera, castor oil, vitamin E, which have been used for centuries for their therapeutic properties. These ingredients are believed to nourish and revitalize the scalp, strengthen hair follicles, and promote healthier, shinier hair. Furthermore, this thesis explores the effectiveness of herbal hair serums in promoting hair health, comparing them to conventional hair products in terms of their benefits, application, and consumer perception. It also aims to evaluate the potential of herbal remedies in addressing hair-related issues through

an in-depth analysis of their key ingredients, and long-term outcomes. Hair plays a vital role in the human body. As hairs are considered to be one of the essential parts that complement the beauty of a person, it is important to take right care of the hairs. Human hair is considered as one of the symbols of beauty in humans and the scalp is an important element for hair growth. It's a cyclical medium involving hair shaft conflation, extension, and eventually shedding. Human hair generally comprises follicle of anagen and telogen phases. Herbal hair serum is one of the ornamental products with veritably high attention of active component in their formula for furnishing ferocious nutrition to the deeper skin subcaste and non-greasy finish product which is suitable for skin. Containing slightly thicker thickness than water. Hair serums are the liquid medication. Hair serums add natural shine while shielding hair from environmental or heat-related damage with its rich moisturizing characteristics. Hair serum blocks the humidity and makes the hair healthier. Hair serum is a liquid-based treatment usually formulated using provide a protective layer over the hair fiber, assisting in smoothing frizz. This smooth layer then reflects the light, which is how serum gives you get heat. Hair can be defined as a slender, thread-like outgrowth from a follicle in the skin of mammals. Composed mainly of keratin, it has three morphological regions: the cuticle, medulla, and cortex. The hair is made up of 95% Keratin, a fibrous, helical protein (shaped like a helix) that forms part of the skin and all its appendages (body hair, nails, etc.) Keratin synthesized by Keratinocytes and is insoluble in water, thus ensuring impermeability and protection for the hair. Some 18 amino acids can be found in the hair, threonine, leucine and arginine. Keratin is particularly rich in cysteine (a type of sulfurated amino acid), which forms disulfide bonds between molecules, adding rigidity and resistance to the entire structure[1].



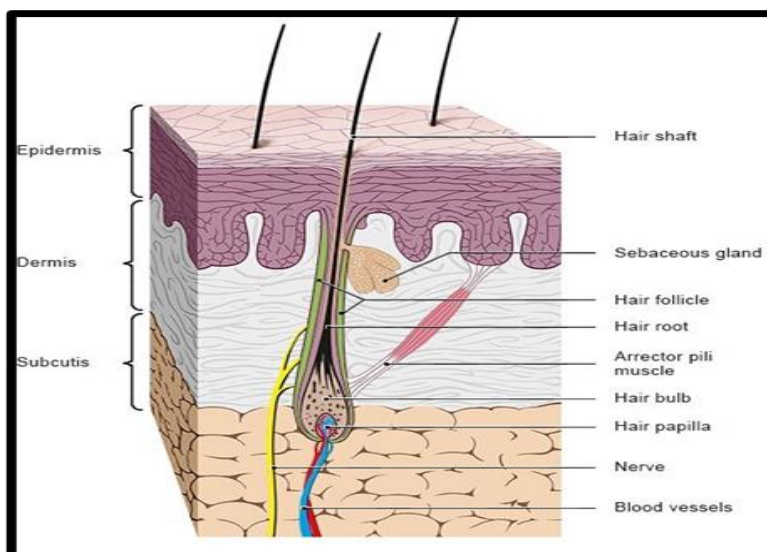


Fig. no. 1. Anatomy of Hair Scalp

The hair structure can be divided into 3 distinct parts:

- **Medulla:** Innermost layer of the hair shaft composed of an amorphous soft oily substance.
- **Cuticle:** Thin protective outer layer that contains the nourishing portion essential to the hair growth it is highly keratinised composed cell shape like scales that are layered one over the other measuring about 60 micro meters long about 6 microns.
- **Cortex:** Main component of the hair, containing long keratin chain that add elasticity, suppleness and resistance to the hair. The cells of the cortex are joined together by an intracellular cement eric him lipids and proteins each cell is composed of bundles that lie in the direction of The hair length: these are macro fibrils which are made up of microfibrils, which in turn contain protofibrils[4].

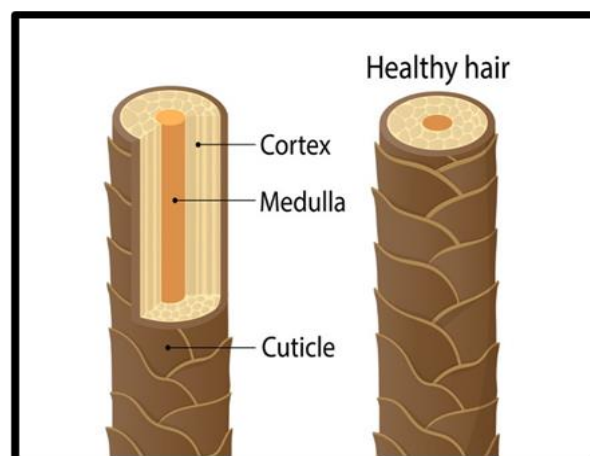


Fig. no. 2. Hair Structure

1.1 Benefits of hair serum:

Protect hair: Acts it against the heat, sun damage. Dirt, dust, pollution when hair serum applied on hair it forms the thin layer on hair. It protect the hair from the hair damage.[5].

Gives shine to the hair: Hair serum from the thin layer which reflects the light. The serum provides the shiny appearance to the hair. Hair serum contained the amino acids which protect coloured and chemically treated hair.

Multi purpose: Hair serum are used to treat the various hair related problems. Few drops of hair serum make your hair shiny and silky it turns your

bad day into the good day. It is one remedy to multi hair issue[5].

Nourished hairs: Hair serum fill the follicular cracks and act on damaged hairs. Hair serum make hair manageable which make them lustrous and easy to carry[3].

Best for hair dry: Most commonly hair serums are used for the damaged, dry, and frizz hairs. Hair serum lock and provide the moisture to the hair and make them smooth and shiny[5].

Prevent hair fall from breakage: When our hair becomes frizz, damaged, messy, tangled in further condition we loss lot of hair follicles. Hair serums act as the lubricant in such cases and make them detangled easily. It may cause the stop the hair fall problems[3].

1.2 Problems of hair: Hair is an important part of human body. The problem associated with it includes hair loss, lack of hair volume, conditioning, immature greying, dandruff, thinning of hair, dullness etc. Hairs can in shape, length, diameter, texture and colour.

All mammals have hair. Its main purpose is to regulate body temperature. It also wants to decrease friction to guard against sunlight. For the scalp, hairs were known as protective covering in ancient times[4].

1. Dandruff: Dandruff is little white pieces of dead skin in someone's hair, or fallen someone's hair. It's apparently caused by a fungus called *Malassezia restricta* and *Globose*, formerly called *Pittosporum* may be a yeast causing infection of skin and scalp. It's caused by not brushing hair, allergy, not showering enough etc[2].



Fig. no. 3.Dandruff

2. Hair loss:

- Although historically as a haul among men, hair loss is additionally common among women.
- Female hair loss is typically caused by stress, medication, changing hormones and even menopause. Many hair styling product can contribute to hair loss.



Fig. no. 4. Hair Loss

- **Dry hair:** Shampooing too often cause dry hairs. Although squeaky clean hair may be good thing, many overdo it by washing once, sometimes twice or per day which strip away all of the hair's natural oils.
- **Split ends:** Over brushing hair, excessive perming, too much heat and lack of a good conditioner cause split ends. Exposure to

extreme weather conditions, and hair care techniques such as blow drying, straightening, and curling may cause split ends.



Fig. No. 5. Split Ends

- **Grey hair:** To many, grey hair is a badge of honour. But others would prefer to get rid of it because grey hair can be brittle and more unruly than other strands.
- **Dull hair:** There are many causes of dull looking hair chemical or heat styling damage and environmental soil.
- **Oily/greasy hair:** Oily hair is caused scalp produces an excessive amount of natural oil called sebum. Sebum is produced by sebaceous glands, which leading to excessive amounts of oil.
- **Heat damaged hair:** Heat damaged hair occurs when you blow dry, flat iron, or curl your hair at the highest temperature settings over an extended period of time.[4]

1.3 How to Apply Hair Serum:-

Step 1: Shampoo your hair:

- Use shampoo to wash the oil from your hair. If you rinse without shampooing, it'll leave your hair looking oily. Shampoo your hair just once, and apply it to your scalp in the same way you applied the oil. Start at the front of your head,

work your way towards your crown, and then massage from the nape area up to the crown.



Fig. no. 6. Shampoo your hair

Step 2: Apply On Damp Hair:

- The best time to apply a serum is after you have washed your hair. When your hair is a bit damp post-washing, apply a few drops of the product to detangle your mane.

Step 3: Rub a few drops of Serum into your palms:

- Just take 4-5 drops of the serum in your palms and rub it before applying it evenly to your strands. The quantity of the product you take totally depends on the length of your hair. Just make sure not to go overboard as it might make your hair look greasy.



Fig. no. 7. Few drops of serum

Step 4: Applying the serum:

- Apply the serum to the back of your hair first. Don't start with the front or the top of your hair and ruin your style with too much serum. Instead, use your hands to gently blot the serum into the midsection and tips of your hair-starting at the back and moving forward to the front of your hair. This way, if you apply too much to your hair to start, it won't be noticeable.



Fig. no. 8. Applying the serum

Step 5: Comb your hair:

- Comb your dry hair until it's tangle-free. Start at the ends of your hair and work your way up to prevent painful snagging and breakage.

Step 6:Run your fingers through your hair:

- Start at the ends of your hair and then slowly work up into the strands, stopping at least 5 inches (12.7cm) from the scalp. Coating the ends of your hair with Serum will tame flyway's and frizz and give your hair a sleeker look. Don't apply it too close to your roots, or your hair will look oily.

Step 7: Repeat once a week for best results:

- Doing regular Serum treatments will help foster new hair growth over time. It will also

make your hair strong, smooth and soft by sealing in moisture.[2]

2. Plant Profile

1. Flaxseed



Fig. no. 9. Flaxseed

Botanical name: *Linum usitatissimum*

Family: Linaceae

Synonym: Linseed, flaxseed

Biological source: It consists of the dried fully ripe seeds of *Linum usitatissimum* Linn.

Chemical constituent: Alpha-linoleic acid (ALA), Omega-3 fatty acid, lignans, etc

Uses: Anti-inflammatory, anti-oxidants, hair growth [5].

2.Aleo vera



Fig. no. 10.Aloe vera

Botanical name : *Aloe barbadensis milleer*

Family : Liliaceae

Synonym : Aloe vera, aloe, burn plant, lily .

Biological Source : It is the leaves of various species of *aloe-vera- aloe beardedensis'* aloe perry¹, aloe spicata, aloe African.

Chemical constituents : Aloe vera are measure source of anthraquinone glycoside. Aloe vera contain aloin, barbaloin, aloe emodin.

Uses : To make stronger hair,It provides antioxidant properties and also act an emollient

Improve texture of hair,repair dead skin on the scalp.

Aloe vera gel is slightly viscous & clear liquid having good moisturizing properties[6].

3. Orange Peel



Fig. No. 11. Orange Peel

Botanical name: *Citrus sinensis*

Family: Rutaceae

Synonym: Orange or sweet orange

Biological source: It is obtained from the orange peel which is dried or fresh outer part of the pericarp of ripe or nearly ripe fruits of *citrus sinensis*.

Chemical constituents: limonene, (S)-linalool, pectin, octanal, decanal, essential alcohols, etc.

Uses: Anti-oxidant, anti-inflammatory, Orange oil as perfuming agent, help to relief from itchy[5]

4. Fenugreek



Fig. no. 12. Fenugreek

Botanical name: *Trigonella foenum-graceum*

Family : Leguminosae

Synonym: Methi, Methika, Alholva, Chandrika.

Biological Source : It is obtained from the dried seeds to *Trigonella foenum- graecum*

Chemical Constituents: Vitamin B,alkaloids. flavonoids, saponins, etc

Uses : Hair growth stimulant, antibacterial, Increases blood flow to the scalp[6]

5. Hibiscus



Fig. no. 13. Hibiscus

Botanical name: *Hibiscus Rosa sinensis*

Family : Malvaceae

Synonym: Hibiscus, Hibiscus mutabilis, Roselle.

Biological source It is obtained from the petals of flower of *Hibiscus Rosa sinensis*.

Chemical constituents : Vit. A, C, amino acids, alpha hydroxyl acids,(AHA) etc.

Uses: Hair growth stimulator, anti-dandruff, colouring agent, add volume to hairs and thicken them ,treat the problem related to dandruff[9].

6. Castor Oil



Fig. no. 14. Castor Oil

Botanical name: *Ricinus communis*

Family: Euphorbiaceae

Synonym: Ricinus oil.

Biological source: Castor oil is the fixed oil obtained by the cold expression of the seeds of *Ricinus communis*.

Chemical constituents :80% riconeleic acid, fatty acids such as isoricinoleic, linoleic, stearic and isosteric acids.

Uses: Hair growth stimulator, anti-dandruff, anti-inflammatory, provides required nourishment to hair root.[8]

Other ingredients use are:

7.vitamin E

Tocopherol- A vitamin E-rich oil can help to restore shine by rebuilding the protective layer. In general, oil helps to seal in moisture, minimise breakage, and protect the hair from harm. 35 Vitamin E may help support a healthy crown and hair since it contains natural antioxidants that may aid in hair growth. Vitamins and antioxidants can reduce the quantity of oxidative stress and free radicals that lead to the deterioration of the hair follicle cells in one's crown.

8.Triethanolamine: use as preservative

9. Rice water

10. Orange Essential oil : Perfuming agent[5].

3. MATERIAL AND METHOD

The material used in the preparation of flaxseed herbal serum are flaxseed extract ,Aleo vera,orange peel powder, fenugreek seed powder, hibiscus powder, castor oil,vitamin E, Triethanolamine (TEA), Rice Water.

Table.1 Formulation Table for Flaxseed Hair Serum

Sr. no	Ingredients	Quantity taken			Property
		F1	F2	F3	
1.	Aleo vera	Q. S	Q. S	Q. S	Conditioner
2.	Flaxseed	8.75g	8.80g	8.75g	Gelling agent
3.	Orange Peel powder	1.5g	1.5g	1.5g	Anti-oxidant
4.	Fenugreek seed	8.75g	8.70	8.75g	Hair growth stimulant
5.	Hibiscus powder	2.5g	2.5g	2.5g	Colouring agent
6.	Castor oil	0.5ml	0.5ml	0.5ml	Hair growth
7.	Vitamin E	1ml	1ml	1ml	Antioxidant
8.	Triethanolamine	1ml	1ml	1ml	Preservative
9.	Orange Essential oil	1ml	1ml	1ml	Perfuming agent
10.	water	Q. S	Q. S	Q. S	Vehicle
	Total	2.5ml			

Equipment: Laboratory equipment and apparatus were used for preparation.

METHOD:

Procedure for Herbal serum:

Procedure for preparation of 25ml of Herbal hair serum is divided into four parts:

Solution 1

1. In a beaker, add flaxseeds in distilled water and apply heat.
2. Continue heating until clear, slight viscous gel is formed.
3. Filter the gel using muslin cloth.
4. To the obtained gel, add 1 capsule of Vitamin E and 1ml of cold pressed castor oil.
5. Mix the solution using magnetic stirrer for 30 minutes.
6. After, add Aloe vera extract homogeneous solution is obtained. Drop wise until.

Solution 2

1. In a beaker, add 1 dried fenugreek seeds in distilled water and boil the solution for 5 minutes.

2. Filter the solution and of orange peel powder and keep the mixture at room temperature.
3. Additionally, add rice water to the solution in order to make a solution free from any lumps.

Solution 3

1. In a beaker, add Hibiscus powder in water.
2. Heat the solution until requisite colour is obtained.
3. Filter the solution and store.

Solution 4

1. In a beaker, add solution 1 and solution 2 with continuous stirring with a stirrer.
2. Then, add solution 3 drop wise until suitable colour is obtained and continue stirring with a glass rod[10].
3. To this solution, add about 1ml of triethanolamine that acts as a preservative and 1-2 drops of orange oil which acts as perfuming agent.
4. Mix the solution using magnetic stirrer for 15 minutes.
5. Store serum in well closed container [5].





Step 1: Collection of ingredients



Step 2: Extraction of ingredients



Step 4: Prepared final formulation



Step 3: Filtration using muslin cloth

4. Evaluation Of Flaxseed Hair Serum:

1. **Physical appearance** - The Physical appearance, colour and feel of the prepared hair serum were visually tested[5].
2. **Homogeneity Test** – The clean and dried glass slide was smeared with the herbal serum and covered using glass cover. The appearance investigated under light. The serum was also visually tested for homogeneity, aggregates or floccules[5].
3. **PH** –pH was determined by using pH paper. The pH of herbal hair serum observed to be 4.5 to 5.5 that are suitable for formulation[8].
4. **Viscosity**–The viscosity of prepared formulation was determined by using Oswald viscometer [8].
5. **Microbial contamination** – Cup Plate and Pour Plate Method: Nutrient agar medium is used for the antimicrobial assay. Nutrient agar was prepared by its prescribe procedure and autoclaved at 121°C for 45 minutes. The sterilized media was allowed to cool at 37°C -

38°C. Plate were filled with nutrient agar solution and allowed for solidification. After solidification, the microorganisms from the subculture were inoculated into the nutrient agar medium. Sub-cultured Bacteria were inoculated by striking on the surface media of the petri plate and subjected to incubation. Later 4 wells were drawn with help of borer in each plate to receive Herbal Extract, Individual Formulation Polyherbal Formulation and the marketed reference standard. These were immediately poured into it and kept for incubation for 24 hours at 37°C for growth of

microorganisms and the test and standard samples to diffuse through it. After the incubation was measured by zone meter and recorded.[24]..

6. **Skin Irritation test**–It is carried out by applying the serum on the skin and tested for redness or itching. After 2 hours. It was observed that there is no redness or itching on the part of skin where the serum was applied. It is suggested that the hair serum was safe for use.[24].



Fig. no. 15. pH Test

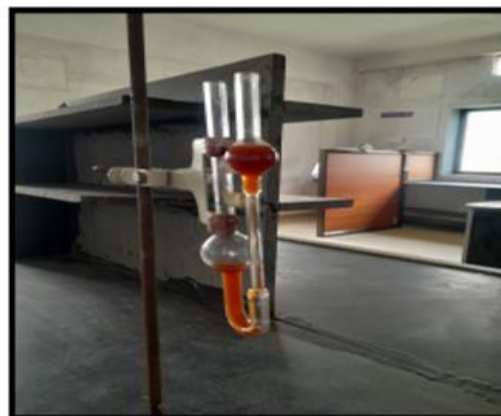


Fig. no. 16. Viscosity Test

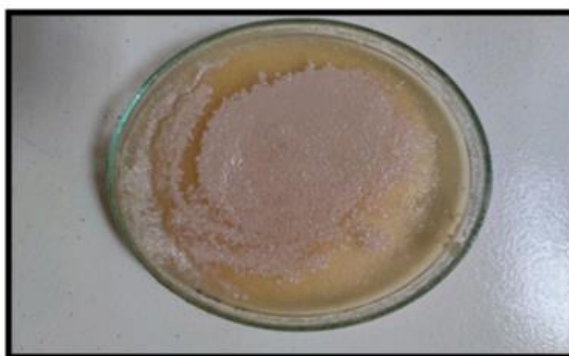


Fig. no. 17. Microbial Assay

5. RESULT AND DISCUSSION:

1. **Physical appearance:** The physical appearance, colour and feel of the developed herbal hair serum were visually tested. There was no presence of any foreign particles. The

colour observed was pale brownish to pale reddish with translucent finish which was smooth and clean on application.

2. **Homogeneity :** By visual examination of serum, appearance and presence of any lumps,

flocculates or aggregates was checked for homogeneity. The homogeneity of prepared serum was observed to be good.

3. **pH** : The pH of the prepared herbal serum was observed to be 5.5 that are suitable for formulation
4. **Viscosity** : The viscosity of the prepared herbal was determined using Oswald viscometer
5. **Microbial contamination** : After three days, the anti-microbial activity of the prepared herbal hair serum was observed and was found to be about 1-2cm around the well prepared
6. **Skin Irritation test** : It is carried out by applying the serum on the skin and tested for redness or itching. After 2 hours. It was observed that there is no redness or itching on the part of skin where the serum was applied.

research study and outcomes shown. It contains natural components that assist hair maintenance and development. Herbal hair serums have been shown to be a highly effective and natural way to promote hair growth, improve hair texture, and address various hair-related issues. The unique blend of herbs and natural ingredients in these serums provides nourishment, moisturization, and protection to the hair, leading to healthier, stronger. The anti-oxidant properties of herbal components including orange peel powder, hibiscus powder, and vitamin E primarily function by halting the premature greying of hair. Castor oil, fenugreek, and flaxseeds are effective stimulators of hair growth. Hibiscus powder can be also employed as a colour agent in this case. When compared to synthetic chemicals, the components are not dangerous. People now days are really interested in the herbal sector. Due to its strength, effectiveness, and growing use in cosmetics, the herbal business has a promising future.

REFERENCES

1. Bhatkar VD, Garkar RV, Hiwase RD, Bekate PS. Flaxseed: As a medicinal herb. Indo Am J Pharm Sci. 2023;10(5):501F.
2. Gujar S, Pawar AB, Bhusari P, Kadu G. The herbal hair remedy: Herbal hair serum. Int Res J Modern Eng Technol. 2023.
3. Rawat S, Jaybhaye SS, Vyas GV, Gaikwad BS, Rathod KS. Formulation and evaluation of herbal hair serum. EPRA Int J Res Dev. 2024 Nov;9(11). doi:10.36713/epra2016.
4. Bhanu MS, Sri Rama Krishna SH, Kumar KS, Sri SB, Bhanu SG, Sruthi YS. Formulation and evaluation of herbal hair mask containing Linum usitatissimum. ISO 9001:2015 Certified Journal. 2024;13(5):945.
5. Penkar GM, Salkar MR, Chavan PS, Ambade MS, Parab SA, Sawant MM, Japgap VA. Formulation and evaluation of herbal hair

Table 2. Evaluation Parameter

Parameters	Results		
	F1	F2	F3
Colour	Brownish - red	Brownish - red	Brownish - red
Odor	Citrus type	Citrus type	Citrus type
Appearance	Good	Good	Good
Homogeneity	Good	Good	Good
Viscosity	11.40 cP	11.39 cP	11.40 cP
pH	5.5	5.2	5.5
Skin irritation	No	No	No

7. SUMMARY AND CONCLUSION:

The herbal hair serum was successfully formulated and evaluated by using herbal ingredients. The produced herbal hair serum offers a variety of critical nutrients that are crucial for keeping healthy hair and scalp conditions, according to the



- serum in treatment of various hair-related problems. *Res J Pharm Phytochem.* 2021.
6. Anusha R, Akhila N, Nikhitha J, Harish K, Shaikh AR, Sony Y, Inamul. Formulation and evaluation of herbal hair serum a review. *Int J Basic ClinPharmacol.* 2023 Sep-Oct;12(5):759. Doi:10.18203/2319-2003.ijbcp20232578.
 7. Ansari 5.H., Ali M. Hair care and herbal drug. *Indian J Nat Prod.* 1997;13(1):3rreviewKathi VR, Rathi JC, Tamizharasi S, Pathak AK. Plants used for hair growth promotion: A review. *Pheog Rev.* 2008;2(3):165-7.
 8. Dixit VK, Adhirajan N, Gowri C. Development and evaluation of herbal formulations for hair growth. *Indian Drugs.* 2001;38(11):559-63.
 9. Patni P, Varghese D, Balekar N, Jain DK. Formulation and evaluation of herbal hair oil for alopecia management. *Planta Indica.* 2006;2(3):27-30.
 10. Adhirajan N, Ravikumar T, Shanmugasundaram N, Babu M. In vivo and in vitro evaluation of hair growth potential of *Hibiscus rosasinensis* Linn. *J Ethnopharmacol.* 2003;88:235-9.
 11. Purwal L, Gupta SBN, Pande MS. Development and Evaluation of Herbal Formulations for hair growth. *E-J Chem.* 2008;5(1):34-8.
 12. Hiremath RS. Textbook of Industrial Pharmacy. 1st ed. Hyderabad: Orient Longman Pvt Ltd; 2007. P. 99-102.
 13. N, Ravikumar T. Evaluation of Hair growth potential of *Hibiscus*. (Additional info may be needed for complete citation).
 14. Mithal BM, Shah RN. Handbook of Cosmetics. 1st ed. Delhi: VallabhPrakashan; 2000. P. 141-2.
 15. Hiremath RS. Textbook of Industrial Pharmacy. 1st ed. Hyderabad: Orient Longman Pvt Ltd; 2007. P. 99-102.
 16. Bhatia SC. Perfumes, Soaps, Detergents, and Cosmetics. 2nd ed. Delhi: CBS Publishers and Distributors; 2001. P. 639-41.
 17. Saraf S. Herbal hair oil cosmetics: Advancements and recent findings. *World J Pharm Res.* 2014;3(2):3278-94.
 18. Dwivedi S. Formulation and evaluation of herbal hair oil. *Int J Chem Sci.* 2012;10:149.
 19. Mithal B, Shah RN. Handbook of Cosmetics. 1st ed. New Delhi: VallabhPrakashan; 2000. P. 141-2.
 20. Saraf S, Jharaniya M, Gupta A, Jai V, Saraf S. Herbal hair cosmetics: Advancements and recent findings. 2014;3(2):2277-7105.
 21. Khatal MS, Ghodke P, Udupurkar P. Herbal hair serum. *Int J Creat Res Thoughts.* 2023 May;11(5). Available from: <https://ijcrt.org>. ISSN: 2320-2882.
 22. R A, N A, J N, K H, Shaikh AR, Y S, Inamul. Formulation and evaluation of herbal hair serum-a review. *Int J Basic ClinPharmacol.* 2023 Sep-Oct.
 23. Randad SS, Hingane LD. Preparation and evaluation of hair serum. *Int J AdvEngManag.* 2022 Jun;4(7).
 24. Vishal Rasve, Anup Kumar Chakraborty, Sachin Kumar Jain, & Sudha Vengurlekar. (2022). "Comparative evaluation of antidiabetic activity of ethanolic leaves extract of *clematis triloba* and their SMEDDS formulation in streptozotocin induced diabetic rats". *Journal of Population Therapeutics and Clinical Pharmacology*, 29(04), 959–971.
 25. Uno H, Stenn KS, Messenger AG, Baden HP. Molecular and Structural Biology of Hair, Quantitative models for the study of hair growth in vivo. *N Y Acad Sci.* 1991;642:107 124.
 26. Harrison S, Birgfeld W. Diffuse hair loss: its triggers and management. *Cleve Clin Med.* 2009;76(6):361-367. Doi: 10.3949/ccjm.764.08080.



27. Pundkar AS, Murkute PM, Wani SW, Tathe M. A Review: Herbal Therapy Used in Hair Loss. *Pharm Reson.* 2020;3(1).
28. Kalra S. Hair care: Advantages, disadvantages and everything you need to know about hair serums. *Pinkvilla.* March 2020.
29. Saraf S. Herbal hair oil cosmetics: Advancements and recent findings. *World J Pharm Res.* 2014;3:3278-94.
30. Lanjewar A, Maurya S, Sharma D, Gaur A. Review on hair problems and its solutions. *J Drug DelivTher.* 2020;10(2):204-209.

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