

Formulation And Evaluation of Herbal Hair Oil and It's Comparative Study with Marketed Hair Oil

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Abstract—Objective: This study aimed to develop and evaluate an herbal hair oil formulation using bioactive plant extracts of Ayurvedic significance *Camellia sinensis*, *Rosa-sinensis*, *Allium sativum*, *Nigella sativa*, *Cucurbita pepo*, *Azadirachta indica*, and aerial roots of *Ficus benghalensis* incorporated into a suitable oil base. **Methods:** Plant extracts were prepared using appropriate extraction techniques and blended into the oil base via the direct boiling method, where plant materials were boiled with oil at a controlled temperature to ensure sufficient transfer of active constituents.

Results: The formulated herbal hair oil demonstrated satisfactory organoleptic properties appearance, color, odor, and consistency and all physicochemical parameters including pH, acid value, saponification value, refractive index, viscosity, and spreadability were within acceptable limits when compared to a marketed product.

Conclusion: The herbal hair oil was successfully formulated using the direct boiling method, considering scalp health and individual herbal potentials. This polyherbal formulation holds promising potential in herbal cosmetics as a safer alternative to synthetic hair care products.

Index Terms—Herbal hair oil, *Ficus benghalensis*, *Camellia sinensis*, Polyherbal hair oil formulations, Hair growth promotion.

I. INTRODUCTION

Cosmetics

As per the Drugs and Cosmetics Act 1940 and Rules 1945, cosmetics are defined as any article intended to be rubbed, poured, sprinkled, or sprayed on or otherwise applied to the human body for cleansing, beautifying, promoting attractiveness, or altering appearance. This definition encompasses all

products described under Section 3(aaa) of D and C Act.^[16,17]

Hair Oil

b) Definition:

Hair oils are hair care preparations used for the prevention and treatment of baldness and related scalp ailments. They promote healthy, luxuriant hair growth by supplying essential nutrients to maintain the sebaceous glands and scalp health.^[2,18]

b) Side Effects of Chemical Hair Oils

Prolonged use of chemically formulated hair oils has been associated with the following adverse effects:

- Allergic reactions^[4]
- Scalp and eye irritation^[2]
- Acne breakouts^[11]
- Hormonal disruption with prolonged use^[3]
- Frizzy, brittle hair^[14]

To overcome these limitations, an herbal alternative was formulated in this study.

Herbal Hair Oil:

Herbs are a gift of nature, naturally compatible with human skin and hair. Unlike chemical-based products, herbal ingredients are gentle on the body, extremely effective, and carry minimal side effects.^[3] They address a wide range of scalp disorder including baldness, greying, hair fall, and dryness while providing essential nutrients for normal sebaceous gland function and natural hair growth.^[5]

Key Benefits of Herbal Hair Oil: ^[21,12,16,11]



Ideal Properties of Hair Oil: [16,14,15,17]



Role of Herbal Ingredients: [2,4,5,6,7,8,10]

Table I. Role of Herbs

Sr. No.	Herbal ingredients	Role
1.	Black cumin	Prevent scalp infection [10]
2.	Green tea	Promote hair growth by catechins that reduces hormone Dihydrotestosterone that causes hair loss [8]
3.	Pumpkin seeds	Contain cucurbitin which is responsible for hair growth [2]
4.	Raw garlic	Shows antimicrobial properties and it contains Vitamin C helps to promote hair growth [5]
5.	Aerial roots of banyan tree	Natural hair growth promoter and scalp

		conditioner [6,7]
6.	Hibiscus	Improves elasticity and thickness of hair [8]
7.	Neem	It has antimicrobial activity [4]

II. MATERIALS AND METHODS USED

All the required raw materials were procured from local market, Nagpur.

Method For Preparation of Herbal Hair Oil: [2,9,17]

The steps used to prepare the herbal hair oil using decoction method are as follows

Phase 1- General Decoction Steps (for each ingredient) [2,9]

- Dry and coarse powder the plant material (leaves, flowers, or seeds) was accurately weighed in grams.
- The above weighed plant material was added to required quantity of base oil (coconut / sesame / almond).
- The above contents were heated at the specified temperature using a thermometer to maintain temperature throughout the process.
- Further it was stirred continuously. Oils were not allowed to exceed the temperature limit to avoid charring or deterioration of oils.
- Heating was discontinued and the oil was strained immediately through muslin cloth twice.
- The filtered oil was collected and allowed set aside. The procedure was repeated for remaining six other ingredients separately.

Phase 2 – Blending [2,9,17]

- All above 6 filtrates were allowed to cool at room temperature.
- Each filtrate was filtered one final time through fine muslin cloth.
- Finally, all filtrates were mixed a single vessel gently.
- The base oils (coconut, sesame, almond, castor) were added to make up the desired final volume.
- The final blend was further warmed at 65° C for 5 minutes to homogenize, then allowed to cool at room temperature.
- After cooling, the oil was poured into a dark-colored glass bottle and sealed tightly.

Sr. No.	Ingredients	Quantity (% w/w)
1.	Hibiscus flower's powder	2%
2.	Green tea powder	2%
3.	Black cumin seeds	2%
4.	Raw garlic powder	4%
5.	Aerial roots powder of a banyan tree	3.5%
6.	Pumpkin seeds powder	5%
7.	Neem powder	2.5%



Fig.1.Separately prepared herbal oil decoctions of individual ingredients

Temperature Reference

Table II. Temperature summary

Ingredients	Temperature	Duration (mins)	Key active compound
Green tea [8]	55-60°C	20-25	EGCG (Catechins)
Hibiscus [8]	70-75°C	20	Flavanoids, mucilage
Pumpkin seeds oil [2]	75-80°C	30	Beta-sitosterol, Zinc
Raw garlic [5]	60-65°C	30	Allicin
Neem [4]	90-95°C	35-40	Azadirachtin, Nimbin
Black cumin [10]	80-85°C	25	Thymoquinone
Aerial roots of	55-65°C	30	Leucoanthocyanidin derivatives,

banyan tree [6,7]			tannin.
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Formulation:

The herbal hair oil was prepared using following formula for 30 ml: - [2,4,5,6,7,8,9,10]

Table III. Formulation table

The above ingredients were collected and purchased from local vendor and are kept in cold place before formulation and development of herbal hair oil.

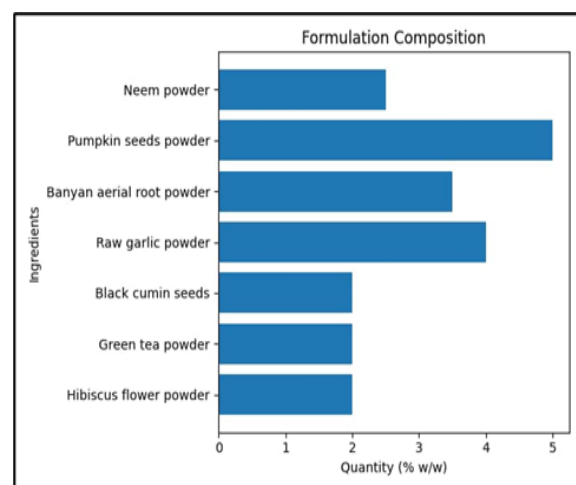


Fig. 2. Final prepared herbal hair oil formulation

Table IV. Plants used for preparation of herbal hair oil

Common Name/Biological Source/ Family	Parts Used	Uses	Figures
1.Green Tea Syn: Unoxidized tea, Herbal tea Biological Source: Dried leaves and buds of <i>Camellia sinensis</i> Family: Theaceae Chemical Constituents: Polyphenols (EGCG), catechins, caffeine, amino acids (L-theanine), vitamins ^[8]	Leaves	- Promotes hair growth ^[8] - Reduces hair fall ^[8] - Provides antioxidant property ^[12] - Controls dandruff ^[12] - Improves scalp health ^[8]	
2.Pumpkin Seeds Syn: Pepitas Biological Source: Seeds of various <i>Cucurbita</i> species (primarily <i>C. pepo</i>, <i>C. maxima</i>) Family: Cucurbitaceae Chemical Constituents: Palmitic acid, stearic acid ^[2]	Seeds	- Contains cucurbitin responsible for hair growth ^[2] - Reduces dandruff on Scalp ^[12]	
3.Hibiscus Syn: China rose Biological Source: Flowers and leaves of <i>Rosa-sinensis</i> Family: Malvaceae Chemical Constituents: Anthocyanins, flavonoids, hibiscetin, mucilage ^[8]	Flowers	- Improve hair elasticity ^[8] - Increases thickness of hair ^[8] - Prevent greying of hair ^[8]	
4.Black Cumin Syn: Black caraway Biological Source: Seeds of <i>Nigella sativa</i> Family: Ranunculaceae Chemical Constituents: Thymoquinone, nigellone, fixed oils, alkaloids ^[10]	Seeds	Prevents scalp inflammation ^[10] Has anti-inflammatory action ^[10] Prevents scalp infection ^[10]	

5.Raw Garlic Syn: Ail, Lasuna Biological Source: Bulbs (cloves) of <i>Allium sativum</i> Family: Amaryllidaceae Chemical Constituents: Allicin, alliin, Sulphur compounds, flavonoids ^[5]	Bulbs	- Shows anti-microbial properties - Contains Vitamin C promotes hair growth ^[5]	
6.Aerial roots of banyan tree Syn: Indian fig Biological Source: Aerial roots, bark, and latex of <i>Ficus benghalensis</i> Family: Moraceae Chemical Constituents: Flavonoids, tannins, sterols, glycosides, Aerial Roots Bark Latex ^[6,7]	Aerial roots	- Strengthens hair roots ^[6] - Promotes hair growth ^[7]	
7.Neem Syn: Indian lilac, Margosa Biological Source: Leaves, bark, and seeds of <i>Azadirachta indica</i> Family: Meliaceae Chemical Constituents: Azadirachtin, nimbin, nimbidin. ^[4]	Leaves	- Improves follicle health ^[4] - Kills dandruff-causing fungus ^[4]	

Evaluation of Herbal Hair Oil: ^[1,2,6,15]

- Organoleptic property:

Tabel V. Organoleptic property

Parameters	Purpose
Colour	Confirms herbal extracts; ensures batch-to-batch consistency ^[1,2]
Spreadability	Uniform scalp coverage; affects user compliance ^[14,16]
Irritancy	Safety parameter – oil must be non-irritating (safe for topical use) ^[14]
Grittiness	Absence confirms proper processing; ensures smooth texture ^[2]
Sedimentation	Checks physical stability; indicates particle settling. ^[6]

- Physical Evaluation:

a) Specific Gravity: Empty specific gravity bottle (W1) weighed, then filled with water (W2) and with hair oil (W3). Specific gravity of water = 0.9961 g/cm³. ^[5,15]

$$\text{Formula: } \rho = \frac{W3-W1}{W2-W1}$$

b) pH: Measured using a digital pH meter; 30 ml of herbal hair oil taken in a beaker. ^[2,6]

c) Viscosity: Measured using a viscometer. Viscosity depends on base oil type, herbal extract concentration, and temperature. Ideal polyherbal oil should have moderate viscosity neither too thick nor too runny. ^[1,6,15]

- Chemical Evaluation:

a) Acid Value: 1 g substance dissolved in ethanol–ether mixture (neutralized with 0.1 M KOH). Titrated

with phenolphthalein indicator against 0.1 M KOH until faint pink (30 min shaking). ^[13,15]

$$\text{Formula: Acid value} = \frac{5.61 \times N}{W}$$

(N = ml of 0.1 M KOH used: W = weight of substance)

b) Saponification Value: 2 ml oil + 25 ml alcoholic KOH heated on water bath (30 min). Phenolphthalein added; titrated against 0.5 M HCl. Blank performed. ^[6,15]

Formula:

$$\text{Saponification Value} = \frac{(b-a)}{\text{weight of substance}} \times 28.05$$

(b = blank; a = assay value)

c) Ascorbic Acid Test: 1 drop freshly prepared 5% w/v sodium nitroprusside + 2 ml dilute NaOH added to 1 ml of 2% w/v solution + 5 ml water. 0.6 ml HCl added; result recorded. ^[5,15]

- Sensitivity Test:

Simple patch test performed. No sensitivity (irritation, redness, or skin changes) observed. Grittiness testing confirmed smooth texture which was safe for topical use. ^[14,15]

Comparative study of prepared polyherbal hair oil and marketed hair oil:

1. Herbal Ingredient: Polyherbal Hair Oil uses modern evidence-based herbs rich in flavonoids with antifungal and antimicrobial properties, while Keshking uses classical Ayurvedic herbs. ^[4,5,8,10]

2. Preservative: Polyherbal oil uses natural preservation via herbal antimicrobial properties; Keshking uses synthetic chemical preservatives, which may cause skin sensitivity. ^[3,14]

3. Antioxidant: Polyherbal oil relies on natural antioxidants from its herbs; Keshking uses an external plant-derived antioxidant. ^[8,11]

4. Acid Value: Both oils have similar, acceptable acid values, confirming no significant hydrolytic rancidity in either formulation. ^[13,15]

5. Saponification Value: Polyherbal oil shows a higher saponification value, indicating shorter-chain fatty acids that are more easily absorbed by the scalp. ^[6,15]

6. Ascorbic Acid Test: Polyherbal oil tested positive for Vitamin C (supports collagen and hair growth); Keshking tested negative. ^[5,15]

7. Refractive Index: Both formulations fall within the standard range, confirming purity and absence of adulteration. ^[6,15]

8. Specific Gravity: A slight difference exists between both oils due to differences in herbal composition and base oils, but both are within standard limits. ^[9,12]

9. Viscosity: Both oils differ slightly in viscosity; ideal viscosity ensures better spreadability and scalp penetration. ^[6,14,15]

III. RESULT AND DISCUSSION

1. Organoleptic property determination

Table VI. Organoleptic property results

Sr. No.	Parameters	Results
1.	Colour	Yellowish-green transparent liquid
2.	Spreadability	Good
3.	Irritancy	Non-irritant
4.	Grittiness	Absent
5.	Sedimentation	Present

2. Physical evaluation

Table VII. Physical evaluation results

Sr. No.	Parameters	Results
1.	Specific gravity	0.886±0.005g/cm ³
2.	pH	6.99±0.025
3.	Viscosity	4.59±0.015 poise



Fig.3. pH meter



Fig.4. Specific gravity Bottle Fig.5. Oswald viscometer

3. Chemical evaluation:

Table VIII. Chemical evaluation results

Sr.No.	Parameters	Results	Range
1.	Acid value	2.08 mg KOH/g	0.5-4.7 mg KOH/g
2.	Saponification value	220 mg KOH/g	53-255 mg KOH/g
3.	Ascorbic acid	A transition from yellow to blue	



Fig.6. Acid value determination



Fig.7. Saponification value determination



Fig.8. Ascorbic acid test results

4. Sensitivity test:

The test for sensitivity is done by simple patch test and no sensitivity was observed in case of formulation



Before application

(a)

After application

(b)

Fig.9. (a & b). Patch test

5. Comparative study of prepared polyherbal hair oil and marketed hair oil:

Parameters	Polyherbal Hair Oil	Keshking Hair Oil
Herbal Ingredients	Green tea Hibiscus Raw garlic Neem Black cumin Pumpkin seeds Ficus benghalensis	Bhringaraj Amla Hibiscus Brahmi Jatamansi
Preservative	Oil suspension (Coconut virgin oil)	Butylated Hydroxy Toluene
Antioxidant	No antioxidant used	Gro- Biotin (Sesbania grandiflora)
Acid value	2.08 mg KOH/g	2.00 mg KOH/g
Saponification value	220 mg KOH/g	193 mg KOH/g
Ascorbic acid test	Positive	Negative
Refractive index	1.619 at 27.7°C	1.626 at 27.7°C
Specific gravity	0.886 g/cm ³	0.881 g/cm ³
Viscosity	4.59 ± 0.015 poise	4.60 ± 0.015 poise

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REFERENCES

- [1] Gautam, S. A. P. N. A., Sumeet Dwivedi, Kushagra Dubey, and Hemant Joshi. "Formulation and evaluation of herbal hair oil." *Int J Chem Sci* 10, no. 1 (2012): 349-53.
- [2] Pavan, S., C. Prathibha, P. N. Dr Kavitha, and C. D. Dr Saraswathi. "Formulation and Evaluation of herbal hair oil." *International Journal of Pharmaceutical Research and Applications* 6, no. 5 (2021): 1285-1299.
- [3] Sabu, Melvin, Oleeviya Sojan, C. Prathibha, P. N. Kavitha, and C. D. Saraswathi. "Formulation and evaluation of herbal hair oil." *National Journal of Pharmaceutical Sciences* 1, no. 2 (2021): 94-97.
- [4] Pandav S, Gaikwad V, Dhangare G, Jauk P, Ugale S, Raut V, and Sanap G. "Formulation and Evaluation of Herbal Hair Oil." *International Journal of Novel Research and Development* 9, no.2 (2024): 875–891.
- [5] Indumani AVV, Sahithi I, Maheshwari K, Vaishnavi K, Sridevi P, and Bhagavan Raju M. "Formulation and Evaluation of Herbal Hair Oil." *Sri Venkateswara College of Pharmacy* 2, no. 3 (2024): 18–22.
- [6] Darade DV, Gote VP, Deshmukh SP, and Bansod NY. "A Review on Formulation and Evaluation of Herbal Hair Oil." *GSC Biological and Pharmaceutical Sciences* 25, no. 3 (2023): 001–004.
- [7] Bhosle S, Andhale V, Jaware P, and Payghan S. "Formulation and Evaluation of Hair Oil from Aerial Roots of Ficus Benghalensis." *International Journal of Pharmaceutical Sciences* 3, no. 4 (2025): 516–527.
- [8] Nursiyah, Romadhiyana Kisno Saputri, and Akhmad Al-Bari. "Hair Growth Activity Test of Hair Tonic that Contain Combination of Green Tea Leaf Extract and Celery Leaf Extract." *Ad-Dawaa'Journal of Pharmaceutical Sciences* 4, no. 2 (2021):88-98
- [9] Chothe C, and Shaha R. "Comparative Study of Formulated Herbal Hair Oil with Marketed Preparation." *Asian Journal of Pharmaceutical Research and Development* 6, no. 1 (2018): 1-3.
- [10] Patil DA, and Tayade SK. "Black Cumin (*Nigella sativa* Linn.): A Miraculous Spice and Herb." *Journal of Emerging Technologies and Innovative Research (JETIR)* 12, no. 6 (2025):854-868
- [11] Kibria, A., Rahman, MS., et al. "Investigating the Effect of Herbal Component-Based Natural Hair Oil Using the Indigenous Source of Bangladesh." *South African Journal of Botany* 6, no. 1 (2025): 24–31.
- [12] Munde, PD., Gosavi, GP., Shivaji, BM., Kawale, AG., and Padmakar, MS. "Herbal Hair Oil: A Natural Approach to Hair Nourishment and Growth." *International Journal of Current Science (IJCS PUB)* 15, no. 2 (2025): 2250–1770.
- [13] Chaure, S., B R., B P., B M., D R., S V., and Sonawane, G. "Formulation and Evaluation of Herbal Hair Oil." *Open Access Journal of Pharmacy Research* 8, no. 1 (2024): 325–345.
- [14] Shaikh, H., and Shaikh, S. "Formulation and Evaluation of Herbal Hair Oil." *World Journal of Advanced Scientific Research* 3, no. 5 (2020): 26–31.
- [15] Banerjee, PS., Sharma, M., and Nema, RK. "Preparation, Evaluation and Hair Growth Stimulating Activity of Herbal Hair Oil." *Journal of Chemical and Pharmaceutical Research* 1, no. 1 (2009): 261–267.
- [16] Joshi, AA. "Formulation and Evaluation of Polyherbal Hair Oil." *International Journal of Green Pharmacy (IJGP)* 11, no. 1 (2017): 135–139.
- [17] Baishya, D., Choudhury, A., Deka, H., et al. "Preparation of Herbal Hair Oil Exploring the Therapeutic Benefits of Herbs and Its

Evaluation." Journal of Applied Pharmaceutical Research 12, no.1 (2024): 116–126.

- [18] Bagad Yogesh M., Barhate, Shashikant D., and Samir K., Shaikh. "Design, Formulation and Evaluation of Herbal Hair Oil for Enhance Hair Growth Activity." Research Journal of Pharmaceutical Sciences.