

**FORMULATION AND EVALUATION OF HERBAL
ANTIFUNGAL HAIR SPRAY**

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ABSTRACT

This study aimed to formulate and evaluate an herbal antifungal hair spray using natural oils such as neem oil, amla oil, rosemary oil, jasmine oil, and almond oil. The ingredients were mixed thoroughly to obtain a homogeneous formulation and filled into sterilized spray bottles. The prepared hair spray showed good homogeneity, pleasant aroma, suitable pH, and excellent spray ability. Antifungal evaluation indicated effective inhibition of scalp fungi without causing irritation. The formulation was found to be safe, stable, and effective, suggesting its potential as a natural alternative for the treatment of scalp fungal infections and hair care.

KEY INGREDIENTS: Neem oil, Amla oil, Rosemary oil, Jasmine oil, Almond oil.

INTRODUCTION

The word “cosmetic” derived from a Greek word “kosmesticos” that means to adorn. Cosmetics and beauty practices have been integral to human civilization since its earliest days. India, known for its rich biodiversity, has a long-standing tradition of using plants for health and beauty purposes.^[1] Indian herbs are renowned globally for their therapeutic and cosmetic benefits.

Herbal cosmetics, derived from nature, represent a valuable and increasingly sought-after gift in the global market. Traditional formulations based on herbs have always garnered significant attention due to their potent efficacy and generally minimal or non-existent side

effects compared to synthetic alternatives. These natural products are often favored for their holistic approach, addressing not only physical beauty but also overall well-being ^[2]. Herbal cosmetics are beauty products formulated with natural herbal ingredients known for their beneficial physiological activities. These include properties such as healing, soothing, conditioning, and enhancing the skin's appearance.^[3] The active compounds in herbal cosmetics often derive from plants, roots, flowers, and essential oils, providing vitamins, antioxidants, and natural nutrients that help promote skin health and overall well-being. Herbal cosmetics cover a wide range of products, such as skincare (creams, lotions), haircare (shampoos, conditioners), and personal care items (soaps, face masks). This growing demand reflects a broader trend towards natural and organic products, driven by consumer preferences for environmentally friendly and ethically sourced options.^[4] Herbal oils have been used for centuries in traditional systems like Ayurveda, Siddha, and Unani for promoting scalp health, stimulating hair growth and treating various hair disorders. Their therapeutic efficacy combined with minimal side effects and environmental compatibility makes them ideal candidates for incorporation into modern cosmetic formulations.^[5] This study focuses on developing an Herbal-oil based hair spray using Neem oil, amla oil, Rosemary oil, Almond oil aiming to provide both styling function and deep nourishing to the hair and scalp. Each of these oils contributes to unique therapeutic effects, supported by ethnobotanical and pharmacological evidence.^[6] Fungal infection is the most common irritating disease in humans. They may lead to scalp irritation, itching, flaking, inflammation, and in severe cases hair thinning and hair loss. However fungal infection of scalp such as dandruff (Pityriasis capitis), seborrheic dermatitis and other superficial mycoses are common problems affecting a large portion of population worldwide.^[7] Herbal sprays are especially beneficial for individual with sensitive scalps or those seeking to avoid chemical exposure due to allergies, environmental concerns or life style choices. They are generally non-toxic, biodegradable, and suitable for all types of hair.^[8] Herbal antifungal hair sprays are a topical formulation prepared from natural plant-based ingredients with anti-fungal activities. They are the hair formulations designed for easy and direct application to the scalp and hair.^[9-12]



Fig. 01: Herbal Oils.

Advantages

Herbal oils offer several advantages due to their natural plant-based ingredients such as neem, amla, rosemary, almond, and jasmine, which help reduce the chances of chemical side effects. They possess effective antifungal activity that helps control scalp infections like dandruff, and seborrheic dermatitis. Herbal formulations are generally mild and safe for long-term use compared to synthetic antifungal agents. In addition, they nourish the hair and scalp by conditioning the hair, strengthening roots, and improving hair texture and shine. These oils also have fewer side effects, with minimal risk of irritation, allergy, or toxicity. Being eco-friendly and biodegradable, they are safer for the environment. Furthermore, herbal oils are multifunctional as they help reduce itching, flakiness, and hair fall while promoting healthy hair growth.

MATERIALS AND METHODOLOGY

MATERIALS

1. NEEM OIL (*Azadirachta indica*)^[15,16,18]

Neem oil is yellowish to brown, bitter-tasting oil with a strong odor. It is cold-pressed or solvent-extracted from the seed and kernels of the neem tree. The oil contains active compounds such as azadirachtin, nimbin, nimbidin which are responsible for its antifungal, antibacterial, and insecticidal properties.



Fig. 02: Neem Oil.

2. AMLA OIL (*Emblica officinalis*)^[17,18]

Amla oil is a yellowish to greenish oil with a characteristic mild, fruity aroma. It is rich in Vitamin C, tannins, and polyphenols, which contribute to its antioxidant, hair-strengthening, and antifungal properties. Traditionally, it is used in Ayurvedic hair care to prevent hair fall, dandruff and premature greying.



Fig. 03: Amla Oil.

3. ROSEMARY OIL (*Rosmarinus officinalis*)^[16]

Rosemary oil is a pale yellow to greenish essential oil with a strong, aromatic, herbaceous scent. It contains volatile compounds like camphor, cineole, and alpha-pinene, which contribute to its antimicrobial, antifungal, and stimulating properties. Traditionally, hair care and scalp treatments are used to promote hair growth, prevent dandruff, and improve circulation.



Fig. 04: Rosemary Oil.

4. JASMINE OIL (*Jasminum officinale*)^[18]

Jasmine oil is a yellowish to brownish aromatic oil with a rich, sweet, floral fragrance. It is highly concentrated and used in small quantities in cosmetic and hair formulations. It possesses antimicrobial, soothing, and moisturizing properties, making it valuable in scalp care and hair conditioning.



Fig. 05: Jasmine Oil.

5. ALMOND OIL (*Prunus dulcis*)^[19]

Almond oil is a pale yellow, odorless to mildly nutty-scented oil with a smooth texture. It is rich in monounsaturated fatty acids, vitamins (especially vitamin E), and proteins, making it widely used in cosmetics, hair care, and skincare formulations.



Fig. 06: Almond Oil.

6. BENZYL ALCOHOL Synonym: Benzene methanol; Chemical name: Benzyl alcohol
Molecular formula: C_7H_8O ; Uses: Solvent, Preservative.

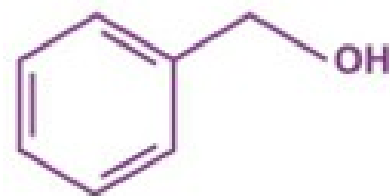


Fig. 07: Benzyl Alcohol.

7. SALICYLIC ACID Synonyms: 2-Hydroxybenzoic acid; Chemical Name: 2-Hydroxybenzoic acid
Molecular Formula: $C_7H_6O_3$; Uses: antifungal, antimicrobial agent, preservative.

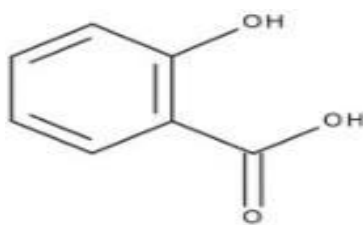


Fig. 08: Salicylic Acid.

8. GLYCERIN Synonyms: Glycerol, 1, 2, 3-Propanetriol; Chemical Name: Propane-1, 2, 3-triol Molecular Formula: $C_3H_8O_3$; Uses: Humectant, emollient, solvent.

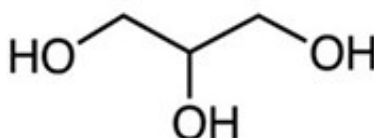


Fig. 09: Glycerin.

METHODOLOGY

The active ingredients and other excipients which were used in present study was given in table below

Table No. 1: List of Materials Used.

Sr. No.	Materials
1	Neem oil
2	Amla oil
3	Rosemary oil
4	Jasmine oil
5	Almond oil
6	Benzyl alcohol
7	Salicylic acid
8	Glycerin

Table No. 2: List of Instruments Used.

Sr. No.	Name of instrument
1	Weighing balance
2	Magnetic stirrer
3	Ph meter
4	Stability chamber

Table No. 3: Formulation Table.

Sr. No.	Ingredient	Quantity	Category
1	Neem oil	1ml	API
2	Amla oil	3ml	API
3	Rosemary oil	3ml	Scalp stimulant

4	Jasmine oil	7.5ml	Fragrance
5	Almond oil	13ml	Base oil
6	Benzyl alcohol	1ml	Preservative
7	Glycerin	1ml	Humectant
8	Salicylic acid	0.5gm	Preservative

PREPARATION OF ANTIFUNGAL HAIR SPRAY

The antifungal hair spray was prepared by first taking a clean and dry beaker. The required quantities of oils were accurately measured and added into the beaker. Salicylic acid was then added to the oils and stirred using a magnetic stirrer until it was evenly dispersed throughout the mixture. After proper mixing, glycerin and benzyl alcohol were added to the formulation. The entire solution was mixed thoroughly using the magnetic stirrer to ensure uniformity and homogeneity of the preparation. Finally, the prepared antifungal hair spray formulation was transferred into a suitable spray bottle for storage and use.

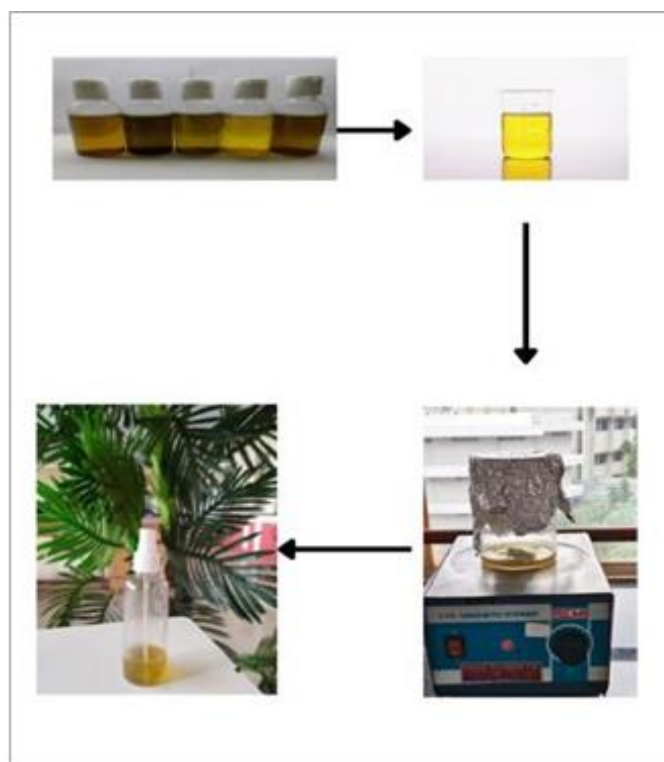


Fig: 10 Diagrammatic Outlines of the Formulation Procedure.

Characterization of formulation

Physical characteristics of the prepared formulation, such as appearance, odor, pH, spray pattern, phase separation, and spread ability, were assessed. Additionally, formulations were assessed for antibacterial activity and antifungal activity.

1. Appearance

Examination for color, appearance, and odor were done by visual examinations. After being placed in the container, prepared formulation was subjected to visual examinations to determine their physical characteristics.

2. pH determination

The pH value of formulated hairspray was determined using digital pH meter which gave the pH of around 4.5 – 4.7.^[13,14]

3. Phase separation

Generally, this test is checked every 24 hours. Put the formulated oil in a spray bottle at room temperature and protect it from sunlight.

4. Spray pattern

Assesses the spread of hair or scalp. Evaluated by spraying on glass slab.^[10,11,20]

5. Drying Time

Measured after spraying to check how quickly it evaporates. Faster drying is preferred to avoid stickiness.^[11,20]

6. Stickiness

After drying, the formulation does leave a sticky or greasy film.^[11]

7. Spread ability

By placing 0.5ml of oil on a glass slide, a second slide was placed on top of it. Allow it to spread evenly. Then spread ability of oil was measured.^[10]

8. Antifungal study of formulation

Antifungal activity by Agar well diffusion method: The inoculum of the microorganism was prepared from the fungal cultures. 15ml of Sabouraud agar (Hi media) medium was poured in clean sterilized Petri plates and allowed to cool and solidify. 100 µl of broth of fungal strain was pipette out and spread over the medium evenly with a spreading rod till it dried properly. Wells of 6mm in diameter were bored using a sterile corkborer. Solutions of the compounds (100µl/ml) were prepared in DMSO and 100µl of prepared test solutions and standard was added to the wells. The petri plates incubated at 28°C for 24-48 hrs.

Miconazole (1mg/ml) was prepared as a positive control and DMSO was taken as negative control. Antifungal activity was evaluated by measuring the diameters of the zone of inhibitions (ZI). All the determinations were performed in triplicates.^[16,18]

9. Stability test

The stability assessment of the final product was carried out by keeping it under a constant temperature (room temperature) for 2 to 3 months. Further, the physical instabilities such as changes in color, odor, phase separation of the formulation, and any signs of microbial growth were checked.

RESULTS AND DISCUSSION

Phytochemical screening

Table No. 4: Phytochemical Screening of Formulation.

Test	Observation	Interference
Add 1% ferric chloride to sample	Deep green color	Phenol present
Add lead acetate to sample	Yellow color	Flavonoids present
Add 0.1% ferric chloride to sample	Blue-black color	Tannins present
Add borax solution to sample and heat	Sweet odor	Glycerin present
Add conc. H ₂ SO ₄ to sample	Aromatic odor	Benzyl alcohol present
Add ferric chloride and alcohol to spray	Violet color	Salicylic acid present



Fig: 11 Phytochemical Test.

Evaluation parameters

1. Physical appearance of formulated spray

State - Liquid

Color – Yellowish brown

Odor – Pleasant

Phase separation – No phase separation.

2. Measurement of pH

The pH of prepared formulation ranges from 4.4 to 4.7.

3. Spread ability

Easily spreadable.

Anti-fungal activity

Table No. 5: Antifungal Activity of test Samples against *M.furfur*.

Sr. No.	Samples	Zone of diameter
1	Control	00
2	Standard (Miconazole)	24
3	F1	14



Fig: 12 Zone of Inhibition against Fungal Strains *M.furfur*.

Stability test

Table No. 6: Stability Test.

Time period	After 1 month	After 2 months	After 3 months
Appearance	No microbial growth	No microbial growth	No microbial growth
Color	No color change	No color change	No color change
Odor	No bad odor	No bad odor	No bad odor
Consistency	No aggregates	No aggregates	No aggregates
pH	4.5	4.7	4.6

CONCLUSION

Herbal antifungal hair spray is more preferred and is used in many ailments of hair. They promote hair growth, improve the elegance of hair, and prevent hair from falling. It not only promotes hair growth; but they also provide necessary moisture to the scalp rendering in beautiful hair. Herbal hair spray is natural oil-based product with essential properties to treat hair problems like thinning of hair and dry or flaky scalp. These oils are used not only for moisturizing purposes but also to promote hair growth, improve circulation of blood in the scalp, prevent dandruff, and add volume to the hair shaft. Based on the formulation experiments, it appears that these formulation constituents work well to prevent fungal infections. This herbal antifungal hairspray contains multiple ingredients. It was successfully developed as a spray that can be used on additional subjects in subsequent research. The current project is promising and offers a fresh approach to antifungal treatment, according to the numerous investigations and findings. The antifungal herbal hair spray was formulated successfully with chosen medicinal plant oils possessing antifungal activity. The efficiency of the herbal ingredients was confirmed by the antifungal activity by the agar well diffusion method.

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