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Formulation and Evaluation of Polyherbal Hair serum for Hair Strengthening and Antidandruff

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Abstract

Hair problems such as dandruff, hair fall, and scalp infections are common issues affecting people of all age groups. Herbal formulations are increasingly preferred due to their safety, effectiveness, and minimal side effects compared to synthetic products. The present study aims to formulate and evaluate an herbal hair serum using natural plant ingredients known for their beneficial effects on hair health. The serum was prepared using extracts of Hibiscus rosa-sinensis, Murraya koenigii, Rosmarinus officinalis, Eclipta prostrata, and Nigella sativa. These herbal ingredients are traditionally used to promote hair growth, reduce dandruff, and strengthen hair follicles.

The formulation was prepared using suitable emulsifying agents and evaluated for various physicochemical parameters such as pH, viscosity, appearance, stability, and antimicrobial activity. The results indicated that the prepared herbal hair serum possessed acceptable physical properties and showed potential anti-dandruff activity. The study concludes that herbal hair serum can be considered a safe and effective alternative to synthetic hair care products.

Keywords: Herbal hair serum, Anti-dandruff activity, Medicinal plants, Hair growth promotion, Emulsion formulation, Phyto chemical constituents.

1. INTRODUCTION

Hair serum is a leave-in product that is designed to treat and protect hair. The main objective of the hair and scalp serum is to enhance the hair's appearance, add shine, reduce frizz, prevent damage and impart hair growth promoting properties. Herbal hair serums, due to its various herbal ingredients can provide major benefits to hair and scalp. These herbal formulations are formulated using plant extracts. Plant extracts helps in providing several properties such as anti-oxidant, anti-inflammatory, anti-septic and anti-microbial properties. Serum is one of the cosmetic products with very high concentration of active ingredient in their formula for providing intensive nutrition to the deeper skin layer and non-greasy finish product which suitable for skin. Using the shampoo and conditioner isn't enough to ensure maximum protection. Hair Serum plays a significant role because it can keep the hair secure from environmental Pollution. This is the reason why applying hair serum is very important to guard the hair completely and supply them with strength.

1.1. Anatomy of Hair

Hair, one of the body parts derived from the skin ectoderm, is a complex structure made up of the scalp, hair follicle, and hair shaft. The scalp, a thick layer formed by both skin and hair, contains a high density of hair follicles and sebaceous glands. The hair follicle is considered a mini-organ, responsible for regulating growth phases and producing the hair shaft. The shape of the hair shaft is also determined by the bulb, in particular the degree of axial symmetry/asymmetry of the hair matrix. The stem is a keratinized cellular extension produced in the follicle, which suffer continuous cytoplasm transformation into hair leading to hair growth. The stem extends from the hair follicle to

the stratum corneum that communicates it with the external environment. Thus, growth occurs in alternating cycles with periods of both growth and rest throughout bulb life.

1.2. Hair

In humans, hair serves as elegant role, conveying our look. Nowadays, physical, mental, emotional and social factors influence hair patterns Baldness, dandruff and excess hair loss can lower confidence level. Hair shape and texture are depends on our lifestyle and also genetics play an important role It is a complex structure with three main parts:

- **Bulb:** A swelling at the base located in the dermis.
- **Root:** The portion of hair below the skin surface.
- **Shaft:** The visible part of hair protruding above the skin

Hair growth happens in three phases:

- **Anagen:** active growth phase.
- **Catagen:** The transitional phase.
- **Telogen:** The resting phase, after which the hair sheds

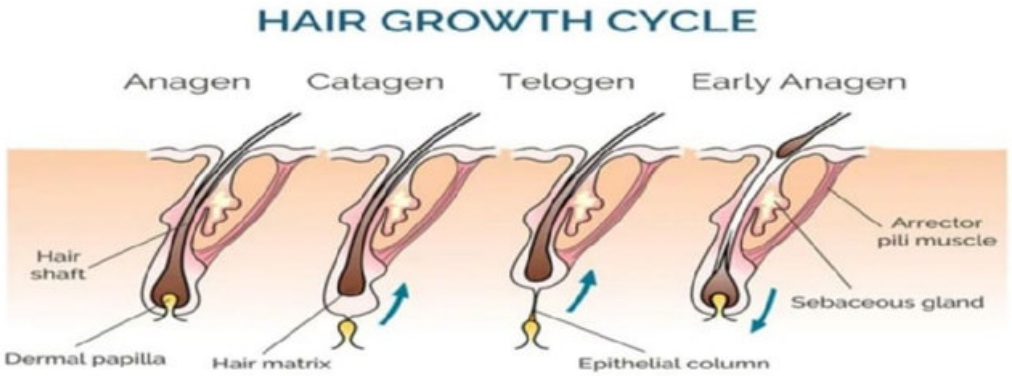


Fig. 1

2. HERBAL HAIR SERUM

Hair serum is a leave-in product that is designed to treat and protect hair. .It is basically a hair care product in liquid form; its consistency is thicker than water. They are used for treating multiple hair concerns like dry hair, dull hair, and unmanageable hair. It is intended to be used on wet hair. Several scientific attempts have been made to prevent hair loss and increase hair growth, but nothing has offered any great promise. The Suitable types of hairs for using hair serum: Straight. Wavy, Curly, Coily.[1]

2.1. Types of Hair Serum

Hair serums are of different types depending upon the purpose with which they are meant to act.

- **Anti-frizz Serum:** These serums help to reduce frizz and smoothen the hair. This smoothness can be achieved by the silicones or oils that coat the hair and give a shiny appearance.
- **Shine Serum:** These serums are composed of light oils or silicones which gives the hair a glossy, shiny finish. It is best for dull hair
- **Heat protection Serum:** These serum protect the hair from the heat damage caused by the heat styling tools like straighteners, curlers etc. They contain ingredients that present moisture loss and thermal damage.
- **Hydrating Serum:** These serums are formulated to hydrate dry brittle hair by providing moisture to the hair. It contains oils, argan oil or coconut oil.
- **Growth Serum:** These serums are formulated with ingredients that promote hair growth like biotin. They strengthen hair follicles and promotes healthier hair growth.

- **Repair Serum:** These serums help in strengthening and repairing damaged hair. They contain protein, vitamins etc. To restore hair moisture and prevent damage.

2.2. Hair Serum Benefits

Hair serums offer a range of benefits to the hair.

1. Adding shine one of the benefits of hair serums is their ability to revive dry, dull-looking hair by infusing moisture into each hair strand. Healthy, moisturized hair tends to be silkier and glossier. Some hair serums may also have light reflecting ingredients, which add sheen and lustre to the hair without making it feel greasy.
2. Controlling frizz and dryness Damaged hair typically looks dry, brittle, and frizzy. It is also common for dry, damaged hair to have fly a ways and split ends. Serums can create help tame unruly hair strands and create a polished finish. The silicone content in many hair serums helps manage these issues by forming a protective coating around the hair cuticle. This seals the hair and keeps weak and damaged hair hydrated and moisturized. Some hair serums contain hydrolyzed keratin proteins, which offer several hair benefits, improves the hair's ability to retain moisture prevents strands from splitting repairs damaged hair neutralizes the negative static charge that causes frizz, flyaway, and friction improves the tensile strength of dry.
3. Reducing knots and tangles. Hair serums smoothen the hair, causing a detangling effect on the hair. As the serum makes the hair smoother and silkier, it becomes easier to comb through and manage.
4. Enhancing the hair's natural look Hair serums improve the natural structure and texture of the hair, hair, resulting in sleeker, more defined hair, enhancing the hair's natural look.
5. Photo damage, and heat damage from styling. This is why serums are often applied to the hair before they undergo styling. Most serums contain ingredients that protect the hair from: heated styling tools such as straightening and curling irons and hair dryers chemical processing used to dye, straighten, bleach, or perm the hairs. Environmental stress, such as photo damage and weather mechanical damage from repeated treatments. And styling they help to protect, improve and recover the hair fibers properties, including smoothness, elasticity, and hair dryers.[2]

3. AIM AND OBJECTIVE

Our project plan is to develop a poly herbal hair serum using the extraction of herbal plants. The Bhringraj, Hibiscus, Rosemary, Curry leaves, Kalonji seed are best for hair strengthening and dandruff control. The literature review also provides effectiveness of them against hair growth and anti-hair fall.

3.1. Objective of Work

1. To ensure the final serum has an appealing appearance, pleasant texture, and fragrance suitable for cosmetic use.
2. To select and identify effective herbal extracts known for their benefits in promoting hair growth, nourishing the scalp, and improving hair health.
3. To measure the pH of the serum to confirm it matches the natural pH of the scalp.
4. To develop an herbal hair serum using carefully chosen plant-based active compounds. To assess the serum's viscosity and ease of spreading to guarantee comfortable application.
5. To optimize the levels of each herbal extract to achieve the best balance of effectiveness and minimal scalp irritation.

4. MATERIALS AND EQUIPMENT

4.1. Bhringraj



Fig. 2

Botanical Name: Eclipta Alba.

Biological Source:

It is obtained from the leaves of Eclipta Alba

Family: Asteraceae

Uses:

- ✓ promotes hair growth
- ✓ improves scalp blood circulation
- ✓ prevents all hair problems

4.2. Hibiscus



Fig. 3

Botanical Name: Hibiscus rosa-sinensis.

Biological Source: It is a species of tropical hibiscus, a Flowering plant in the hibisceae tribe.

Family: Malvaceae

Uses:

- ✓ strengthening hair shaft
- ✓ promoting scalp health
- ✓ balancing sebum production

4.3. Rosemary



Fig. 4

Botanical Name: Salvia rosmarinus.

Biological Source:

The plant salvia rosmarinus, a member of thelamiaceae family of rosemary.

Family: Lamiaceae

Uses:

- ✓ promotes hair growth
- ✓ reduces hair fall & thinning
- ✓ control dandruff and itchy scalp
- ✓ strengthens hair strands

4.4. Curry Leaves



Fig. 5

Botanical Name: Murraya koenigii

Biological Source:

Dried leaves of Murraya koenigiiis is a tropical to sub-tropical tree native to Asia.

Family: Rutaceae.

Uses:

- ✓ strengthening roots
- ✓ stimulating dormant follicles
- ✓ repairing Hair damage

4.5. Kalonji Seed



Fig. 6

Botanical Name: Nigella Sativa

Biological Source:

Kalonji seeds are derived from Nigella sativa L., an annual herbaceous flowering plant

Family Name: Ranunculaceae

Uses:

- ✓ nourishes the scalp
- ✓ helps reduce scalp inflammation
- ✓ improves scalp's blood circulation
- ✓ protects from oxidative stress
- ✓ regulates the hair growth cycle

4.6. List of Chemicals

- Methanol
- Almond oil
- Flaxseed oil
- Lavender oil
- Sodium benzoate
- Tween 80
- Vitamin e capsule

4.7. Equipment Used

- Mortor And Pestle
- Mechanical Stirrer
- Hot Plate
- Weighing Balance

5. EXPERIMENTAL WORK

Collection and Extraction of Herbs: [3, 4, 5, 6]

5.1. Bhringraj

5.1.1. Collection of Herbs

The plant of Bhringraj leaves are collected from the local market.

5.1.2. Extraction Method

Plant EcliptaAlba (Bhringraj) were procured from local market. The leaves were washed thoroughly with distilled water to eliminate any surface impurities such as dust or microbes and then shade-dried at room temperature (25 ± 2°C) for 7–10 days. Shade drying was chosen to prevent degradation of heat-sensitive phytoconstituents. Once completely dried, the leaves were pulverized into a fine

powder using an electric grinder and stored in airtight glass containers under cool and dry conditions to avoid moisture uptake and microbial contamination. Extraction of phytochemicals was carried out using the cold maceration technique. 50 grams of dried leaf powder was soaked separately in 500mL of 70% methanol in a beaker. The beaker were covered and kept at room temperature for 72 hours with intermittent shaking to ensure maximum extraction of both polar and non-polar constituents. After the maceration period, the mixtures were filtered using Whattman No. 1 filter paper to remove the plant debris. The filtrates were then concentrated under reduced pressure using a rotary evaporator at 40°C to remove the solvent. The resulting semi-solid extracts were air dried to a paste-like consistency and stored in airtight containers at 4°C until further use in formulation development.

5.2. Hibiscus

5.2.1. Collection of Herbs

The flower of hibiscus plant was collected from the medicinal garden.

5.2.2. Extraction Method

The fresh plant flower was collected and washed under the running tap water to remove soil particles and other dust particles. The flowers were air dried under the laboratory condition at room temperature for 15 days. The dried samples were ground well in to a fine powder with the help of mixer grinder. A 10 gm air dry plant was soaked into 50ml methanol .extracts, separately for 24hrs at normal temperature. The extracts were filter through the Whattman filter paper No: 1. the condensed extracts were stored in airtight container at 4°C till further investigation. After that the extract was taken in a beaker and kept on hot plate and heated at 30-40ºC till all the solvent got evaporated. Dried extract was kept in refrigerator at 4ºC for their future use in phyto chemical analysis

5.3. Rosemary

5.3.1. Collection of Herbs

The Rosemary leaves was collected from the local market.

5.3.2. Extraction Method

25 gm of dried Rosemary leaves were simply crushed and bruised, the leaves were then allowed to steep in a sufficient amount of methanol solvent v/v. The resulting extract was filtered using muslin cloth. The resulting solution was stored and used for further process

5.4. Kalonji Seeds

5.4.1. Collection of Herbs

The kalonji seeds are collected from the local market.

5.4.2. Extraction Method

Cold Extraction

The 100grams of seeds were soaked into 100ml of coconut oil. Then seeds were soaked for one week at room temperature. Then oil was filtered using muslin cloth and then stored.

5.5. Curry Leaves

5.5.1. Collection of Herbs

The plant of curry leaves are collected from the medicinal garden.

5.5.2. Extraction Method

Take 12-15 leaves of curry leaves. Wash them, and let them dried.

Then the leaves directly add into oil and boil it.

Boiled the leaves until the leaves become brown.

5.6. Phyto chemical Screening

The result of phyto chemical screening for Bhringraj extract, rosemary extract and hibiscus extract are given in

Table: 1

S. No	Phytochemical Compounds	Bhringraj Extract	Hibiscus Extract	Rosemary Extract
1.	Alkaloid	✓	-	-
2.	Carbohydrate	-	✓	✓
3.	Glycoside	✓	-	-
4.	Saponin	✓	-	✓
5.	Flavonoid	-	✓	✓
6.	Terpenoid	-	✓	-
7.	Tannin	-	✓	✓
8.	Protein	✓	-	-

5.7. Preparation of PolyHerbal Hair Serum (30 ml)

- In a clean beaker add Bhringraj, hibiscus, rosemary extract in a desired proportion.
- Stir well to ensure thorough mixing on mechanical stirrer.
- Measure the desired amount of almond oil, flaxseed oil, kalonji seed oil extract, curry leaves oil extract and add it to the herbal extract mixture.
- Allow the mixture to mix properly on the mechanical stirrer.
- Add a few drops of lavender oil aroma and scalp benefits.
- Stir the mixture well to ensure that all the ingredients are evenly distributed and blended.
- Add the sodium benzoate as preservative and add tween 80 as emulsifying agent. Mix well as evenly distributed.
- Then finally mix on by using mortar and pestle for even distribution.
- Pour the prepared scalp hair growth serum into the clean, air tight dark-colored bottle for storage.

5.8. Composition of PolyHerbal Hair Serum

Table. 2

S. No	Ingredients	Quantity For(30ml)	Uses
1	Bhringraj	5ml	Promote Hair Growth
2	Hibiscus	4ml	Natural Conditioner
3	Rosemary	5ml	Reduce Hair fall
4	Curry Leaves	4ml	Reduce Dandruff
5	Kalonji Seed	4ml	Strengthen Hair Follicles
6	Almond Oil	3ml	Deep nourishment And Moisture
7	Flaxseed Oil	3ml	Promote Growth And Strengthen Strands
8	Lavender Oil	0.05ml	Fragrance
9	Vitamin-E Capsule	0.5ml	Boost Hair Growth
10	Tween80	1.8ml	Emulsifying Agent
11	Sodium Benzoate	0.2gm	Preservative

5.9. Evaluation of PolyHerbal Hair Serum: [7]

5.9.1. Physical Appearance

To determine the physical appearance, we must observe the following characteristics: Color, texture, and consistency. Observe the color of hair serum with naked eyes. Note the odor of the serum.

5.9.2. pH Test

This test is performed by dipping the pH paper into the solution. Then compare the pH paper color obtained by dipping the paper in the solution with the standard. The value of pH for hair serum should be 4.5 to 6.5.

5.9.3. Homogeneity

Take a clean and dry glass container. Add the prepared solution to the container and then it was sealed. Then it was observed under the light to check for uniformity. The presence of any lumps, flocculates, or aggregates was noted.

5.9.4. Skin Irritation Test

Apply the prepared serum on the skin and observe any redness or itching observed after 2 hours.

5.9.5. Skin Sensitivity Test

Procedure involves applying the serum to the skin, exposing it to the sun, and checking after 10 minutes to see whether there are any rashes or irritation.

5.9.6. Viscosity

The viscosity of the formulation was evaluated by the Ostwald viscometer. Time taken by the serum (solution) to travel from one mark to another mark was noted down, and viscosity was calculated.

5.9.7. Spreadability Test

Weigh a small amount of hair serum about 1ml, then place the serum on the top of the glass slide and place another glass slide on the top of the serum.

$S=M\times L/T$

Where, S=Spreadability

M=Weight tied to upper slide(g) L = Length moved (cm)

T=Time taken

5.9.8. Stability study

The formulation was kept at room temperature for 1 week. After 1 week, the pH, homogeneity, and color of the formulation were evaluated and compared with the initial observations.

5.9.9. Anti-Microbial Activity

Nutrient agar medium was used for the antimicrobial assay. The nutrient agar was prepared according to the standard procedure and sterilized by autoclaving at 121°C for 15 minutes. After sterilization, the medium was allowed to cool to about 45–50°C and then poured into sterile Petri plates. The plates were allowed to solidify. After solidification, the previously cultured microbial strains were inoculated uniformly over the surface of the nutrient agar plates using a sterile cotton swab to obtain a lawn culture. Sterile Whatman filter paper discs impregnated with the test sample (poly herbal formulation), marketed formulation, and standard antibiotic were placed carefully on the surface of the inoculated agar plates using sterile forceps. The plates were then incubated at 37°C for 24 hours to allow microbial growth. After incubation, the antimicrobial activity was evaluated by measuring the diameter of the zone of inhibition (in mm) around each disc. The results were recorded and compared with the standard antibiotics.

6. Result And Discussion

6.1. Organoleptic Parameters

The physical appearance, color, odor and texture of the prepared herbal hair serum are visually tested.

Table. 3

S. No	Organoleptic Parameter	Result
1.	Color	Olive Green
2.	Odor	Aromatic
3.	Texture	Smooth

6.2. Skin Irritation and Sensitivity Test

The skin irritation and skin sensitivity test are evaluated.

Table. 4

S. No	Evaluation Test	Observation	Result
1.	Skin Irritation Test	No redness, itching, burning (or) inflammation observed after 2hours	Non-irritant
2.	Skin Sensitivity Test	No rashes, no photo sensitivity reaction are observed after sun exposure	Non-sensitive

6.3. Other Parameters

Table. 5

S. No	Parameters	Result
1.	pH determination	5.5

2.	Spreadability	Easily spreadable
3.	Homogeneity	Good

6.4. Stability

The short-term stability evaluation was conducted by observing color, pH, and homogeneity of the prepared formulation at pre-determined time intervals of 2, 4 and 7 days.

S. No	Days	Observation		
		Color	pH	Homogeneity
1.	2days	No change	No change	No change
2.	4days	No change	No change	No change
3.	7days	No change	No change	No change

Table. 6

6.5. Viscosity

The viscosity of the prepared herbal hair serum was calculated using the Ostwald Viscometer.

$\eta s = (\rho s \times ts / \rho w \times tw) \times \eta w$

Where, ηs =viscosity of serum

ηw=viscosity of water(cps)

ρs=density of serum (gm/ml)

ρw=density of water (gm/ml)

ts=time required to travel from mark A to B for serum(sec)

tw=time required to travel from mark A to B for water(sec)

Table. 7

S. No	Viscosity
1.	2.28 cps

6.6. Anti-Microbial Activity

The Anti microbial activity of the Formulation

Table: 8

S. No	Microbial Strains	Zone Of Inhibition(Mm)	
		1ml	STANDARD (10µg/ml)
1.	**Gram(-) bacteria** (Pseudomonas aeruginosa)	16mm	32
2.	**Gram(+)bacteria** (Staphylococcus aureus)	17mm	28
3.	**Fungus** (Candida albicans)	18mm	12

7. CONCLUSION

The present study successfully formulated and evaluated a "FORMULATION AND EVALUATIONOFPOLYHERBALHAIRSERUMFORHAIRSTRENTHENINGANTI DANDRUFF" serum using bhringaraj extract, hibiscus extract, rosemary extract, kalonji seed extract, curry leaf extract and essential oils of flaxseed, lavender, almond and coconut, preservative as sodium benzoate and emulsifying agent as tween 80.The formulatedpolyherbalhairserumforhairstrengtheningandanti-dandruffhasgoodtexture and it pass all the evaluation studies. This study concludes that our poly herbal hair strengthening and anti-dandruff hair serum can be considered safe, stable and effective for promoting hair growth and preventing dandruff.

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