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Research Paper

Formulation And Evaluation of Herbal Hair Serum

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ABSTRACT
Hair serums are highly sought after and used by many people in the current world. Herbal hair serums are very well-liked because they are safer, more protective, and don't cause any negative effects. The aim of this study was to create a herbal hair serum using several plants and evaluate its qualities to find the best formulation. Herbal hair serum helps improve hair's manageability, feel, and appearance. Although there are numerous hair serums available, herbal hair serums are better because they have less or no negative side effects.The objective of this research was to formulate and evaluate a novel hair serum leveraging the synergistic properties of hibiscus, flaxseed, and aloe vera.The plant extract was created using the decoction and maceration techniques. Five distinct herbal hair serum formulations were made using a simple mixing method. They were analyzed for pH, viscosity, homogeneity, spreadability, smoothness, anti-frizz test, combability test, microbiological testing, organoleptic evaluation, and moisturizing time determination. Based on the aforementioned features, F4 was found to be the ideal formulation. An investigation of stability was performed on the optimized formulation. The results of the study indicate that the herbal hair serum is intended to reduce frizz and provide hair with a smooth, glossy appearance. The serum is free of harmful ingredients and has good moisturizing properties in comparison to the marketed hair serum.

Keywords: *Aloe barbadensis, Linum usitatissimum, Hibiscus rosa sinensis, herbal cosmetics, hair serum, anti-frizz, human hair.*

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I. INTRODUCTION

Herbal cosmetics is a term used to describe a pharmaceutical product or formulation that is made with a variety of acceptable cosmetic elements to create a base for the addition of one or more herbal ingredients to achieve the desired cosmetic effects. Herbal cosmetics and "natural cosmetics" are terms that are frequently used interchangeably. Over the last few decades, the usage of natural products in cosmetics has dramatically increased. This is because customers often believe that beauty care products made of synthetic materials are bad for their skin, and their growing understanding of herbal goods has led to a desire for natural products and natural extracts in cosmetic formulations (1).Proteins, lipids, water, trace elements, and colors make up human hair. The primary component is protein, which varies from 65 to 95 percent depending on how hydrated the body is. Keratin is the primary protein type found in hair. About eighteen amino acids condense to make it biochemically, with cysteine being the most significant because of its capacity to generate disulfide connections. The key non-ionic interactions found in hair fibers are hydrogen bonds. The main source of hair colour is melanin, which is produced by melanocytes dispersed throughout the bulb's matrix and enters the cortex and medulla cells. True melanin is usually present in dark-colored hair. There are melanin variations in red and blond hair that have higher sulfur and iron. Tyrosinasc, an enzyme required for melanin production, gradually decreases with grey hair. The buildup of air bubbles in the medullary shaft causes white hair (1). One of the cosmetic items that contains a high concentration of active ingredients in its final formula is hair serum, which is a non-greasy solution that is good for hair and provides intense nutrition to the deeper layers of hair. A further means to describe serums is as topical treatments with a thin consistency that have concentrated amounts of active ingredients. There are several serum formulas that may be used on both the scalp and the hair, but the main distinction between hair and scalp serums is that one concentrates on the scalp while the other concentrates on the hair.To fortify hair follicles, promote growth, and improve overall hair health, herbal hair serums typically blend a combination of botanical extracts, essential oils, and micronutrients. They are frequently used

to treat common hair issues like thinning, frizz, breakage, and dryness.Herbal hair serums have the benefit of being typically devoid of harsh chemicals and artificial additives, which makes them a more natural and possibly kinder choice for people who favor a more all-encompassing approach to hair care. Those who have had adverse responses to traditional hair products may find them very helpful. Furthermore, the structure of herbal hair serums is frequently light and non-greasy, making application and absorption into the hair and scalp simple (2).

IDEAL CHARACTERISTICS OF SERUMS

- They must not dry out or harm the hair or scalp; instead, they must be mild.
- Prolonged impact.
- Improves the hair's shine and smoothness and makes combing easier.
- Non-allergic and well tolerated.
- It ought to be simple to use.
- It need to have a regional impact.
- It should be simple to apply and remove.

KEY STRENGTHS OF HAIR SERUM

- Hair serum effectively conditions and refines hair texture, leaving it feeling velvety and looking healthy.
- As a pre-styling and final product, serum serves two purposes.
- It improves the structure and manages frizz in weak and damaged hair.
- A serum for hair that promotes shine and lessens knots.
- Herbal serum's strong moisturizing qualities give our hair a natural luster.
- Hair is known to be moisturized and kept hydrated by serums, which also protect it from brittleness and make it feel smoother (2).

II. MATERIALS AND METHODS

Aloe vera, flaxseed, hibiscus, almond oil, and other components were gathered and verified before being used to make the hair serum.

1. ALOE VERA

Aloe vera has been a long-standing remedy for addressing hair loss due to its nourishing and restorative properties.Moreover, it nourishes hair and calms the scalp. It has the ability to lessen dandruff and clear clogged hair follicles caused by too much oil. Utilizing pure aloe vera gel as a hair and scalp treatment, applied periodically, can be a beneficial option.

Figure no 1: Aloe vera

2. ROSE WATER

Rose water's astringent properties may contribute to reducing dandruff and excess oil. Its anti-inflammatory characteristics could also provide relief for scalp conditions like psoriasis and eczema. Additionally, rose water is often praised by individuals with curly hair for its ability to minimize frizz and enhance hair luster(4).

Figure no 2: Rose water

3. HIBISCUS

Hibiscus contains vitamins, minerals, and antioxidants that can prevent hair loss in addition to nutrition for the hair and scalp. It contains a lot of vitamin C, which increases the synthesis of collagen, a protein that strengthens hair. Additionally, it contains amino acids, which support the growth of healthy hair by nourishing hair follicles.Additionally, hibiscus's anti-inflammatory qualities might help relieve an itchy, flaky scalp (5).

Figure no 3: Hibiscus

4. **ALMOND OIL**

Almond oil's nourishing properties can fortify and soften your hair. Rich in biotin, this oil promotes robust hair and nail health. Additionally, its natural SPF of 5 offers protection against sun-induced damage, safeguarding your hair's integrity. Almond oil can be applied directly to the hair and scalp.(6)

Figure no 4: Almond oil

PREPARATION OF PLANT EXTRACTS

EXTRACTION OF ALOE VERA

The leaves of aloe vera were gathered. The leaves were placed upright in a container to extract the yellow fluid discharges from them. After giving the leaves a good wash with fresh water, the rind and outer peel were cut off with a knife. Using a knife, carefully scrape off the clear gel from the leaves, then blend with a mixer. The gel was kept in a sterile, airtight container after being strained through a muclin cloth (7).

EXTRACTION OF FLAXSEED

The mucilage was extracted from weighed flax seeds. The seeds were immersed in 900 milliliters of distilled water contained within a 1000-milliliter beaker.They were then heated to 50 °C to 60 °C to sufficiently release the mucilage in the water, and they were left to boil for at least 7-8 hours while being constantly stirred.The concentration of the solution was reduced to half of its original volume. To separate the marc from the filtrate, the concentrated solution was filtered through a muslin cloth before being allowed to cool to ambient temperature (8,9).

EXTRACTION OF HIBISCUS

After being gathered, fresh Hibiscus rosa-sinensis Linn blooms were cleaned with water to get rid of dust, dirt, debris, and other impurities before being chopped into tiny pieces. Thirty grams of hibiscus blossoms were

weighed and steeped for twenty-four hours in one hundred milliliters of warm water. After removing the marc from the solution by squeezing it through muslin fabric, mucilage was produced (9).

FORMULATION OF HAIR SERUM

A measured quantity of aloe vera is added to a beaker, followed by the addition of hibiscus extract and flaxseed. The mixture is thoroughly stirred before incorporating glycerin and rosewater. After further stirring, the solution is gently heated for a short duration. A few drops of almond oil and starch are then added to the mixture, which is subsequently agitated using a magnetic stirrer. Sodium benzoate is added as a preservative after thorough mixing. The mixture is then transferred to a measuring cylinder, where the final volume is adjusted to 100 milliliters. Finally, the prepared herbal hair serum is filled into a suitable container.

INGREDIENTS	F1	F2	F3	F4	F5
Aloe vera extract (ml)	31.25	25.0	28.75	25.0	21.25
Flaxseed extract (ml)	25.0	31.25	28.75	33.75	22.5
Hibiscus extract (ml)	18.75	21.25	18.75	21.25	25.0
Almond oil (ml)	0.25	0.25	0.25	0.25	0.25
Glycerin (ml)	18.75	18.75	18.75	18.75	18.75
Rosewater (ml)	2.5	2.5	2.5	2.5	2.5
Sodium benzoate (gm)	0.25	0.25	0.25	0.25	0.25
Starch (gm)	0.625	0.625	0.625	0.625	0.625
Water	q.s	q.s	q.s	q.s	q.s

Table no 1: Formulation of herbal hair serum

EVALUATION OF HERBAL SERUM

Herbal hair serum is used to evaluate formulation quality. The developed hair serums were evaluated based on the following standards. It includes:

ORGANOLEPTIC EVALUATION

Organoleptic evaluation involves employing the senses to study the product. It alludes to the study of characteristics such as flavor, odor, and shape, as well as unique attributes like tooth and texture (11).

pH DETERMINATION

To ensure the safety and suitability of the hair serum formulations, their pH levels were measured using a digital pH meter. The meter was calibrated prior to use. The electrode was immersed in each formulation, allowed to stabilize, and then the pH reading was recorded after a few minutes. This process was repeated three times for each formulation, and the average pH values were calculated.(2)

VISCOSITY DETERMINATION

Using a Digital Brookfield Viscometer, the viscosity of the hair serum is measured. The viscosity of a measured amount of serum is measured in triplicate by immersing the viscometer's tip in the beaker. In centipoises, the results are presented. The values of serum viscosity are ascertained 24 hours following the formation of the formulations (11).

MOISTURIZING TIME MEASUREMENT

A 20-cm-long hair ball weighing one gram is submerged in each of the hair serum formulations (F1, F2, F3, F4, and F5), and the hair ball's total sinking time in the serum is recorded. The ideal moisturizing time is between five and fifteen minutes.

SPREADABILITY

To measure spreadability, parallel plate method is used. Two 20x20 cm horizantal plates are sandwiched with one gram of hair serum, and a 20 gram weight is positioned over the top slide. One minute has passed when the spread diameter is measured. Spreadability was computed using the formula below:

$S = MxL/T$

Where, S= Spreadability

M= Weight in the pan (tied to the upper slide)

L= Length moved by the glass slide

T= Time (in sec) taken to separate the slides completely

MICROBIAL CONTAMINATION

A thin loop of hair serum is applied to a nutrient agar medium, and it is incubated for 24 hours to test whether the serum is microbially contaminated. Any microbial growth's appearance is assessed.

COMBABILITY TEST

A combability test evaluates a hair serum's capacity to detangle and enhance manageability by measuring how readily a comb or brush can move through the hair. After applying various formulations to the hair, the slip point is measured by running a fine tooth comb through the length of the hair. The comb's travel distance is expressed in centimeters (12).

HOMOGENEITY TEST

A small sample of the hair serum is placed on a sterilized glass slide and covered with a cover glass.The serum's appearance is then evaluated for any visible imperfections or inconsistencies. Visual examination is employed to assess the homogeneity of the herbal hair serum and detect any presence of coarse particles, lumps, flocculates, or aggregates. (11).

SMOOTHNESS

By applying the hair serum to the hair strands and examining the texture, feel, and look of the hair following the application of the serum, the smoothness of the formulation is evaluated.

TEST FOR FRIZZINESS

The threads have been untangled. After applying the herbal serum to the hair strands, a visual examination of the hair is carried out.

STABILITY STUDIES

According to ICH guidelines, stability studies are conducted on optimum fomulation. For three months, the formulations are kept in a stability chamber. For a while, the physical stability and attractiveness are examined. Its appearance, texture, color, odor, viscosity, and pH are all measured for physical and chemical stability. The visual technique is used to assess the texture, odor, and look (2).

COMPARISON STUDY

Comparison study is conducted to evaluate the safety and eftectiveness of the prepared herbal hair serum formulation with the marketed product. The frizziness, smoothness, moisturizing properties etc, of the herbal hair serunn fomulation, F4 is compared with the standard synthetic marketed formulation of hair serum (Streax). Both the formulations are applied to individual hair strands and it is evaluated.

III. RESULTS AND DISCUSSION

ORGANOLEPTIC EVALUATION

The organoleptic qualities of the herbal hair serum that was made were assessed. Visual analysis of the hair serum's appearance was done using its color and texture. Five formulations (F1, F2, F3, F4, and F5) were made, and their morphological parameters were assessed.Below are the results:

SL.NO	PARAMETER	F1	F3	F4	F5	F5
1	**State**	Liquid	Liquid	Liquid	Liquid	Liquid
2	**Colour**	Natural pink tint	Natural pink tint	Natural pink tint	Natural pink tint	Natural pink tint
3	**Odour**	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic
4	**Texture**	Smooth	Smooth	Smooth	Smooth	Smooth
5	**Consistency**	Good	Good	Good	Good	Good

Table no2: Organoleptic evaluation

pH DETERMINATION

Serum pH typically ranges from 4.0 to 6.5. All of the herbal serum compositions had pH values between 5.0 and 6.5. All of the herbal hair serum formulations fall within this range since minimizing hair damage can be achieved by using the lowest pH.

SL.NO	FORMULATIONS	pH (MEAN ± S.D)
1	F1	5.51 ± 0.0082
2	F2	5.73 ± 0.0171
3	F3	5.52 ± 0.0216
4	F4	5.49 ± 0.0023
5	F5	5.64 ± 0.0439

Table no3: pH determination

VISCOSITY DETERMINATION

The hair serum's viscosity levels varied from 1000 to 2000 cPs. The delayed viscosity of the prepared product was within the typical range of 1000–5000 cP. The F4 formulation exhibits the highest value, while the F5 formulation has the lowest. All of the hair serum formulations' viscosities were measured, and the findings are displayed in the table.

SL.NO	FORMULATIONS	VISCOSITY (cP)
1	F1	1710 ± 0.5
2	F2	1760 ± 0.5
3	F3	1849 ± 0.25
4	F4	1950 ± 0.5
5	F5	1670 ± 0.5

Table no 4: Viscosity determination

MOISTURIZING TIME DETERMINATION

The findings demonstrated that the rate of moisturizing increases in tandem with the serum's concentration. The longest moisturizing time was achieved at the highest serum concentration. All the five formulation showe results within the normal range of 5-15 min. Hence concluded that, all the five formulations have good moisturizing properties. The result is as follows:

SL.NO	FORMULATIONS	MOISTURIZING TIME	
		0.5gm	**1gm**
1	F1	7.0 ± 0.308	8.3 ± 0.216
2	F2	7.4 ± 0.364	8.7 ± 0.125
3	F3	8.8 ± 0.294	9.1 ± 0.170
4	F4	10.5 ± 0.168	11.2 ± 0.170
5	F5	5.0 ± 0.287	6.9 ± 0.289

Table no 5: Moisturizing time determination

SPREADABILITY TEST

It was discovered that the formulated serum spread evenly in a time range of 4-10 seconds, and that its spreadability increased as the spreading time decreased. The results demonstrated that the serum has a high spreadability and takes less time to spread.

SL.NO	FORMULATIONS	SPREADABILITY (Gm.cm/sec)
1	F1	6.66 ± 0.0954
2	F2	7.5 ± 0.1706
3	F3	10 ± 0.216
4	F4	20 ± 0.206
5	F5	5.7 ± 0.0432

Table no 6: Spreadability test

MICROBIAL CONTAMINATION

The microbial contamination test results for hair serum showed no detectable presence of harmful microorganisms, indicating that the product met the required safety standards and was free from contamination. This result confirmed that the hair serum is safe for use without any microbial contamination.

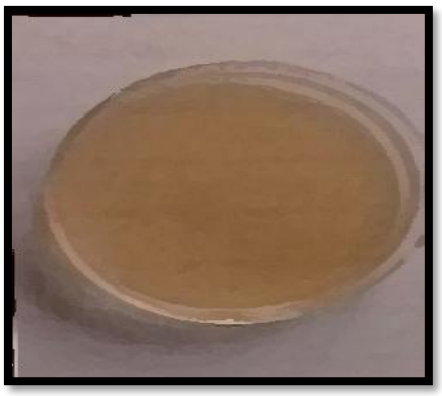

Figure no 5: Microbial test

COMBABILITY TEST

By conducting a combability test, it determines the effectiveness of a hair serum in reducing tangles and making the haír easier to comb or brush through. After the samples were applied to hair, the slip point was observed. It can be concluded that the hair become more manageable and tangle free.

FORMULATION	LENGTH (Cm)	DESCRIPTION
F1	12	Satisfactory
F2	18	Good
F3	23	Moderate
F4	25	Excellent
F5	12	Satisfactory

Table no 7: Combability test

HOMOGENEITY TEST

The homogeneity of the formulated serums was evaluated through visual inspection, checking for any visible lumps, aggregates, or flocculates. The results indicated that all formulations exhibited excellent homogeneity, confirming that the ingredients were uniformly dispersed and thoroughly blended. This ensures consistent and reliable performance of the product.

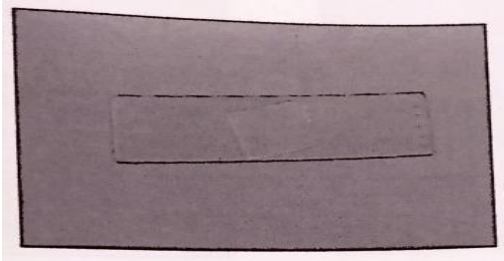

Figure no 6: Homogeneity test

SMOOTHNESS

The herbal hair serum was found to improve manageability, lessen frizz, and give the hair a smooth, silky texture. Every formulation had produced the intended outcomes.

FORMULATIONS	RESULT
F1	Smooth
F2	Smooth
F3	Smooth
F4	Smooth
F5	Smooth

Table no 8: Smoothness test

TEST FOR FRIZZINESS

Drawing from the findings, it can be inferred that the degree of frizz in the hair had diminished and had become easier to control.

Figure no 7: Before serum application

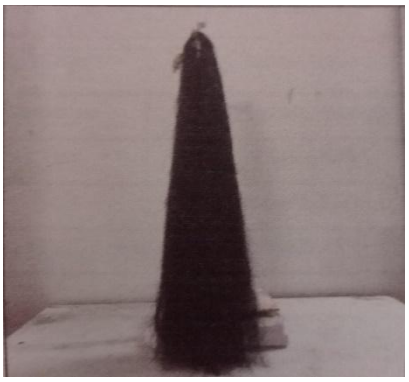

Figure no 8: After serum application

STABILITY STUDIES

The formulation's chemical and physical stability was confirmed through its consistent organoleptic characteristics throughout the storage period. A comprehensive stability study was conducted on the final product, assessing various parameters such as color consistency, fragrance, pH levels, viscosity, homogeneity, moisturizing properties, spreadability, and other relevant factors. The results demonstrated the product's stability, with no significant changes observed in any of the evaluated parameters.

PARAMETERS	INITIAL	FINAL
Appearance	Natural pink tint	Natural pink tint
Texture	Smooth	Smooth
Odour	Characteristic	Characteristic
Homogeneity	Homogenous	Homogenous
Moisturizing time determination (min)	10.5 ± 0.168	10.1 ± 0.05
Spreadability (gm.cm/sec)	20 ± 0.2067	18 ± 0.216
pH	5.49 ± 0.0023	4.98 ± 0.005
Viscosity (Cp)	1950	1938

Table no 9: Stability studies

COMPARISON STUDY

The following is a comparison of commercially available synthetic hair serum (Streax) and herbal hair serum:

PARAMETERS	HERBAL HAIR SERUM	SYNTHETIC HAIR SERUM (Streax)
Anti-Frizz property	Frizz control	Immediate frizz control
Moisturizing property	Moisturizing	Moisturizing
Smoothness	Enhance smoothness of hair	Enhance smoothness of hair
Scent	Natural pleasant aroma	Natural pleasant aroma
Ingredients	Natural plant sources	Synthetic chemicals
Environmental impact	Biodegradable and ecofriendly	Pollution and environmental damage

Table no 10: Comparison study

IV. CONCLUSION

The herbal hair serum provides essential nutrients for maintaining healthy hair and its lustrous appearance. The demand for herbal hair serum is high due to its expanding applications in personal care systems.The bioactive components in herbal hair serum influence hair's biological processes and supply necessary nutrients for healthy hair. This study utilized a herbal hair serum formulated with extracts of Aloe barbadensis, Linum ussitassimum, and Hibiscus rosa sinensis. Aloe vera, flaxseed, and hibiscus extracts have demonstrated exceptional anti-frizz and shine-enhancing properties. Following evaluations, formulation F4 was selected as the optimal herbal hair serum. Its smooth and uniform texture met the required viscosity, pH, and spreadability standards. The multifaceted benefits of formulation F4's ingredients will contribute to maintaining manageable, glossy, and silky hair. Herbal hair serums with hydrating and anti-frizz properties show promise in hair care, offering a natural and organic alternative that meets the growing demand for chemical-free and sustainable products. Herbal hair serums effectively manage frizz and promote hair moisturization by harnessing the power of herbal extracts, essential oils, and nourishing ingredients. Overall, herbal hair serums can be a valuable tool for promoting healthier hair. With their natural ingredients and potential benefits, herbal hair serums are an attractive option for those seeking a more comprehensive approach to hair care. Consistent use of herbal hair serums can lead to stronger, glossier, and more luscious hair.

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