



Research Paper

Formulation and Evaluation of Herbal Hair Conditioner

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ABSTRACT

Hair conditioning products play a critical role in maintaining hair health by improving softness, reducing friction, minimizing breakage, and restoring moisture balance. The present research aimed to formulate and evaluate a polyherbal hair conditioner using Custard Apple (*Annona squamosa*), Hibiscus (*Hibiscus rosa-sinensis*), Fenugreek (*Trigonella foenum-graecum*), Curry Leaves (*Murraya koenigii*), Aloe vera (*Aloe barbadensis*), and Rose Water. Herbal extracts were prepared by infusion extraction and incorporated into a conditioner base. The prepared formulation was evaluated for physicochemical properties such as pH, viscosity, spreadability, washability, foamability, homogeneity, and irritancy. The formulation exhibited satisfactory results, with pH 5.5, viscosity 2100 cps, good spreadability, easy washability, and no irritation. The findings indicate that the developed herbal conditioner can be used as a safe, effective, and economical alternative to synthetic conditioners for hair care management

INTRODUCTION

Hair is an important keratinized appendage of the human body that protects the scalp and enhances cosmetic appearance. Hair damage caused by pollution, UV radiation, chemical treatments, and thermal styling results in dryness, roughness, split ends, and hair fall. Hair conditioners are formulated to restore moisture, reduce static electricity, improve manageability, and enhance shine ^{[[1,2,3]}. The increasing demand for herbal

cosmetics has shifted consumer preference toward plant-based hair care products because of their safety, efficacy, and low adverse effects. Herbal conditioners contain bioactive phytoconstituents such as flavonoids, saponins, alkaloids, tannins, and antioxidants that improve scalp health and strengthen hair fibers ^[4].

Polyherbal formulations offer synergistic effects due to the combination of multiple herbs. Aloe vera acts as a moisturizing and anti-inflammatory agent, fenugreek provides protein and nicotinic

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acid for hair strengthening, hibiscus promotes hair growth, curry leaves prevent premature greying, and custard apple contributes to scalp nourishment [5,6]. Thus, the present study was designed to

formulate and evaluate a herbal hair conditioner using selected medicinal plants for improving hair texture, nourishment, and conditioning properties [7].

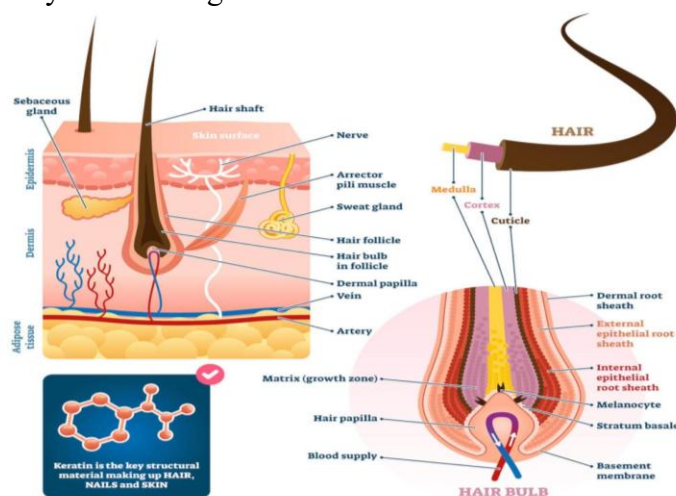


Figure 01: Hair Structure

2. MATERIALS AND METHODS

2.1 Materials

The herbal hair conditioner was formulated using medicinal plant-based ingredients selected on the basis of their traditional therapeutic use and reported pharmacological activities in hair care

formulations. All plant materials were procured from local sources and authenticated before use. Fresh plant materials were washed thoroughly with distilled water to remove dust and foreign matter and then shade-dried to preserve phytoconstituents. The excipients used in the formulation were of pharmaceutical grade.

Table 01: Materials Use

S.No	Ingredient	Quantity (100 mL)	Function
1	Custard Apple Extract	15 mL	Hair nourishment and scalp strengthening
2	Hibiscus Extract	10 mL	Hair growth promoter and anti-hair fall
3	Fenugreek Extract	10 mL	Hair conditioning and protein supplementation
4	Curry Leaves Extract	10 mL	Prevention of premature greying
5	Aloe vera Gel	35 mL	Moisturizer and soothing agent
6	Rose Water	5 mL	Vehicle, fragrance enhancer
7	Propyl Paraben	1 mL	Preservative

The selection of herbal ingredients was based on their phytochemical composition and biological activities. Fenugreek contains saponins, proteins, and nicotinic acid which support hair strengthening. Hibiscus is rich in flavonoids and amino acids that improve follicular nourishment. Aloe vera contains polysaccharides and enzymes which provide hydration and reduce scalp

irritation. Curry leaves contain antioxidants and beta-carotene that support hair pigmentation, while custard apple provides nutrients essential for scalp conditioning [8,9].

2.2 Plant Authentication and Processing

The crude drugs were cleaned and authenticated by morphological and organoleptic characteristics.

The plant materials were shade dried for 5–7 days to avoid degradation of heat-sensitive phytoconstituents. After complete drying, the plant materials were powdered using a mechanical grinder and passed through sieve no. 40 to obtain uniform particle size for extraction. The powdered drugs were stored in airtight containers until use [10].

2.3 Method of Extraction

Infusion Extraction Method

The infusion extraction method was selected because it is simple, economical, and suitable for extracting water-soluble active constituents such as flavonoids, glycosides, and mucilage. Each herbal material was extracted separately.

2.3.1 Extraction of Custard Apple Seeds

Ten grams of dried and crushed custard apple seeds were infused in 100 mL hot distilled water (80–90°C) for 2 hours with occasional stirring. The mixture was cooled and filtered through muslin cloth to obtain a clear extract. The extract was stored in amber-colored bottles for further use [11].

2.3.2 Extraction of Hibiscus Flowers

Ten grams of dried hibiscus flower powder was added to 100 mL hot distilled water and allowed to stand for 1 hour. The mixture was stirred intermittently to facilitate extraction and filtered after cooling. The extract was collected and preserved [12].

2.3.3 Extraction of Fenugreek Seeds

Fenugreek seeds were washed, dried, and lightly crushed. Ten grams of crushed seeds were soaked in boiling distilled water for 2 hours. The extract was filtered and collected. The mucilage-rich extract was used as a natural conditioning agent [13].

2.3.4 Extraction of Curry Leaves

Ten grams of shade-dried curry leaves powder was infused in 100 mL hot water for 1 hour. The mixture was filtered after cooling to obtain the extract rich in antioxidants and nutrients [14].

2.4 Formulation of Herbal Hair Conditioner

The formulation process was carried out under hygienic laboratory conditions. All extracts were measured accurately and mixed according to the optimized formula.

Procedure:

1. Custard apple seed extract (15 mL) was taken in a clean beaker.
2. Hibiscus extract (10 mL), curry leaf extract (10 mL), and fenugreek extract (10 mL) were added gradually with continuous stirring.
3. Aloe vera gel (35 mL) was incorporated slowly into the herbal extract mixture with continuous mechanical stirring to achieve a smooth gel consistency.
4. Rose water (5 mL) was added to improve fragrance and hydration.
5. Propyl paraben (1 mL) was added as preservative to prevent microbial growth.
6. The final mixture was stirred continuously for 20–30 minutes to ensure uniformity and homogeneity.
7. The prepared formulation was transferred into sterilized airtight containers and labeled appropriately.

The formulation process ensured proper dispersion of active herbal constituents and maintained the consistency of the conditioner. Continuous stirring improved uniform mixing and prevented lump formation [15].

2.5 Mechanism of Action of Herbal Ingredients in Conditioner

The herbal ingredients act synergistically in improving hair health. Aloe vera forms a protective moisturizing layer on hair strands. Fenugreek mucilage reduces friction and improves



detangling. Hibiscus enhances follicular blood circulation and promotes hair growth. Curry leaves provide antioxidant protection against free radical damage, while custard apple nourishes the scalp and strengthens roots. Together, these ingredients provide conditioning, shine, softness, and hair protection [16,17].

2.6 Storage Conditions

The formulated herbal hair conditioner was stored in airtight polyethylene containers at room temperature ($25\pm 2^\circ\text{C}$) away from direct sunlight to maintain product stability. Samples were observed periodically for changes in color, odor, pH, and consistency during the study period [18].

3. Evaluation Parameters

The prepared herbal hair conditioner was subjected to detailed physicochemical and performance evaluation in order to determine its quality, safety, efficacy, and stability. Evaluation of cosmetic formulations is essential to ensure product consistency, consumer acceptability, and compatibility with the scalp and hair shaft. All experimental evaluations were carried out in triplicate under controlled laboratory conditions to ensure reproducibility and accuracy of the observations [11].

3.1 Physical Appearance and Organoleptic Evaluation

The prepared formulation was visually evaluated for organoleptic properties such as color, odor, texture, consistency, and overall appearance. Organoleptic evaluation is considered an important preliminary quality control parameter because it directly influences consumer acceptance. A good herbal conditioner should have an acceptable appearance, pleasant fragrance, smooth texture, and uniform consistency. The color and odor of herbal formulations are generally influenced by plant extracts and excipients used in the formulation [12].

Procedure: A small quantity of the formulation was placed on a clean glass slide and observed under normal light conditions for physical appearance, texture, and consistency. Odor was assessed manually by sensory perception.

3.2 pH Determination

The pH of the conditioner plays a significant role in maintaining scalp compatibility and hair cuticle integrity. Hair and scalp generally have a slightly acidic pH, and therefore hair care formulations should maintain pH between 4.5 and 6.5. Acidic pH helps in closing hair cuticles, reducing frizz, and improving shine [13].

Procedure: One gram of the conditioner was dissolved in 10 mL of distilled water and allowed to stand for 10 minutes. The pH was measured using a calibrated digital pH meter at room temperature.

3.3 Viscosity Measurement

Viscosity is an important parameter that determines the consistency, spreadability, and retention time of the conditioner on the hair surface. Proper viscosity ensures uniform application and improves conditioning efficiency. Too low viscosity leads to product dripping, while too high viscosity affects spreadability [14].

Procedure: The viscosity of the formulation was measured using Brookfield viscometer at 25°C using spindle no. 64 at 20 rpm. The reading was recorded after stabilization.

CONCLUSION

The present study successfully formulated and evaluated a polyherbal hair conditioner using natural ingredients such as custard apple, hibiscus, fenugreek, curry leaves, aloe vera, and rose water. The formulation exhibited satisfactory physicochemical characteristics, including acceptable appearance, suitable pH, optimum viscosity, good spreadability, and easy



washability. The absence of irritation confirmed its safety for scalp application.

The conditioner demonstrated effective conditioning performance by improving hair softness, smoothness, shine, and combability while reducing tangling and dryness. Stability studies confirmed that the formulation remained physically stable without phase separation or changes in organoleptic properties during the storage period.

Based on the obtained results, it can be concluded that the formulated herbal hair conditioner is safe, stable, effective, and economical. The use of herbal ingredients provides additional therapeutic benefits such as nourishment, scalp protection, and strengthening of hair roots. Therefore, the developed formulation can be considered a promising natural alternative to synthetic hair conditioners for routine hair care applications.

5. RESULTS

The formulated herbal hair conditioner was successfully prepared and evaluated for various physicochemical and performance parameters. The obtained results demonstrated satisfactory quality, stability, and conditioning performance. The formulation showed acceptable organoleptic properties with smooth texture, pleasant odor, and uniform consistency. The pH of the formulation was found within the acceptable range for scalp application, indicating compatibility with hair physiology. Viscosity was found suitable for easy application and retention on hair strands. Spreadability and washability were satisfactory, ensuring consumer convenience. No signs of irritation were observed during patch testing, indicating the safety of the formulation. Stability studies showed no phase separation or significant physical changes during the storage period. The conditioner also exhibited effective conditioning action by improving hair smoothness, softness, and combability.

Table 02 : Evaluation Results of Herbal Hair Conditioner

S. No.	Evaluation Parameter	Result
1	Color	Creamy light green
2	Odor	Pleasant
3	Texture	Smooth
4	Consistency	Uniform
5	pH	5.5 ± 0.1
6	Viscosity	2100 ± 50 cps
7	Spreadability	6.8 ± 0.2 cm
8	Washability	Easily washable
9	Irritation Test	Nil
10	Foamability	Moderate
11	Homogeneity	Good
12	Bulk Density	0.91 g/mL
13	Stability Study	Stable
14	Conditioning Performance	Good softness and shine
15	Wet Combing Test	Easy combing
16	Dry Combing Test	Improved manageability

Interpretation of Results

The pH value (5.5) was found suitable for scalp application and helps maintain the natural acidic environment of hair. The viscosity (2100 cps) indicated optimum consistency for proper

application and retention. Spreadability (6.8 cm) confirmed easy and uniform application. The washability test showed efficient removal without residue. No irritation confirmed the safety of the formulation. Stability results indicated good



formulation integrity. Wet and dry combing tests demonstrated improved detangling and manageability, confirming the effective conditioning property of the prepared herbal formulation.

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