

## FORMULATION AND EVALUATION OF NATURAL KERATIN SHAMPOO

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### ABSTRACT

The present study focuses on the formulation and evaluation of a natural keratin-based shampoo using herbal ingredients with the aim of developing a safe and effective alternative to conventional synthetic shampoos. Hair damage caused by environmental factors, chemical treatments, and oxidative stress has increased the demand for natural hair care products enriched with strengthening and conditioning agents. In this study, keratin was isolated from human hair using an alkaline hydrolysis method and incorporated into a shampoo formulation containing natural ingredients such as reetha (*Sapindus mukorossi*), shikakai (*Acacia concinna*), amla (*Emblica officinalis*), and flaxseed gel. The prepared shampoo was evaluated for various physicochemical parameters including physical appearance, pH, viscosity, foam formation, foam stability, wetting time, surface tension, and conditioning performance. The results showed that the formulation possessed desirable characteristics such as acceptable pH, good viscosity, stable foam, and effective cleansing action. The herbal components contributed natural surfactant, antioxidant, and conditioning properties, while keratin enhanced hair strength and repair. The formulation was found to be stable and non-irritant, indicating its suitability for regular use. Overall, the developed natural keratin shampoo demonstrated promising performance and can serve as a potential eco-friendly and herbal alternative for hair care. Further studies are recommended to evaluate its long-term efficacy and commercial feasibility.

**KEYWORDS:** Natural Keratin Shampoo; Herbal Formulation; *Sapindus mukorossi*; *Acacia concinna*; *Emblica officinalis*; Flaxseed Gel; Keratin Extraction; Hair Care; Physicochemical Evaluation; Conditioning Effect.

## INTRODUCTION

Hair plays a vital role in personal appearance and self-confidence, and its health is influenced by both internal and external factors such as nutrition, environmental exposure, chemical treatments, and lifestyle habits. Modern hair care practices frequently involve the use of synthetic shampoos and conditioners containing harsh surfactants, preservatives, and chemical additives, which may lead to scalp irritation, dryness, hair damage, and long-term weakening of hair fibers.<sup>[1]</sup> This has led to an increasing demand for natural and safer alternatives in cosmetic and personal care formulations.

Keratin is a fibrous structural protein that constitutes the major component of hair, nails, and the outer layer of skin. It provides strength, elasticity, and protection to hair fibers. Damage to keratin due to chemical treatments (e.g., coloring, bleaching, straightening), heat styling, and environmental stressors results in loss of hair integrity, leading to brittleness, split ends, and hair fall.<sup>[2]</sup> Therefore, the incorporation of keratin or keratin-like substances in hair care formulations has gained attention for restoring hair structure, improving smoothness, and enhancing overall hair health.

Natural keratin-based shampoos aim to combine the restorative benefits of keratin with the safety and efficacy of plant-derived ingredients. Unlike conventional keratin treatments that often involve formaldehyde-based chemicals, natural formulations utilize hydrolyzed keratin along with herbal extracts that provide additional therapeutic benefits such as antioxidant, antimicrobial, and conditioning effects.<sup>[3]</sup> Medicinal plants such as *Aloe vera*, *Hibiscus rosa-sinensis*, *Emblica officinalis* (amla), *Azadirachta indica* (neem), and *Trigonella foenum-graecum* (fenugreek) are widely used in traditional systems for hair care due to their nourishing, strengthening, and scalp-protective properties.<sup>[4]</sup>

The use of herbal ingredients in shampoo formulations not only reduces the risk of adverse effects but also supports eco-friendly and biodegradable product development. Herbal shampoos are generally formulated with mild surfactants, natural conditioning agents, and plant-based actives that cleanse the scalp without stripping natural oils, thereby maintaining hair moisture balance and improving texture and manageability.<sup>[5]</sup> Moreover, the presence of phytoconstituents such as flavonoids, saponins, tannins, and vitamins contributes to improved scalp health and promotes hair growth.<sup>[6]</sup>

In recent years, there has been a growing interest in developing multifunctional cosmetic formulations that provide cleansing, conditioning, strengthening, and protective effects in a single product. Natural keratin shampoos represent such an approach by targeting hair repair at the molecular level while simultaneously offering the benefits of herbal therapy. However, the formulation of an effective natural keratin shampoo requires careful selection of ingredients, optimization of formulation parameters, and evaluation of physicochemical and performance characteristics such as pH, viscosity, foam stability, cleansing ability, and conditioning effect.<sup>[7]</sup>

Therefore, the present study focuses on the formulation and evaluation of a natural keratin shampoo using selected herbal ingredients, aiming to develop a safe, effective, and eco-friendly hair care product with enhanced hair strengthening and conditioning properties.



Figure No. 1: Comparison by healthy and damaged hair.

**METHODOLOGY**

**Table No. 1: Ingredients for shampoo.**

| S.No. | Ingredients      | Quantity | Usage                                  |
|-------|------------------|----------|--|
| 1     | Reetha Extract   | 40%      | Natural cleanser                       |
| 2     | Shikakai Extract | 20%      | Conditioning agent                     |
| 3     | Amla Extract     | 20%      | Hair growth promoter                   |
| 4     | Flax seed gel    | 10%      | Natural thickener and anti-frizz agent |
| 5     | Keratin          | 2%       | Hair repair/Strengthning               |
| 6     | Distilled Water  | -        | -                                      |

1. Isolation of Keratin from Human Hair: Human hair was collected, washed with detergent and distilled water to remove impurities, and dried. The cleaned hair was cut into small pieces to increase surface area. Keratin was extracted using the alkaline hydrolysis method by treating hair with sodium hydroxide solution (1–2 N). The mixture was heated at 70–90°C for 2–4 hours with continuous stirring to break disulfide bonds.



Figure No. 2: Keratin extraction from human hair.



Figure No. 3: Heating of human hair.

The solution was filtered to remove residues. Keratin was precipitated by adjusting pH to 4–5 using acetic acid, followed by washing and drying to obtain keratin powder.

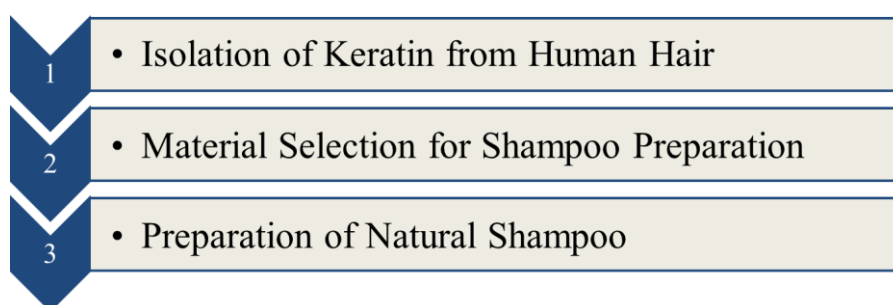


Figure No: 4 Flow chart of keratin extraction and shampoo making procedure.

2. Material Selection for Shampoo Preparation: Natural ingredients were selected based on their cosmetic and therapeutic properties: Reetha – natural cleanser (rich in saponins), Shikakai – conditioning agent, Flaxseed gel – natural thickener and anti-frizz agent, Keratin- Hair repair.



Figure No. 5: Extraction procedure of herbal drugs.

3. Preparation of Natural Keratin Shampoo: Herbal extracts were prepared by decoction method (boiling and filtration), flaxseed gel was prepared separately by boiling flaxseeds in water. All extracts were mixed in required proportions. Keratin was dissolved in warm water and incorporated into the mixture. Glycerin and essential oils were added. Final volume was adjusted using distilled water. The formulation was mixed gently to obtain a homogeneous shampoo.

## **RESULT**

### **Evaluation Tests of Natural Keratin Shampoo**

The formulated natural keratin shampoo was evaluated for various physicochemical and performance parameters to ensure its quality, safety, and effectiveness.

#### **1. Physical Appearance (Color, Odor, Texture)**

The prepared shampoo was visually inspected for its color, clarity, odor, and texture. A good shampoo should have an appealing appearance, pleasant odor, and smooth consistency without any phase separation or particulate matter.

#### **2. pH Determination**

The pH of the shampoo was determined using a calibrated digital pH meter. About 10% shampoo solution was prepared using distilled water and the pH was measured at room temperature. An ideal shampoo should have a pH in the range of 5.5–7 to match the scalp pH and prevent irritation.

#### **3. Viscosity**

Viscosity was measured using a Brookfield viscometer at room temperature. Proper viscosity is essential for easy application, spreadability, and consumer acceptability. Too high viscosity may hinder flow, while low viscosity may reduce product stability.

#### **4. Foam Formation and Foam Stability**

Foam ability was evaluated by the cylinder shake method. A fixed quantity of shampoo solution was shaken in a graduated cylinder and the foam volume was recorded immediately. Foam stability was assessed by measuring the foam volume after a specific time interval (e.g., 5 minutes). Good shampoo should produce adequate and stable foam.

#### **5. Dirt Dispersion Test**

Two drops of India ink were added to the shampoo solution and shaken. The amount of ink present in the foam was observed. Ideally, the ink should remain in the water layer rather than in the foam, indicating good cleansing ability.

#### **6. Surface Tension Measurement**

Surface tension was determined using a stalagmometer. Lower surface tension indicates better cleansing ability, as it enhances wetting and removal of dirt and oil from hair.

#### **7. Wetting Time Test**

A canvas paper disc was placed on the surface of the shampoo solution and the time taken for the disc to sink was recorded. Shorter wetting time indicates better detergent action of the shampoo.

### **8. Solid Content Determination**

A known quantity of shampoo was weighed and evaporated to dryness. The remaining residue was weighed to calculate the percentage of solid content. Ideal shampoos should have moderate solid content (20–30%) to ensure ease of rinsing and application.

### **9. Conditioning Performance**

The conditioning effect was evaluated by applying the shampoo to hair strands and assessing parameters such as smoothness, softness, ease of combing, and shine after drying.

### **10. Stability Study**

The prepared shampoo was subjected to stability studies by storing at different temperatures (room temperature, refrigerated, and elevated temperature). Observations were made for changes in color, odor, pH, and phase separation over time.

### **11. Skin Irritation Test**

A patch test was performed by applying a small amount of shampoo on the skin and observing for redness, itching, or irritation after 24 hours. The absence of irritation indicates the safety of the formulation.

## **CONCLUSION**

The present study successfully formulated and evaluated a natural keratin-based shampoo using herbal ingredients such as reetha, shikakai, amla, flaxseed gel, and isolated keratin. The formulation was developed with the objective of providing a safe, effective, and eco-friendly alternative to conventional synthetic shampoos.

The evaluation studies demonstrated that the prepared shampoo possessed acceptable physicochemical properties, including appropriate pH, good viscosity, satisfactory foam formation and stability, and efficient cleansing ability. The presence of natural surfactants from reetha and conditioning agents like shikakai and flaxseed gel contributed to improved hair texture, smoothness, and manageability. The incorporation of keratin further enhanced the formulation by providing hair strengthening and repair benefits.

Additionally, the herbal extracts used in the formulation are rich in bioactive constituents such as saponins, flavonoids, and vitamins, which offer antioxidant, nourishing, and scalp-protective effects. The formulation was found to be stable under different storage conditions and did not show any signs of irritation, indicating its safety for regular use.

Overall, the developed natural keratin shampoo shows promising potential as an effective herbal hair care product with combined cleansing, conditioning, and strengthening properties. However, further studies including advanced analytical evaluation and clinical trials are recommended to validate its long-term efficacy and commercial applicability.

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**CONFLICT OF INTEREST**

The authors declare that there is no conflict of interest regarding the publication of this research work.

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