

RESEARCH ARTICLE



Formulation, evaluation and comparison of polyherbal antidandruff shampoo cum conditioner with marketed shampoo

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Abstract: The aim of the current research work is to develop a polyherbal shampoo cum conditioning agent and conduct a comparative analysis of various evaluation parameters with a commercially available cosmetic shampoo. The polyherbal shampoo cum conditioner was synthesized utilizing extracts derived from diverse herbs, namely, Soapnut, Hibiscus, Henna, Fenugreek, and Fermented Rice water. Multiple extraction techniques, including hot infusion, decoction, maceration, were employed in the preparation process. The base of the formulation comprised 10% Gelatin, and the perfuming agent Menthol was incorporated to enhance safety in contrast to prevalent commercial formulations. A minimal quantity of the preservative sodium Benzoate was introduced, and the pH was adjusted using lemon juice. Numerous physicochemical properties, including % of solid contents, surface tension, viscosity, foam volume and stability, dirt dispersion, detergency, were assessed to comprehensively evaluate the formulated product and its comparison with a commercial shampoo. The polyherbal shampoo cum conditioner exhibited clarity and aesthetic appeal. It demonstrated efficacious cleansing and detergent activities, evidenced by low surface tension and the formation of small, enduring bubbles even after a 5-minute interval. The results suggest that the formulated shampoo performed exceptionally well in terms of cleansing activity, comparable to the commercially available counterpart. Subsequent research and development endeavors are imperative to enhance the quality and stability parameters of the formulation.

Keywords: Polyherbal Shampoo; Conditioner; Soapnuts; Extraction; Cosmetics; Natural agents

1. Introduction

Hair constitutes a vital aspect of human beauty, contributing not only to aesthetic appeal but also playing a crucial role in thermoregulation. The significance of hair care is underscored by its dual function: maintaining beauty and contributing to overall well-being. [1,2] Among the various hair care products, shampoos stand out as one of the most widely utilized formulations, primarily designed for cleansing the scalp and hair. These formulations comprise a viscous solution of detergents endowed with both hair cleansing and conditioning properties. The inclusion of suitable additives and preservatives in precise proportions is essential to meet the required standards comparable to their synthetic counterparts. [3,4]

The formulation of shampoos presents a major challenge, requiring the judicious selection of ingredients to meet stringent evaluation criteria comparable to those of commercial shampoos. The efficacy of the chosen herbs is pivotal, as they should demonstrate not only effective hair cleansing but also conditioning effects [5]. In traditional synthetic shampoos, the use of surfactants has been associated with adverse effects on prolonged usage, such as eye and scalp irritation, hair dryness, increased hair fall, and a lack of conditioning effects [6].

Recognizing the limitations of synthetic formulations, the present research focuses on developing a polyherbal shampoo and conditioner exclusively utilizing herbal ingredients. This formulation aims to address the aforementioned issues associated with prolonged use of synthetic shampoos. The rational selection of herbs, extraction techniques, and formulation components plays a critical role in achieving a product that not only meets but potentially exceeds the performance of commercial counterparts. This study investigates the formulation process and evaluates the physicochemical properties of the polyherbal shampoo cum conditioner, comparing its efficacy with that of commercially available synthetic shampoos. The ultimate goal is to offer a herbal alternative that provides effective hair cleansing and conditioning without the adverse effects associated with long-term use of synthetic counterparts.

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2. Material and methods

2.1. Plant Material Collection

The crude plant material utilized in this study was sourced from the medicinal plant garden at Narayana Pharmacy College.

2.2 Seed Acquisition

Seeds of *Trigonella foenum-graecum* and *Sapindus mukorosi* were procured from a local supermarket.

2.3 Preparation of Extracts Using Various Techniques

2.3.1 *Sapindus mukorosi*

A total of 50g of powdered material was subjected to hot infusion. The material was soaked in hot distilled water for 2 hours to facilitate the extraction process [5].

2.3.2 *Hibiscus rosa-sinensis*

For the preparation of the extract, 50g of powdered material underwent maceration in water for a duration of 24 hours [6].

2.3.3 *Lawsonia inermis*

The extraction process for *Lawsonia inermis* involved adding 50g of powdered material to boiled water, followed by filtration to obtain the extract.

2.3.4 *Trigonella foenum graecum*

To prepare the extract, 50g of powdered material underwent boiling in water for 4 hours. The resultant extract was filtered, separated, and concentrated to achieve a viscous preparation.

2.3.5 Fermented Rice Water

Fermented rice water was prepared by soaking rice for a period of 48 hours. [7]

The extracts obtained from each plant material were meticulously filtered, separated, and concentrated to yield the desired viscous preparations. The obtained extracts are shown in Figure 1.

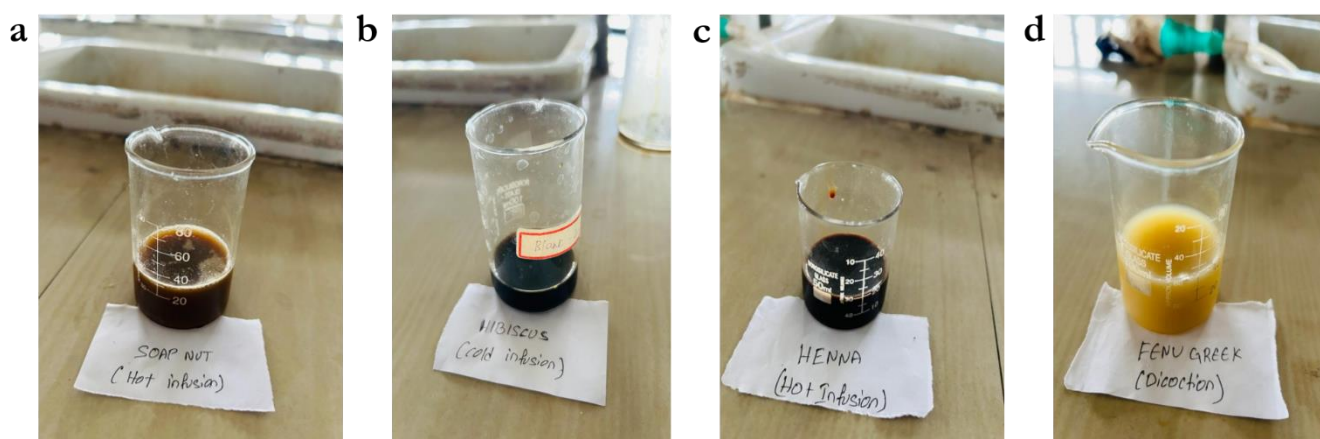


Figure 1 Extracts of a. Soap nut b. Hibiscus c. Henna d. Fenugreek

2.2. Formulation of herbal shampoo

The formulation of the herbal shampoo adhered to the provided formula detailed in Table 1. The herbal extracts were incorporated into a 10% gelatin solution, and the amalgamation was achieved through continuous shaking at 30-minute intervals. In order to enhance the conditioning efficacy of the formulation, an adequate quantity of fermented rice water was introduced. To augment the aroma profile of the formulation, an appropriate volume of a 2% solution of menthol crystals was added. The pH of the formulation was meticulously adjusted through the addition of lemon juice, and the final volume was adjusted to 100ml using a gelatin solution. This methodical approach ensured the integration of herbal components, conditioning agents, and aromatic elements in a balanced manner, resulting in the formulation of the polyherbal shampoo cum conditioner. [8]

Table 1 Formulation of herbal shampoo

S.No.	Ingredient	Botanical name	Part used	Category	Quantity for 100 mL
1.	Soapnut extract	<i>Sapindus mukorosii</i>	Fruit	Cleansing agent	15ml
2.	Hibiscus extract	<i>Hibiscus rosasinensis</i>	Leaf	Cleansing and conditioning agent	15ml
3.	Henna extract	<i>Lawsonia inermis</i>	Leaf	Antidandruff, coloring and conditioning agent	15ml
4.	Fenugreek extract	<i>Trigonella foenum graecum</i>	Seeds	Conditioning agent	15ml
5.	Rice water	<i>Oryza sativa</i>	Seeds	Hair growth promoter	qs
6.	Lemon juice	<i>Citrus limonum</i>	Fruit	pH adjuster	qs
7.	Gelatin solution 10%	---	---	Base	qs
8.	Menthol crystals 2% soln.	---	---	Perfume	-
9.	Sodium benzoate 0.5%	---	---	Preservative	qs

2.3. Evaluation of herbal shampoo

The prepared formulation was evaluated for product performance which included Visual assessment, pH determination, % solid content. To determine the nature of the formulation specific tests was conducted for surface tension, foam stability test, foam volume, Rheological evaluation of viscosity by Brookfield viscometer, dirt dispersion, cleaning action as per the standard protocol

2.3.1. pH determination

The pH of the prepared polyherbal shampoo in distilled water [10%v/v] was evaluated by means of pH analyser at room temperature. [9]

2.3.2 Determination of solid content percentage

The percentage of solid substance was determined by weighing about 4g of shampoo in a dry, clean petridish. To confirm the result the procedure was repeated again. The liquid portion of the shampoo was evaporated in a dish by placing on hot plate. The percentage and the weight of the solid contents present in the shampoo were calculated after drying completely. [10]

2.3.3 Surface tension measurement

The prepared shampoo in distilled water [10%v/v] was evaluated for surface tension using stalagmometer at room temperature.

2.3.4 Foam stability test

The stability of the foam was determined using cylinder shake method. About 50 ml of formulated polyherbal shampoo (1%) solution was taken in a graduated measuring cylinder of 250 ml capacity and shaken for 10 times vigorously. Foam stability was measured by recording the foam volume of shake test after 1 min and 4 min, respectively. The total foam volume was measured after 1 min of shaking.

2.3.5 Dirt dispersion test

To 10 ml of distilled water two drops of formulated shampoo was added and taken in a stoppered measuring cylinder. To this, add one drop of Indian ink and shaken for 10 min after closing the measuring cylinder with a stopper. The volume of ink in the froth was measured and the result was graded in terms of none, slight, medium, or heavy.

2.3.6 Foam volume

10ml of shampoo is taken in a measuring cylinder. Record the initial volume and shake the cylinder 10 times, then record the final volume. The foam volume should be greater than 100

Foam formation = final volume - initial volume

2.3.7 Rheological evaluation

The Rheological evaluation of shampoo was done by the Brookfield viscometer spindle No. 64(LV Spindle set) at 10rpm speed at room temperature.



Figure 2 Measurement of Viscosity of Herbal shampoo by Brookfield Viscometer

3. Results and discussion

3.1 Herbal shampoo formulation

The shampoo was formulated by adding the equal amount of the aqueous extracts of all the ingredients as in Table 2. The above formulation extract contains phytoconstituents like saponins which is a natural surfactant having detergent property and foaming property. An ideal shampoo must have adequate viscosity and abundant saponins to exhibit the desired cleansing activity. The gelatin solution (10%) behaves as a pseudoplastic forming clear solutions. [11]

3.2 Evaluation of the shampoo

3.2.1 Physical appearance

The formulated shampoo exhibited good characteristics in terms of foaming effect and appearance on the visual inspection of the formulation. [5] The results are shown in Table 2.

3.2.2 Determination of pH

The pH of the shampoo is a significant factor for enhancing and improving the hair quality and also for stabilizing the scalp and minimizing the irritation of The eyes. Now a days the shampoo with lower pH are developed for minimizing the damage caused to

the hair. Lowering of pH (mild acidity) promotes tightening of the scalp and improves the shining of hair. Hence, slightly acidic shampoos are gaining popularity. [6]

3.2.3 Determination of %w/w Solid content

Shampoo with high solid content will be very problematic to wash and on the otherhand if less solid contents are present then it is watery and gets easily washed off before exhibiting proper cleansing. Thus the % solid content of 20-30% is apt for proper cleansing activity. The shampoo was prepared with containing 23.25% of solid content. Thus, they considered easy to wash out when having less solid content during preparation of shampoos. [7]

3.2.3 Surface tension

The surface tension reduction of the formulated shampoo was found to be about 32.08 dynes/cm which indicates its good cleansing property. The lower surface tension is the one of the mechanism of the detergent property and this will be the marker for a good detergency effect of the shampoo which could be done by reducing the surface tension of water from 72.8 dynes/cm to the surface 40 dynes/cm. [8]

3.2.4 Foaming Volume and foam stability

From the consumer point of view, foam stability plays a key role in the shampoo evaluation. The foam volume produced by the formulated shampoo is above 100 ml. The prepared shampoo generates uniform, small sized, compact, denser, and stable foam. The foam volume remains same throughout the period of about 5 min showing that the generated foam by the shampoo has good stability and the prepared shampoo exhibits higher foam property which may be due to the presence of Hibiscus, Fenugreek and Soapnut together. The smaller the bubbles the more time it would persist. [9]

3.2.5 Determination of viscosity of herbal shampoo

Viscosity is the resistance of the liquid to flow. This parameter is dependent on the %w/w of solids. Table 2 summarises the findings of viscosity by Brookfield viscometer. [10]

3.2.6 Dirt dispersion test

If the ink is deposited in the foam then it is of poor quality as dirt in foam is hard to remove so the dirt should be present in the water only. If the dirt is in foam it will be deposited on hair [11]

Table 2. Results of Physicochemical properties of the herbal shampoo

S.No.	Evaluation Parameter	Commercial Shampoo	Formulated shampoo
1.	Color	white	Brown
2.	Transparency	Clear	Clear
	Dirt dispersion	Light	Moderate
3.	Odor	Pleasant	Pleasant
4.	pH of 10% solution	5.53±0.05*	5.81 ± 0.01*
	Viscosity (cps)	856	198
5.	Solid contents (%)	29.2%	23.25%
6.	Foam volume (ml)	440ml	410ml
7.	Foam type	dense, small	dense, small
8.	Surface tension (dynes/cm)	31.32 ± 0.02*	32.06 ± 0.01*

Mean + SEM (n=3 observations)

4. Conclusion

The Polyherbal shampoo cum conditioner, formulated with natural extracts, exhibits commendable cleansing effects, though marginally less than commercial counterparts. Unlike market formulations linked to dandruff, our natural formulation, with Henna's antidandruff properties, ensures scalp safety. The blend of Soapnut, Hibiscus, Fenugreek, and Henna offers dual cleansing and conditioning benefits. Additionally, the inclusion of Fermented rice water, rich in inositol, promotes hair health. While surpassing physicochemical evaluation parameters, future stability and antimicrobial studies are essential for comprehensive product assessment, contributing to its sustained effectiveness and safety.

Compliance with ethical standards

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Conflict of interest statement

Authors declare no conflict of interest.

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Author's short biography

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My research interests include drug discovery and development utilizing natural products. Obtained an M.Pharm degree from the Department of Phytopharmacy and Phytomedicine, TIFAC CORE in Herbal Drugs at JSS College of Pharmacy in Ooty. Research expertise involves the extraction, isolation, purification, and characterization of compounds derived from natural sources. Completed an internship at The Himalaya Drug Company in Bangalore and subsequently served as a trainer in various US Healthcare MNCs in Bangalore and Chennai. Currently, employed as an Assistant Professor in the Department of Pharmacognosy at Narayana Pharmacy College in Nellore, Andhra Pradesh, India

