CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

SJIF Impact Factor: 7.187

https://doi.org/10.5281/zenodo.15591174

https://www.iajps.com/volumes/volume12-may-2025/48-issue-05-may-25/

Available online at: http://www.iajps.com Research Article

FORMULATION AND EVALUATION OF NOVEL HERBAL SHAMPOO BY ALOE VERA GEL

Shreya Patwa[1*], Vishal Rasve[2], Gaffar Sayyed[3], Sanjay Garje[4]

[1*-4]SAJVPM's College of pharmaceutical Science and Research Centre, Kada (Beed) India-414202

Abstract:

The human skin, the body's largest organ, plays a crucial role as a protective barrier and is composed of multiple layers with specialized cells and functions. Skin health and appearance are profoundly influenced by its type, which determines the most appropriate care and treatment strategies. This study provides a comprehensive overview of the various skin types' namely normal, oily, dry, combination, sensitive, acne-prone, mature or aging, and hyper pigmented skin emphasizing their unique characteristics and skincare requirements. Normal skin is well-balanced with minimal issues, whereas oily skin is marked by excessive sebum production and a predisposition to acne. Dry skin lacks moisture, leading to flakiness and irritation, while combination skin presents a mix of oily and dry areas, particularly an oily T-zone and dry cheeks. Sensitive skin is reactive to environmental and chemical stimuli, often showing signs of redness and irritation. Acne-prone skin is susceptible to breakouts due to clogged pores and increased oil production. Mature or aging skin exhibits signs of degeneration such as wrinkles and loss of elasticity, while hyper pigmented skin shows uneven tone and dark patches caused by excessive melanin production. The identification and understanding of individual skin types are essential for designing personalized skincare regimens that address specific needs and promote long-term skin health. Furthermore, this paper underscores the importance of selecting appropriate ingredients and formulations tailored to each skin type, as well as the need for sun protection and professional dermatological consultation when required. This foundational understanding aids not only in everyday skincare but also in guiding the development of effective dermatological and cosmeceutical interventions.

KEYWORDS: *Aloe vera gel, shampoo, Azadirachta indica, Xanthan Gum, sodium benzoate Shikakai etc.*

Corresponding author:

Shreya Patwa,

SAJVPM's College of pharmaceutical Science and Research Centre Kada (Beed) India-414202

Email: patwashreya699@gmail.com

QR code

Please cite this article in press Shreya Patwa et al., ***Formulation And Evaluation Of Novel Herbal Shampoo By Aloe Vera Gel.,*** *Indo Am. J. P. Sci, 2025; 12(05).*

INTRODUCTION:

The growing awareness regarding the harmful effects of synthetic chemicals in personal care products has significantly increased the demand for herbal and natural formulations. Among these, herbal shampoos have gained immense popularity due to their mildness, minimal side effects, environmental friendliness, and multifunctional benefits. Herbal shampoos are formulations enriched with natural ingredients derived from plant sources, which cleanse the scalp and hair while offering nourishment, conditioning, and therapeutic properties. Unlike conventional shampoos containing sulfates, parabens, and synthetic fragrances, herbal shampoos are perceived as safer and more beneficial for long-term hair and scalp health.

One of the most promising ingredients in herbal cosmetics is Aloe vera (Aloe barbadensis Miller), a succulent plant known for its extensive medicinal and cosmetic applications. Aloe vera gel, extracted from the inner leaf pulp, is rich in vitamins (A, C, E, B12), minerals (calcium, magnesium, zinc), amino acids, enzymes, polysaccharides, and bioactive compounds like aloin and saponins. These components make Aloe vera gel an ideal candidate for hair care formulations due to its moisturizing, anti-inflammatory, antimicrobial, and antioxidant properties. It helps soothe irritated scalp, reduce dandruff, promote hair growth, and restore natural shine and softness to the hair. The mucilaginous nature of Aloe vera gel also imparts a natural viscosity and conditioning effect, making it suitable as a base material in herbal shampoo development.

The formulation of a novel herbal shampoo using Aloe vera gel not only enhances the functional and aesthetic properties of the product but also addresses the increasing consumer preference for chemical-free and sustainable alternatives. The development of such formulations requires a systematic approach involving the selection of compatible herbal ingredients, optimization of concentrations, and evaluation of physicochemical properties such as pH, viscosity, foaming ability, cleansing action, stability, and organoleptic characteristics. Additionally, the product should meet standard quality parameters to ensure efficacy and consumer acceptability.

In this context, the present study aims to formulate and evaluate a novel herbal shampoo using Aloe vera gel as the principal ingredient. The research focuses on the integration of natural components to develop a product that is not only effective in cleansing and conditioning but also offers therapeutic benefits for various hair and scalp issues. Through comprehensive evaluation and optimization, this study endeavors to provide a safe, effective, and eco-friendly alternative to conventional synthetic shampoos.

MATERIALS AND METHODS:

The present study aimed to formulate a novel herbal shampoo using Aloe vera gel in combination with other potent herbal extracts known for their hair-enhancing properties. The formulation was developed using naturally derived ingredients, carefully selected for their individual and synergistic effects on hair health, scalp condition, and product performance.

Materials and Ingredients

Various herbal extracts were used in the formulation, each serving a specific therapeutic purpose. All herbal ingredients were procured from certified suppliers, ensuring authenticity, standardization, and pharmaceutical quality.

- **Shikakai Extract** *(Acacia concinna)* was used as a natural hair cleansing agent due to its rich saponin content, which gently removes dirt and oil without stripping the hair of its natural moisture. A quantity of 5 grams was procured from *Pharma Natural Extractions Pvt. Ltd.*
- **Amla Extract** *(Emblica officinalis)*, known for its high vitamin C content and antioxidant properties, was incorporated as a hair conditioning and nourishment agent. It strengthens hair follicles and promotes healthy hair growth. A 5-gram quantity was sourced from *Aarkay Natural Extracts Pvt. Ltd.*
- **Neem Extract** *(Azadirachta indica)*, valued for its antimicrobial and antifungal properties, was included to support scalp treatment and reduce dandruff. A quantity of 5 grams was obtained from *Vedic Herbals Pvt. Ltd.*
- **Aloe Vera Extract** *(Aloe barbadensis Miller)* served as the central component of the formulation. Known for its deep moisturizing, soothing, and scalp-conditioning effects, 10 grams of Aloe vera extract were procured from *Green Chem Organic Pvt. Ltd.*
- **Hibiscus Extract** *(Hibiscus rosa-sinensis)* was added to enhance hair growth and impart conditioning benefits. It also helps in preventing hair fall and premature greying. A 5-gram quantity was sourced from *Natural Extracts Enterprises Pvt. Ltd.*

These herbal ingredients were incorporated in appropriate ratios based on their traditional efficacy, compatibility, and overall benefit to hair and scalp health.

CHEMICALS USED:

In addition to herbal ingredients, certain naturally derived excipients and preservatives were used to enhance the physical properties, stability, and shelf-life of the shampoo.

- **Coco Glucoside**, a non-ionic surfactant derived from coconut oil and glucose, was used in a quantity of 8 grams to provide gentle cleansing and foaming action. It was procured from *Aarati Industries Pvt. Ltd.*
- **Xanthan Gum**, a natural polysaccharide, was added as a thickening and stabilizing agent to improve the consistency of the shampoo. One gram was used, obtained from *Lalji Hirachand & Co. Pvt. Ltd.*
- **Sodium Benzoate** (0.2 grams) and Potassium Sorbate (0.1 grams) were included as natural preservatives to prevent microbial growth and extend product shelf-life. These were sourced from *BASF India Ltd.* and *Nirali Chemicals Pvt. Ltd.*, respectively.

These chemicals were carefully selected to ensure the formulation remained free from synthetic additives, aligning with the natural theme of the herbal shampoo.

Instruments Used

The formulation and evaluation processes involved various analytical and compounding instruments to ensure accuracy and consistency. The instruments used are as follows:

- A **Hot Air Oven** (Model: HOS-6) manufactured by *Labline, Mumbai* was used for drying and sterilization of glassware and ingredients.
- A **Digital pH Meter**, also from *Labline, Mumbai*, was utilized for measuring and adjusting the pH of the shampoo to ensure skin compatibility.
- A **Digital Balance** (Model: PGB 600) from *Wensar Weighing Scales Limited* was used for precise weighing of all raw materials and chemicals.
- A **Heating Mantle**, manufactured by *Labline, Mumbai*, was employed for controlled heating during the formulation process.

All instruments were calibrated and maintained regularly to ensure the reliability and reproducibility of the results.

Formulation of the Herbal Shampoo

The novel herbal shampoo was formulated by combining the selected herbal extracts and other ingredients in the following manner:

1. A 1% (w/v) solution of Xanthan Gum was prepared in distilled water by slowly adding the powder to the water under continuous stirring using a magnetic stirrer until a homogenous gel was formed.
2. The required quantities of Shikakai, Amla, Neem, Aloe Vera, and Hibiscus extracts were weighed and added to a clean beaker.
3. Coco Glucoside was added to the herbal extract mixture and stirred gently to ensure uniform mixing.
4. The Xanthan Gum gel solution was then slowly added to the mixture under continuous stirring to achieve the desired viscosity.
5. Sodium Benzoate and Potassium Sorbate were dissolved in a small amount of distilled water and added to the shampoo formulation as preservatives.
6. The pH of the shampoo was adjusted to the range of 5.5-6.5 by adding a few drops of citric acid solution (10% w/v), with continuous monitoring using a calibrated pH meter.
7. The final volume of the shampoo was made up to 100 mL with distilled water.
8. The formulated herbal shampoo was stored in an airtight container at room temperature for further evaluation.

Evaluation parameters of Herbal Shampoo:

Visual Assessment: The formulated herbal shampoo was visually inspected for its color, clarity, odor, and the appearance of foam upon gentle shaking.

pH Determination: The pH of a 10% (v/v) solution of the herbal shampoo in distilled water was determined at room temperature (25 ± 2 °C) using a calibrated digital pH meter. The electrode was immersed in the solution, and the reading was recorded once it stabilized.

Surface Tension Measurement: The surface tension of a 10% (v/v) solution of the herbal shampoo in distilled water was measured at room temperature (25 ± 2 °C) using a stalagmometer. The stalagmometer was cleaned with chromic acid and rinsed thoroughly with distilled water before use. The number of drops of distilled water and the shampoo solution between two marked points on the stalagmometer were

counted, and the surface tension of the shampoo solution was calculated using the formula:

$$\gamma 2=\gamma 1\times n2\times \rho 1 n1\times \rho 2$$

where γ2 is the surface tension of the shampoo solution, γ1 is the surface tension of distilled water, n1 is the number of drops of distilled water, n2 is the number of drops of the shampoo solution, ρ2 is the density of the shampoo solution, and ρ1 is the density of distilled water.

Testing of Wetting Foam Stability:

- **Wetting Time:** A canvas paper disc of 1-inch diameter and average weight of 0.66 g was carefully placed on the surface of a 1% (v/v) shampoo solution in a beaker. The time taken for the disc to completely sink was recorded as the wetting time using a stopwatch.
- **Foam Stability:** The cylinder shake method was used to assess foam stability. A 50 mL volume of a 1% (v/v) shampoo solution was placed in a 250 mL graduated cylinder, which was then stoppered and shaken vigorously 10 times. The total volume of the foam produced was recorded immediately after shaking and again after 1 minute and 4 minutes to assess the stability of the foam.

Figure 1: Foam of shampoo

Dirt Dispersion Test: Two drops of the formulated herbal shampoo were added to 10 mL of distilled water in a test tube. One drop of India ink was then added to the solution. The test tube was stoppered and shaken 10 times. The amount of ink dispersed in the foam was visually estimated and categorized as none, light, moderate, or heavy.

Conditioning Performance Evaluation: A panel of 10 volunteers was recruited to evaluate the conditioning performance of the herbal shampoo. Each volunteer washed a pre-treated hair tress with the formulated herbal shampoo and another identical tress with a commercially available mild shampoo (used as a control). After washing and drying, the volunteers were asked to subjectively assess the softness, smoothness, and manageability of both hair tresses on a scale of 1 to 5 (1 being poor and 5 being excellent). The average scores for each parameter were then calculated for both the herbal shampoo and the control.

Physicochemical Properties Analysis:

- **Viscosity:** The viscosity of the formulated herbal shampoo was measured at room temperature (25 ± 2 °C) using a Brookfield Viscometer with an appropriate spindle at a speed of 10 rpm. The reading was recorded in centipoise.
- **Solid Content:** Approximately 4 g of the formulated herbal shampoo was accurately weighed in a pre-weighed evaporating dish. The dish was placed on a hot plate, and the liquid portion of the shampoo was evaporated until a constant weight was obtained. The ;percentage of solid content was calculated using the formula:

Percentage Solid Content = Initial weight of shampoo/ Weight of solid residue×100

Table 1: Evaluation parameters of physicochemical properties

Evaluation Parameter	Purpose	Method Summary	Key Interpretation/Outcome
Skin Irritation Test	Assess irritation/inflammation potential	Apply to skin for 5 min, wash, observe for irritation	No irritation = safe for use
Washability	Ease of removal	Wash hands after application, note residue	Easy wash-off = good formulation
Wetting Time	Assess wetting/cleansing efficiency	Canvas disc method, time disc takes to sink	Shorter time = better wetting/cleansing
Antimicrobial Activity	Efficacy against dandruff-causing microbes	Agar well diffusion, measure inhibition zone	Larger zone = stronger antimicrobial effect
Stability Studies	Product consistency over time	Periodic checks for appearance, pH, solids, transparency	Stable parameters = good shelf-life

Skin Irritation Test

- **Purpose:** To assess whether the prepared polyherbal anti-dandruff shampoo causes any irritation or inflammation when applied to the skin.
- **Method:** A small amount of the shampoo is applied to the skin (commonly on the forearm or behind the ear) and left for 5 minutes. After washing off, the area is observed for signs of irritation such as redness, itching, or swelling.
- **Interpretation:** Absence of visible irritation or inflammation indicates the formulation is safe and non-irritant for topical use. This is supported by studies showing herbal shampoos with similar compositions were classified as "Non-Irritant" in both animal and human models.
- **Significance:** Ensures the product is suitable for individuals with sensitive skin and is unlikely to cause adverse reactions.

Washability

- **Purpose:** To determine how easily the shampoo can be removed from the skin or hair after application.
- **Method:** After applying the shampoo to the hands, they are washed under running water, and the ease of removal is noted.
- **Interpretation:** A good shampoo should rinse off easily without leaving a residue, indicating proper formulation and user convenience.
- **Significance:** Ensures user satisfaction and prevents product build-up on hair or scalp.

Wetting Time

- **Purpose:** To evaluate the efficiency of the shampoo's wetting action, which is crucial for effective cleansing.
- **Method:** The canvas disc method is commonly used. A smooth canvas disc is placed on the surface of the shampoo solution, and a stopwatch is started. The time taken for the disc to sink (indicating it is fully wetted) is recorded as the wetting time.
- **Interpretation:** Shorter wetting time indicates better wetting ability, which is desirable for quick and thorough hair washing. Herbal shampoos with good wetting properties are considered effective cleansers.
- **Significance:** Reflects the surfactant quality and user experience during application.

Stability Studies

- **Purpose:** To ensure the shampoo maintains its quality, safety, and efficacy over time.
- **Method:** Conducted according to ICH guidelines. The shampoo is stored under various conditions and periodically evaluated for:
  - Physical appearance (color, clarity, consistency)
  - Percentage of solid content
  - Transparency
  - pH
- **Interpretation:** No significant changes in these parameters indicate good stability. The referenced formulations maintained appropriate pH (close to neutral), solid content within limits, and stable physical appearance throughout the study period.
- **Significance:** Ensures product shelf-life and consistent performance for consumers.

RESULT AND DISCUSSION:

Results of Evaluation Tests

The formulated novel herbal shampoo exhibited a light brown color with a slightly viscous consistency and a pleasant herbal odor. The foam produced upon shaking was moderate and appeared stable for a reasonable duration.

Table 2: Physicochemical Properties of the Formulated Herbal Shampoo

Property	Result
pH	6.2 ± 0.1
Viscosity (PI)	450 ± 25
Surface Tension (dyne/cm)	35.5 ± 0.5
Solid Content (%)	25.0 ± 1.0

Table 3: Performance Evaluation Results of the Formulated Herbal Shampoo

Test	Result
Wetting Time (seconds)	25 ± 2
Foam Volume (Initial, mL)	100 ± 5
Foam Volume (1 min, mL)	90 ± 4
Foam Volume (4 min, mL)	80 ± 3
Dirt Dispersion	Light

The pH of the shampoo formulation was measured to be 6.2 ± 0.1, which is within the ideal range for hair care products. This slightly acidic pH helps maintain the scalp's natural balance and minimizes the risk of irritation, making the product suitable for regular use. The viscosity of the shampoo was determined to be 450 ± 25 centipoise (PI), indicating a moderately thick consistency. This viscosity level contributes to ease of application and spreading on the hair, while also ensuring the product is not too runny or too stiff. The surface tension of the formulation was found to be 35.5 ± 0.5 dyne/cm. This value reflects the shampoo's ability to wet the hair and scalp effectively, which is essential for optimal cleansing performance and the formation of stable foam. The solid content of the shampoo was 25.0 ± 1.0%, representing the total amount of non-volatile substances present in the formulation. A solid content of this level indicates a well-balanced concentration of active and supporting ingredients, contributing to the product's efficacy and stability. This are physiochemical properties result after formulation of herbal shampoo.

The performance of the formulated herbal shampoo was evaluated using standard testing parameters. The wetting time was recorded as 25 ± 2 seconds, indicating the shampoo's ability to quickly penetrate and wet the hair surface. A shorter wetting time is desirable, as it suggests efficient spreading and interaction with hair strands, aiding in better cleansing. The foam volume was assessed at three intervals to determine foaming ability and stability. The initial foam volume was 100 ± 5 mL, which reflects the shampoo's good lathering capacity upon application. After 1 minute, the foam volume slightly decreased to 90 ± 4 mL, and further to 80 ± 3 mL after 4 minutes, showing that the foam was relatively stable over time. Foam stability is an important characteristic in consumer perception and product effectiveness. In the dirt dispersion test, the shampoo showed a light level of dirt dispersion. This means that while the formulation can lift dirt from the hair, most of it remains in the foam rather than being redeposited onto the hair strands—an indicator of good cleansing efficiency. Overall, these results suggest that the herbal shampoo demonstrates favorable wetting, foaming, and cleansing performance.

Table 4: Conditioning Performance Evaluation

Parameter	Herbal Shampoo	Control Shampoo
Softness	4.2 ± 0.3	3.8 ± 0.4
Smoothness	4.0 ± 0.4	3.5 ± 0.5
Manageability	4.1 ± 0.3	3.7 ± 0.4

Based on average scores provided by volunteers, highlights the enhanced efficacy of the herbal shampoo compared to the control shampoo. Three key parameters were assessed: softness, smoothness, and manageability. For softness, the herbal shampoo scored 4.2 ± 0.3, outperforming the control shampoo, which received 3.8 ± 0.4. This indicates that users experienced a noticeably softer hair texture after using the herbal formulation. In terms of smoothness, the herbal shampoo again showed superior results with a score of 4.0 ± 0.4, whereas the control shampoo lagged behind with a rating of 3.5 ± 0.5, suggesting that the herbal product left hair feeling more polished and sleek. Manageability, a crucial factor for daily hair care and styling, was also rated higher for the herbal shampoo at 4.1 ± 0.3, compared to 3.7 ± 0.4 for the control shampoo. These findings collectively suggest that the herbal shampoo delivers better overall conditioning performance, likely due to the presence of natural, hair-friendly ingredients that enhance the texture, feel, and manageability of hair.

Fig. 2: Method of preparation

Fig. 3: Herbal Noel Shampoo

The pH of the formulated herbal shampoo was found to be 6.2, which falls within the slightly acidic to neutral range considered ideal for hair and scalp health. This pH helps to maintain the integrity of the hair cuticle and minimizes the risk of scalp irritation. The viscosity of 450 cp indicates a consistency that is suitable for easy application and distribution through the hair. The surface tension of 35.5 dyne/cm demonstrates the shampoo's ability to reduce the surface tension of water, which is crucial for effective wetting of the hair and removal of dirt and sebum. A solid content of 25% is within the acceptable range for shampoos, ensuring a balance between ease of application and sufficient active ingredients for cleansing.

The wetting time of 25 seconds suggests that the shampoo effectively wets the hair, facilitating the removal of dirt and oil. The initial foam volume of 100 mL and the gradual decrease to 80 mL after 4 minutes indicate a moderate foaming ability and reasonable foam stability. While the foam volume might be less copious compared to some synthetic shampoos, it is considered sufficient for effective cleansing, and the stability ensures that the lather persists during washing. The dirt dispersion test showed a light dispersion of ink in the foam, indicating that the shampoo effectively lifts dirt and keeps it suspended in the water rather than redepositing it on the hair.

The subjective evaluation by volunteers indicated that the herbal shampoo performed well in terms of conditioning. The average scores for softness, smoothness, and manageability were higher for the hair tresses washed with the herbal shampoo compared to the control shampoo, suggesting that the herbal formulation effectively conditions the hair, likely due to the presence of ingredients like Aloe Vera and Hibiscus.

The physicochemical properties of the formulated herbal shampoo are crucial for its overall performance and stability. The slightly acidic pH is beneficial for maintaining the scalp's acid mantle, which acts as a protective barrier. The moderate viscosity ensures that the shampoo is easy to handle and apply without being too runny. The reduction in surface tension facilitates the wetting of hair and emulsification of oils and dirt, which is essential for effective cleansing. The solid content indicates the concentration of non-volatile components, including the herbal extracts and thickening agent, which contribute to the shampoo's overall efficacy.These properties collectively suggest that the formulated herbal shampoo possesses a favorable

physicochemical profile for a hair cleansing and conditioning product.

While the evaluation results are promising, some potential limitations of the formulated herbal shampoo can be considered. The foaming ability, while sufficient, might be perceived as lower compared to some synthetic shampoos that utilize high levels of sulfate-based surfactants. The natural odor of the herbal extracts, although considered pleasant in this case, might not appeal to all consumers who are accustomed to stronger, artificial fragrances in conventional shampoos. Further studies on the long-term stability and shelf life of the formulation, including microbial challenge testing, would be necessary to ensure its safety and efficacy over time, as herbal formulations can sometimes be more susceptible to degradation without strong synthetic preservatives.

CONCLUSIONS:

The novel herbal shampoo formulated with extracts of Shikakai, Amla, Neem, Aloe Vera, and Hibiscus demonstrated promising physicochemical and performance properties. The shampoo exhibited a slightly acidic pH, suitable viscosity, and effective reduction in surface tension. It showed adequate wetting time and moderate foam stability. The dirt dispersion test indicated good cleansing action, and subjective evaluation suggested effective conditioning performance, resulting in soft, smooth, and manageable hair. The research successfully achieved its aim of formulating and evaluating a novel herbal shampoo. All the specific objectives were met, including the selection of appropriate herbal ingredients, the formulation of the shampoo, the evaluation of its physicochemical properties and performance through various tests, the assessment of its conditioning performance, and the identification of potential limitations. The findings of this research have significant implications for the development of natural and herbal hair care products. The formulated shampoo provides evidence that a blend of traditional herbs can offer effective cleansing and conditioning benefits while minimizing the use of synthetic chemicals. This study supports the growing consumer preference for natural alternatives in cosmetics. Future research could focus on further optimizing the formulation to enhance foaming ability and stability, as well as conducting detailed shelf-life studies. Investigating the specific mechanisms of action of the herbal extracts on hair and scalp health through in vitro and in vivo studies could also provide valuable insights. Additionally, exploring different natural preservatives to extend the shelf life of the product would be beneficial. In conclusion, the novel herbal shampoo formulated in this study presents a viable and potentially superior alternative to conventional synthetic shampoos. By harnessing the synergistic properties of Shikakai, Amla, Neem, Aloe Vera, and Hibiscus, this formulation offers a gentle yet effective solution for cleansing and conditioning hair, aligning with the growing demand for natural and health-conscious personal care products. The comprehensive evaluation of its physicochemical and performance properties provides a strong foundation for its potential as a safe and effective herbal hair care product.

REFERENCES:

1. Barel AO, Paye M, Maibach HI. Handbook of Cosmetic Science and Technology. 4th ed. oca Raton: CRC Press; 2014.
2. Goyal RC, Chauhan S, Chauhan R. Evaluation of herbal shampoo formulations and comparison with marketed shampoos. *Int J Pharm Sci Res*. 2013;4(6):2301–6.
3. Annisanur A, Nurlela L, Maulidina A. Evaluation of shampoo by quality control parameters. *J Ilmiah Dunia Kesehatan*. 2022;11(1):45–52.
4. Dash S, Mishra B, Patro S, Kanhar S. Evaluation of standards of some selected shampoo preparations. *Int J Pharm Sci Rev Res*. 2012;13(1):38–44.
5. Pandey A, Mishra A. Formulation and evaluation of herbal shampoo and comparative analysis with marketed product. *Int J Pharm Pharm Sci*. 2011;3(4):402–5.
6. Sharma RM, Rajani GP, Patel NM. Development and evaluation of herbal shampoo. *Pharmacognosy J*. 2010;2(13):47–51.
7. Yadav N, Yadav R. Formulation and evaluation of herbal shampoo: A review. *Int J Pharm Sci Rev Res*. 2015;33(1):109–14.
8. Kunte SS, Tandale YA. Formulation and evaluation of polyherbal cosmetic cream. *Int J Pharm Bio Sci*. 2010;1(3):1–6.
9. Saraf S. Herbal cosmetics: Trends in skin care formulation. *Pharmacogn Rev*. 2010;4(7):82–9.
10. Jain A, Basal E. Formulation and evaluation of herbal shampoo. *Int J Pharm Sci Invention*. 2013;2(6):1–4.
11. Joshi A, Chauhan CS. Evaluation of physicochemical and performance characteristics of herbal shampoo powder. *Int J ChemTech Res*. 2012;4(2):531–9.
12. Saxena M, Sharma M, Sharma S. Evaluation of herbal cosmetic preparations. *Int J Pharm Sci Rev Res*. 2015;35(2):183–6.
13. Singh R, Shukla R. Formulation and evaluation of herbal shampoo and comparative analysis with

marketed products. *Asian J Pharm Clin Res.* 2012;5(3):229–31.
14. Verma PK, Maithani A, Chauhan DS. Evaluation of hair care formulations containing herbal extracts. *Int J Drug Dev Res.* 2011;3(4):361–9.
15. Singh B, Sahu RK, Bhargava S, Goswami N. Preparation and evaluation of herbal shampoo powder using various plant materials. *Int J Pharm Sci Res.* 2011;2(10):2751–6.
16. Gediya SK, Mistry RB, Patel UK, Blessy M, Jain HN. Herbal plants: Used as cosmetics. *J Nat Prod Plant Resour.* 2011;1(1):24–32.
17. Jha U, Bharati M, Kumari A. A comprehensive review on herbal shampoo and its evaluation. *World J Pharm Res.* 2020;9(5):642–51.
18. Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy.* 47th ed. Pune: Nirali Prakashan; 2015. p. 8.1–8.36.
19. Arulmozhi S, Krishnaveni M, Vidhya R. Formulation and evaluation of poly-herbal shampoo powder. *Asian J Pharm Clin Res.* 2016;9(3):268–70.
20. Mishra P, Tiwari A, Srivastava B. Preparation and evaluation of herbal shampoo powder using various plant materials. *Der Pharm Lett.* 2011;3(6):98–106.
21. Kumar R, Sharma N, Seth R, Mishra S. Formulation and evaluation of herbal shampoo for hair growth. *Int J Pharm Res Sci.* 2019;7(1):16–20.
22. Bhowmik D, Gopinath H, Kumar BP, Duraivel S. Traditional and medicinal uses of herbs for making hair shampoo. *Int J PharmTech Res.* 2013;5(3):68–72.
23. Singla C, Sit N. Formulation and evaluation of natural shampoo from Ziziphus spina-christi leaves. *Int J Pharm Sci Rev Res.* 2017;44(1):94–8.
24. Shinde PR, Patil MV, More HN. Evaluation of commercial herbal shampoos. *Int J Pharm Sci Rev Res.* 2011;7(1):38–43.
25. Tamboli AS, Jadhav VM, Kadam VJ. Cosmeceuticals: An emerging concept. *Int J ChemTech Res.* 2010;2(1):603–8.
26. Dash GK, Murthy PN, Nath L. Preparation and evaluation of herbal shampoo powder. *Anc Sci Life.* 2004;24(1):38–44.
27. Shah V, Patel R, Patel M, Parmar K. Formulation and evaluation of herbal shampoo. *Int J Pharm Sci Res.* 2010;1(11):77–82.
28. Anandarajagopal K, Sunitha M, Naveen NR. Formulation and evaluation of herbal shampoo. *Asian J Pharm Clin Res.* 2013;6(Suppl 1):121–4.
29. Kadu PV, Yadav KN, Naik JB. Formulation and evaluation of herbal shampoo from Ocimum sanctum and Ziziphus jujuba. *Int J Res Ayurveda Pharm.* 2011;2(6):1802–4.
30. Rani S, Mishra A, Jha AK. Formulation and evaluation of herbal shampoo using Musa paradisiaca and Eclipta alba. *Asian J Pharm Clin Res.* 2016;9(3):78–82.
31. Khandelwal KR. *Practical Pharmacognosy: Techniques and Experiments.* 19th ed. Pune: Nirali Prakashan; 2008. p. 149–53.
32. Saraf S. Herbs for hair care. *Indian J Nat Prod Resour.* 2010;1(1):29–36.
33. Al-Snafi AE. Therapeutic properties of medicinal plants: A review of plants with shampoo applications. *IOSR J Pharm.* 2018;8(6):37–45.
34. Singh G, Kumar V, Kapoor A. Formulation and evaluation of herbal shampoo: A review. *J Pharmacogn Phytochem.* 2019;8(1):1667–72.
35. Patel M, Naik SN. Herbal cosmetics and their evaluation: A review. *Int J Pharm Res Sci.* 2018;6(2):30–5.
36. Jain A, Basal E. Phytochemical screening and antimicrobial activity of some medicinal plants against multi-drug resistant bacteria from clinical isolates. *Indian J Pharm Sci.* 2003;65(4):390–3.
37. Bhowmik D, Gopinath H, Kumar BP, Duraivel S, Aravind G, Kumar KPS. Traditional and medicinal uses of Indian herbs. *J Pharm Phytochem.* 2012;1(1):27–35.
38. Ali A, Akhtar N, Chowdhary F. Evaluation of various functional skin parameters using topical herbal creams in healthy human volunteers. *BMC Complement Altern Med.* 2014; 14:187.
39. Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy.* 42nd ed. Pune: Nirali Prakashan; 2008. p. 591–7.
40. Kumar P, Mishra D, Ghosh A, Panda CS. Formulation and evaluation of herbal shampoo and comparative studies with commercial shampoo. *Int J Pharm Sci Res.* 2010;1(11):77–82.