World Journal of Biology Pharmacy and Health Sciences
eISSN: 2582-5542
Cross Ref DOI: 10.30574/wjbphs
Journal homepage: https://wjbphs.com/

(REVIEW ARTICLE)

Check for updates

Review on formulation and evaluation of herbal shampoo

Shraddha A. Meshram [1] and Surendra Pardhi [2,*]

[1] *Research Scholar of Institute of Pharmaceutical Science & Research, Balaghat (MP), India.*
[2] *Professor of Institute of Pharmaceutical Science & Research, Balaghat (MP), India.*

World Journal of Biology Pharmacy and Health Sciences, 2025, 21(02), 565-571

Publication history: Received on 09 January 2025; revised on 22 February 2025; accepted on 25 February 2025

Article DOI: https://doi.org/10.30574/wjbphs.2025.21.2.0201

Abstract

Herbal shampoos have gained significant attention as natural alternatives to synthetic hair care products due to their mildness, environmental friendliness, and therapeutic properties. This review explores the formulation, key ingredients, and benefits of herbal shampoos, highlighting their potential in promoting healthy hair and scalp. Herbal shampoos are typically formulated using natural surfactants, herbal extracts, essential oils, and conditioning agents derived from plants. Common herbs such as Aloe Vera, Bhringraj, Neem, Hibiscus, and Fenugreek are rich in bioactive compounds, including alkaloids, flavonoids, saponins, and polyphenols, which help nourish hair, reduce dandruff, and prevent hair fall. Additionally, natural thickening and pH-adjusting agents ensure stability and scalp compatibility. Compared to synthetic shampoos, herbal formulations are free from harmful chemicals like sulfates, parabens, and silicones, making them suitable for sensitive scalps and long-term use. Despite their advantages, challenges such as shorter shelf life, inconsistent foaming, and formulation stability remain areas for further research. This review aims to provide insights into the current advancements, formulation strategies, and future perspectives of herbal shampoos, emphasizing their role in sustainable and holistic hair care.

Keywords: Herbal Shampoo; Natural Surfactants; Hair Care; Bioactive Compounds; Sustainable Formulation; Scalp Health

1. Introduction

From ancient time beyond memory, mankind has been borrowing abundantly from nature to care for their health, skin and hair, as natural ingredients that have preventive, protective and corrective action. The warehouse of cosmetics, nature provides such versatile natural ingredients that enhance beauty of the skin and hair.

Hair is one of the external barometers of internal body conditions. Shampooing is the most common form of hair treatment. The primary function of shampoo is aimed at cleansing of the hair necessitated due to accumulated sebum, dust, scalp debris etc. Various shampoo formulations are associated with hair quality, hair care habit and specific problems such as treatment of oily hairs, dandruff and for androgenic alopecia. Shampoos are liquid, creamy or gel like preparations. The consistency of the preparation depends on the inclusion of traditional soaps saturated with glycerides and natural or synthetic fatty alcohols or the thickening agents (e.g. gum, resin and PEG). Indian women use herbals such as *Shikkakai* and *Reetha* that are natural cleansing agents without harmful effects.

Nowadays natural sources remain attractive primarily when compared to the synthetic one, so herbal shampoos are popular with the consumer when compared to the synthetic one.[1]

*Corresponding author: Surendra Pardhi.

A shampoo is a preparation of a surfactant in a suitable form- liquid, solid or powder- which when used under the specific conditions will remove surface grease, dirt and skin debris from the hair shaft without adversely affecting the user

1.1. Ideal characters of shampoo

- Should effectively and completely remove the dust, excessive sebum.
- Should effectively wash hair.
- Should produce a good amount of foam
- The shampoo should be easily removed by rinsing with water.
- Should leave the hair non dry, soft, lustrous with good, manageability.
- Should impart a pleasant fragrance to the hair.
- Should not make the hand rough and chapped.
- Should not have any side effects or cause irritation to skin or eye.

1.2. Herbal material used for hair growth

Several herbs are rich in bioactive compounds that promote hair growth by nourishing the scalp, improving blood circulation, and stimulating hair follicles. Here are key herbal chemicals and their effects:

1.3. Alkaloids: Nicotine, Berberine

- Source: Bhringraj (Eclipta alba), Berberis
- Effect: Increases blood circulation to hair follicles, stimulating growth.

1.4. Flavonoids: Quercetin, Kaempferol

- Source: Green tea, Hibiscus, Ginseng
- Effect: Antioxidant properties protect hair follicles from oxidative stress and reduce hair fall.

1.5. Triterpenoids: Azadirachtin, Betulinic acid

- Source: Neem, Gotu Kola (Centella asiatica)
- Effect: Promotes collagen production and improves scalp health.

1.6. Saponins: Ginsenosides

- Source: Ginseng, Fenugreek (Trigonella foenum-graecum)
- Effect: Stimulates dermal papilla cells, promoting hair growth.

1.7. Polyphenols

- Example: Epigallocatechin gallate (EGCG)
- Source: Green tea (Camellia sinensis)
- Effect: Reduces dihydrotestosterone (DHT) levels, a major cause of hair loss.

1.8. Phytosterols: Beta-sitosterol

- Source: Pumpkin seeds, Saw palmetto
- Effect: Inhibits 5-alpha reductase, reducing DHT and preventing hair loss.

1.9. Essential Oils and Volatile Compounds: Menthol, Cineole, Thymol

- Source: Peppermint, Rosemary, Lavender
- Effect: Improves scalp circulation and reduces inflammation

Table 1 Top Herbs for Hair Growth and Their Active Chemicals

Herb	Active Compounds	Effect on Hair Growth
Bhringraj	Alkaloids, Flavonoids	Activates hair follicles, reduces hair fall
Amla (Gooseberry)	Tannins, Vitamin C, Flavonoids	Strengthens roots, prevents premature greying
Fenugreek	Saponins, Proteins	Nourishes hair and reduces dandruff
Hibiscus	Flavonoids, Anthocyanins	Promotes hair growth and prevents breakage
Neem	Azadirachtin, Nimbidin	Antifungal, reduces scalp issues
Rosemary	Cineole, Rosmarinic acid	Stimulates circulation to the scalp
Ginseng	Ginsenosides	Boosts dermal papilla cell proliferation

2. Literature review

- Ali Heyam Saad and Rasool Bazigha Kadhim reported formulation of self-preserving shampoo having a low concentration of the detergent using *Ziziphus spina cristi* leaves with emphasis on safety and efficacy. Evaluation of organoleptic, physicochemical and performance tests were performed and compared with herbal marketed product and considered as safe.[3]
- Sachin Dubey et al. formulated two preparations of herbal shampoo using some common traditional drugs such as bahera, amla, neem tulasi, shikakai henna and brahmi and evaluated for organoleptic, powder characteristics, foam test and physical evaluation and considered as safe.[4]
- Sutar Manisha et al. formulated a polyherbal shampoo using amla fruit, hibiscus leaf, neem leaf, shikakai fruit, aloe leaf, henna leaf, ritha fruit and evaluated for organoleptic, powder characteristics, dirt dispersion, wetting time, foam test and physical evaluation and considered as safe.[5]
- Gholamreza Dehghan et al. formulated an herbal conditioner shampoo using fenugreek seeds methanol extract and evaluated for physicochemical properties. It is concluded that the formulated shampoo has a good quality of introducing it to the market.[6]
- Mohamed Halith et al. formulated herbal shampoo using natural ingredients with tulasi and neem. Both are having anti dandruff action. The study revealed that the anti-dandruff activity of Ocimum sanctum and Azadiracta indica against strains of G+ and G- organisms and fungal organisms.7
- Swati Deshmukh et al. formulated an herbal shampoo, sing aloevera, neem, shikakai, ritha, amla, brahmi and evaluated and concluded as safe.[8]
- Naresh et al. formulated an herbal shampoo containing chamomile, rose and orange peel and sodium lauryl sulphate. The shampoo is evaluated for physical parameters and considered as safe.[9]
- Suriya Prakash et al. formulated an herbal shampoo for its antimicrobial and anti-lice activity. The natural ingredients used are neem leaf, thulasi leaf, mehandi leaf and gooseberry fruit. The prepared formulation was evaluated for its physicochemical properties, antimicrobial and anti-lice activity, which was compared with the marketed products.[1]
- Nasrin aghel et al. formulated a herbal shampoo using, total saponins of *acanthophyllum squarrosum.* The foaming ability of shampoo was evaluated by the Ross-Miles method and the cleansing power by Thompson test.[10]
- Shampoos are probably the most widely used cosmetic products for cleansing hairs and scalp in our daily life (Ishi, 1997).
- A shampoo is basically a solution of a detergent containing suitable additives for other benefits such as hair-conditioning enhancement, lubrication, medication etc. Now-a-days many synthetic, herbal, medicated and non-medicated shampoos are available in the market but popularity of herbal shampoo among consumers is on rise because of their belief that these products being of natural origin are safe and free from side effects (Manikar and Jolly, 2001).
- Synthetic surfactants are added to shampoo primarily for the foaming and cleansing action but their regular use leads to dryness of hairs, hair loss, irritation to scalp and eyes (Potluri et al., 2013).
- Herbal formulations are considered as alternative to synthetic shampoo but formulating cosmetics using completely natural raw material is a difficult task (Shinde et al., 2013).
- There are large numbers of medicinal plants which are reported to have beneficial effects on hair and are commonly used in formulation of shampoo (Firthouse, 2009).

- These plant products may be used in their powdered form, crude form, purified extracts, or derivative form (Pooja et al., 2011).
- The pericarp of *Spindus mukorossi*, commonly known as Soapnut or reetha, fruits of Phyllanthus emblica commonly known as Amla, and dried pods of Acacia *concinna* (Sheekakai) have traditionally been used in Indian folklore system for centuries for washing hair (Kapoor, 2005).
- Reetha and Sheekakai produce rich lather when shaken with water due to their high content of saponins. They are also known to produce beneficial effects on skin and other organ systems (Khushboo et al., 2010).
- Amla fruit is rich in vitamin C and is employed in hair preparations as antidandruff agent, hair growth promoter and to strengthen hairs (Srivasuki, 2012).
- The *Ziziphus spina-christi* tree, known as Sidr in Arabic, is indigenous to the Middle East including Oman, and its leaves are traditionally used by women to wash, darken and lengthen hairs (Ali and Kadhim, 2011)
- It is reported to contain four saponin glycosides that help in removing excess sebum without causing adverse reactions (Mahran et al., 1996).
- Saponins also exhibit antibacterial and antifungal activities that make them important ingredients of cosmetic applications (Chen et al., 2010).
- The pH of 10% v/v shampoo solution in distilled water was measured by using pH meter (Mi 151, Martini instruments) at room temperature (Tarun et al., 2014).
- The formulation prepared was evaluated for the clarity, color, odor and foam producing ability (Aghel et al., 2007).
- To evaluate the quality of commercial and prepared formulations, several quality control tests including visual assessment, physicochemical controls conditioning performance tests were performed (Ashok and Rakesh, 2010).
- Two drops of shampoo were added to 10 mL of distilled water taken in a large test tube. To this solution, one drop of India ink was added and the test tube was stoppered and shaken ten times. The amount of ink in the foam was indicated by the rubric such as None, Light, Moderate or Heavy (Ali and Kadhim, 2011).
- To evaluate the quality of commercial and prepared formulations, several quality control tests including visual assessment, physicochemical controls conditioning performance tests were performed (Ashok and Rakesh, 2010).
- The wetting ability of a surfactant is dependant on its concentration and is commonly used to test its efficacy. The canvas disc method is quick, efficient and reliable test to evaluate the wetting ability of a shampoo (Manikar and Jolly, 2000).
- Foaming or lathering is very important to the consumer and therefore, it is considered as an important parameter in evaluation of shampoo. Herbal Essences and formulated shampoo produced the foam volume above 100 mL (115, 113 mL respectively) while dove shampoo generated a foam volume of 92 mL. The foams generated by formulated shampoo were small, compact, uniform, denser and stable similar to commercial samples. All tested shampoo had the same foam volume for 5 min showing that their foam has good stability. The higher foaming property of formulated shampoo may be due to the combination of soap nut, Sheekakai and Ziziphus (Sarath et al., 2013).
- Surface tension is a the term indicates the amount of surfactant present in shampoo to reduce the surface tension. Lesser the surface tension stronger is the cleaning ability of the shampoo. A shampoo is considered of good quality if it decreases the surface tension of pure water from 72.28 dyn/cm to about 40 dyn/cm (Ilton et al., 2007).
- Dirt dispersion is an important criterion for evaluation of cleansing action of shampoo. Shampoos that cause the ink to concentrate in the foam are considered of poor quality because ink or dirt that stays in foam is difficult to rinse away and gets re-deposited on the hair (Ali and Kadhim, 2011).
- Most shampoos are formulated as either neutral or slightly alkaline to minimize the damage to hair. The pH of shampoo also helps in minimizing irritation to the eyes, enhances the qualities of hair and maintain the ecological balance of the scalp (Baran and Maibah, 1998).
- The pH of tested commercial shampoos was found within the preferred range (between 7 and 5) (Tarun et al., 2014)

2.1. Quantity selection for herbal shampoo formulation

When formulating a herbal shampoo, it's essential to balance cleansing, conditioning, and therapeutic properties. Here's a standard guideline for selecting ingredient quantities:

2.1.1. Base Surfactants (Cleansing Agents): 30–50%

- Cocamidopropyl Betaine (5–10%) – Mild, reduces irritation

- Sodium Lauryl Glucose Carboxylate (5–10%) – Eco-friendly cleanser
- Decyl Glucoside (10–15%) – Mild, plant-derived cleanser

2.1.2. Herbal Extracts and Infusions: 5–15%

- Aloe Vera (5–10%) – Moisturizes and soothes the scalp
- Bhringraj Extract (2–5%) – Promotes hair growth
- Neem Extract (2–5%) – Reduces dandruff and scalp infections
- Hibiscus Extract (2–5%) – Strengthens roots and adds shine

2.1.3. Conditioning Agents: 3–10%

- Panthenol (Provitamin B5) (1–3%) – Improves softness and shine
- Hydrolyzed Wheat Protein (1–3%) – Strengthens hair
- Glycerin (2–5%) – Retains moisture

2.1.4. Essential Oils: 0.5–2%

- Rosemary Oil (0.5%) – Boosts circulation and reduces hair fall
- Peppermint Oil (0.2%) – Stimulates scalp and gives a refreshing feel
- Lavender Oil (0.3%) – Soothes the scalp and reduces stress

2.1.5. Natural Thickening Agents: 1–5%

- Xanthan Gum (0.2–0.5%) – Adds viscosity
- Guar Gum (0.5–1%) – Adds slip and conditioning
- Carrageenan (0.5–1%) – Natural thickener from seaweed

2.1.6. pH Adjusters: 0.2–0.5%

- Citric Acid (0.2–0.5%) – Adjusts pH to 5.5 (ideal for hair)

2.1.7. Preservatives (for Shelf Life): 0.5–1%

- Geogard ECT (0.8%) – EcoCert-approved natural preservative
- Optiphen Plus (1%) – Paraben- and formaldehyde-free preservative

2.1.8. Distilled Water or Hydrosols: 20–40%

- Use hydrosols like rose water or lavender water for added benefits

Table 2 Example Formula for 100g Herbal Shampoo

Ingredient	Percentage	Quantity (g)
Distilled Water or Aloe Vera Juice	30%	30g
Decyl Glucoside	12%	12g
Cocamidopropyl Betaine	10%	10g
Bhringraj Extract	3%	3g
Neem Extract	2%	2g
Panthenol (Provitamin B5)	2%	2g
Hydrolyzed Wheat Protein	1.5%	1.5g
Glycerin	3%	3g
Xanthan Gum	0.3%	0.3g
Rosemary Essential Oil	0.5%	0.5g
Citric Acid (pH Adjuster)	0.2%	0.2g

Geogard ECT (Preservative)	0.8%	0.8g
Total	**100%**	**100g**

2.2. Evaluation of herbal shampoo

2.2.1. Physical appearance/visual inspection

The formulations prepared were evaluated in terms of their clarity, foam producing ability and fluidity.

- **Determination of pH:** The pH of 10% shampoo solution in distilled water was determined at room temperature 25°C3.
- **Determine percent of solids contents:** A clean dry evaporating dish was weighed and added 4 grams of shampoo to the evaporating dish. The dish and shampoo was weighed. The exact weight of the shampoo was calculated only and put the evaporating dish with shampoo was placed on the hot plate until the liquid portion was evaporated. The weight of the shampoo only (solids) after drying was calculated.
- **Wetting time:** The canvas was cut into 1-inch diameter discs having an average weight of 0.44g. The disc was floated on the surface of shampoo solution 1%w/v and the stopwatch started. The time required for the disc to begin to sink was measured accurately and noted as wetting time.
- **Rheological evaluations:** The viscosity of the shampoos was determined by using Brookfield Viscometer (Model DV-l Plus, LV, USA) set at different spindle speeds from 0.3 to 10 rpm3. The viscosity of the shampoos was measured by using spindle T95. The temperature and sample container's size was kept constants during the study.
- **Dirt dispersion:** Two drops of shampoo were added in a large test tube contain 10 ml of distilled water. 1 drop of India ink was added; the test tube was stoppered and shakes it ten times. The amount of ink in the foam was estimated as None, Light, Moderate, or Heavy.
- **Cleaning action**: 5 grams of wool yarn were placed in grease, after that it was placed in 200 ml. of water containing 1 gram of shampoo in a flask. Temperature of water was maintained at 350C. The flask was shaked for 4 minutes at the rate of 50 times a minute. The solution was removed and sample was taken out, dried and weighed. The amount of grease removed was calculated.
- **Surface tension measurement:** Measurements were carried out with a 10% shampoo dilution in distilled water at room temperature. Thoroughly clean the stalagmometer using chronic acid and purified water. Because surface tension is highly affected with grease or other lubricants
- **Detergency ability:** The Thompson method was used to evaluate the detergency ability of the samples. Briefly, a crumple of hair were washed with a 5% sodium lauryl sulfate (SLS) solution, then dried and divided into 3g weight groups. The samples were suspended in a n-hexane solution containing 10% artificial sebum and the mixture was shaken for 15 minutes at room temperature. Then samples were removed, the solvent was evaporated at room temperature and their sebum content determined. In the next step, each sample was divided into two equal parts, one washed with 0.1 ml of the 10% test shampoo and the other considered as the negative control. After drying, the resided sebum on samples was extracted with 20 ml n-hexane and re-weighed. Finally, the percentage of detergency power was calculated.
- **Foaming ability and foam stability**: Cylinder shake method was used for determining foaming ability. 50 ml of the 1% shampoo solution was put into a 250 ml graduated cylinder and covered the cylinder with hand and shaken for 10 times. The total volumes of the foam contents after 1 minute shaking were recorded. The foam volume was calculated only. Immediately after shaking the volume of foam at 1-minute intervals for 4 minutes were recorded.
- **Skin sensitization test:** The guinea pigs were divided into 7 groups (n=3). On the previous day of the experiment, the hairs on the backside area of guinea pigs were removed. Shampoos were applied onto nude skin of animals of groups. A 0.8% v/v aqueous solution of formalin was applied as a standard irritant on animal. The animals were applied with new patch/formalin solution up to 72 hours and finally the application sites were graded according to a visual scoring scale, always by the same investigator. The erythema scale was as follows: 0, none; 1, slight; 2, well defined; 3, moderate; and 4, scar formation (severe).
- **Eye irritation test:** Animals (albino rats) were collected from animal house. About 1% shampoo solutions was dripped into the eyes of six albino rabbits with their eyes held open with clips at the lid. The progressive damage to the rabbit's eyes was recorded at specific intervals over an average period of 4 seconds. Reactions to the irritants can include swelling of the eyelid, inflammation of the iris, ulceration, hemorrhaging (bleeding) and blindness.
- **Surface characterization**: Surface morphology of the hairs was examined by scanning electron microscopy (Leo 430, Leo Electron Microscopy Ltd., Cambridge, England). The hair samples were mounted directly on the

SEM sample stub, using double side stitching tape and coated with gold film (thickness 200nm) under reduced pressure (0.001 mm of Hg). The photomicrographs of suitable magnification were obtained for surface characterization.

- **Stability studies:** The thermal stability of formulations was studied by placing in glass tubes and they were placed in a humidity chamber at 45°C and 75% relative humidity. Their appearance and physical stability were inspected for a period of 3 months at interval of one month.

3. Conclusion

Globalization is the need of today and the world market will open for all by 2005. The world is also moving towards herbal medicines for health care, health foods and for cosmetic purposes including hair preparations. India is rich heritage for cultivation and production of herbal medicines due to its diversified climatic conditions. The present paper emphasizes on composition, types, methods of evaluation, also a brief review on herbal shampoo formulations.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Suriyprakash TNK, Kalaivani R, Lakshmana Prabu S, Sumathi A. Elixir Pharmacy 39; 2011: 4639-4642.

[2] Formulation and evaluation of various cosmetic and dental product. Pharmaquest. Pharmaquest.weebly.com/upload/ 9/9/4/2/9942916/formulation_evaluation_of_cosmetic_pdts.pdf

[3] Ali Heyam Saad, Rasool bazigha Kadhim. Formulation and development of herbal shampoo from Ziziphus spina leaves extract. International Journal of Research in Ayurveda & Pharmacy 2(6); 2011: 1802-1806.

[4] Sachin Dubey, Neelesh Nema, Nayak S. Preparation and evaluation of herbal shampoo powder. Ancient Science of Life 26(1); 2004: 38-44.

[5] Sutar Manisha, Deshmukh Swati, Chavan Manisha, Singh Sonia. Preparation and evaluation of polyherbal shampoo powder. International Journal of Pharmacy and Biological sciences 392); 2013: 151-159.

[6] Gholamreza Dehghan Noudeh, Fariba Sharififar, Payam Khazaeli, Ehsan Mohajeri, Javad Jahanbakhsh. Formulation of herbal conditioner shampoo by using extract of fenugreek seeds and evaluation of its physicochemical parameters. African Journal of Pharmacy and Pharmacology 5(22); 2011: 2420-2427.

[7] Mohamed Halith S, Abirami A, Jaya prakash S, Chitra Karthikeyini, Kulathuran K, Mohamed Firthouse PU. Effect of Ocimum sanctum and Azadiracta indica on the formulation of antidandruff herbal shampoo powder. Scholars Research Library 1(2); 2009: 68-76.

[8] Swati Deshmukh, Bindurani Kaushal, Shweta Ghode. Formulations and evaluation of herbal shampoo and comparative studies with herbal marketed shampoo. International Journal of Pharma and Bio Sciences 3(3); 2012: 638-645.

[9] Naresh Gorantla, Sai Prasad K, Thimma Reddy VT, Ragadeepika J, Hajarabi T, Hindustan Abdul Ahad. Formulation and evaluation of herbal shampoo containing chamomile, rose and orange peel. Pharma Research Library: International Journal of Medicine and Pharmaceutical Research 1(2); 2013: 192-197.

[10] Nasrin Aghel, Eskandar Moghimipour, Azadeh Raies Dana. Formulation of a herbal shampoo using total saponins of Acanthophyllum squarrosum. Iranian Journal of Pharmaceutical Research 6(3); 2007: 167-172.

[11] Ashok Kumar, Rakesh Roshan Mali. Evaluation of prepared shampoo formulations and to compare formulated shampoo with marketed shampoos. International Journal of Pharmaceutical sciences Review and Research 3(1); 2010: 120-127.