WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.63
Volume 15, Issue 21, 1487-1507. Review Article ISSN 2277–7105

# A REVIEW OF HERBAL SHAMPOO BAR

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Article Received on 05 Oct. 2026,
Article Revised on 26 Oct. 2026,
Article Published on 01 Nov. 2026

https://doi.org/10.5281/zenodo.23911424

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**How to cite this Article:** Ancy R.[1], Sana Hani S.[2], Reshma. K. J.[3]. (2026). A Review of Herbal Shampoo Bar. World Journal of Pharmaceutical Research, 15(21), 1487–1507.

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## ABSTRACT

Herbal solid shampoo bars have gained increasing attention as an alternative to conventional liquid shampoos due to their convenience, portability, and environmental benefits. They offer the advantages of reduced water content, minimal packaging, and ease of storage and transportation. Shampoo bars are designed to cleanse the hair and scalp by removing dirt, excess oil, and other impurities while maintaining hair cleanliness and manageability. The development of herbal solid shampoo bars combines traditional herbal approaches with modern cosmetic formulation techniques. Their quality and performance can be assessed through various evaluation parameters, including physical appearance, pH, hardness, wetting time, foaming ability, foam stability, cleansing efficiency, and storage stability. However, achieving appropriate hardness, satisfactory foaming, effective cleansing, and good stability remains a formulation challenge. Further research is required to establish their safety, effectiveness, and long-term benefits. Overall, herbal solid shampoo bars represent a promising and sustainable approach to modern hair-care product.

**KEYWORDS:** Herbal shampoo bar, solid shampoo, hair care, formulation, evaluation, sustainability development.

## INTRODUCTION

Shampoo is a hair-care preparation primarily used to remove sebum, dirt, dead skin cells and other impurities from the hair and scalp while maintaining desirable hair characteristics.

Surfactants are the major functional components of shampoos and contribute to cleansing, foaming, mildness and deposition of conditioning agents.[1]

Conventional shampoos are generally available as liquid preparations, whereas solid shampoo bars have emerged as an alternative dosage form. Because solid shampoo bars contain little or no water, they can offer convenient handling, reduced packaging requirements and potentially lower transportation-related environmental impact.[2] Solid shampoo formulations, however, require appropriate selection of surfactants and consistency agents to obtain adequate hardness, stability, foaming and cleansing properties.[2]

The use of sulfate-free surfactant systems has received increasing attention in shampoo formulation. Sulfate-free technologies utilize alternative surfactants to provide cleansing and foaming while allowing formulation of products with different mildness and sensory characteristics.[1,3] The selection and combination of surfactants are therefore important in developing an effective sulfate-free shampoo.[1]

Solid shampoo formulation can also present challenges such as cracking, inadequate hardness, excessive wear during use and unsatisfactory foam characteristics. A recent study developed nine solid shampoo formulations by varying solid surfactant concentrations using statistical design and evaluated their stability, physical properties, foaming, cleansing and conditioning performance.[2] These findings demonstrate the importance of systematic formulation and evaluation when developing solid shampoo bars.

Therefore, the present study focuses on the formulation and evaluation of a sulfate-free solid shampoo bar using suitable sulfate-free surfactants and conditioning ingredients. The developed formulation will be evaluated for physical appearance, pH, hardness, wetting time, foamability, foam stability, cleansing ability and stability to determine its suitability as a convenient solid hair-care preparation.[1,2]

## COSMETICS

Cosmetics are products primarily intended for cleansing, beautifying, promoting attractiveness or altering the appearance of the external parts of the human body.[4] Cosmetic

preparations may be formulated for the skin, hair, nails, lips and other external body surfaces.[4] Skin-care cosmetics include products such as creams, lotions, gels, cleansers, moisturizers, sunscreens and masks.[4] These products may contain functional ingredients together with excipients that determine their texture, stability, spreadability and sensory characteristics.[4] Modern cosmetic formulations increasingly incorporate naturally derived materials because of consumer interest in plant-based products.[2,5]

## TYPES OF COSMETICS

Cosmetic products can be broadly classified according to their intended area of application and function. Skin-care cosmetics include cleansers, moisturizers, creams, lotions, gels, masks and exfoliating preparations. Hair-care cosmetics include shampoos, conditioners, hair oils and styling preparations. Colour cosmetics include products such as foundations, lipsticks, rouges, eye cosmetics and related decorative preparations. Fragrance products include perfumes, deodorants and other preparations intended primarily to impart or control body odour. Sun-care products are designed to help protect the skin from ultraviolet radiation and may contain ultraviolet filters or other protective ingredients.[4]

## POTENTIAL BENEFITS OF HERBAL COSMETICS

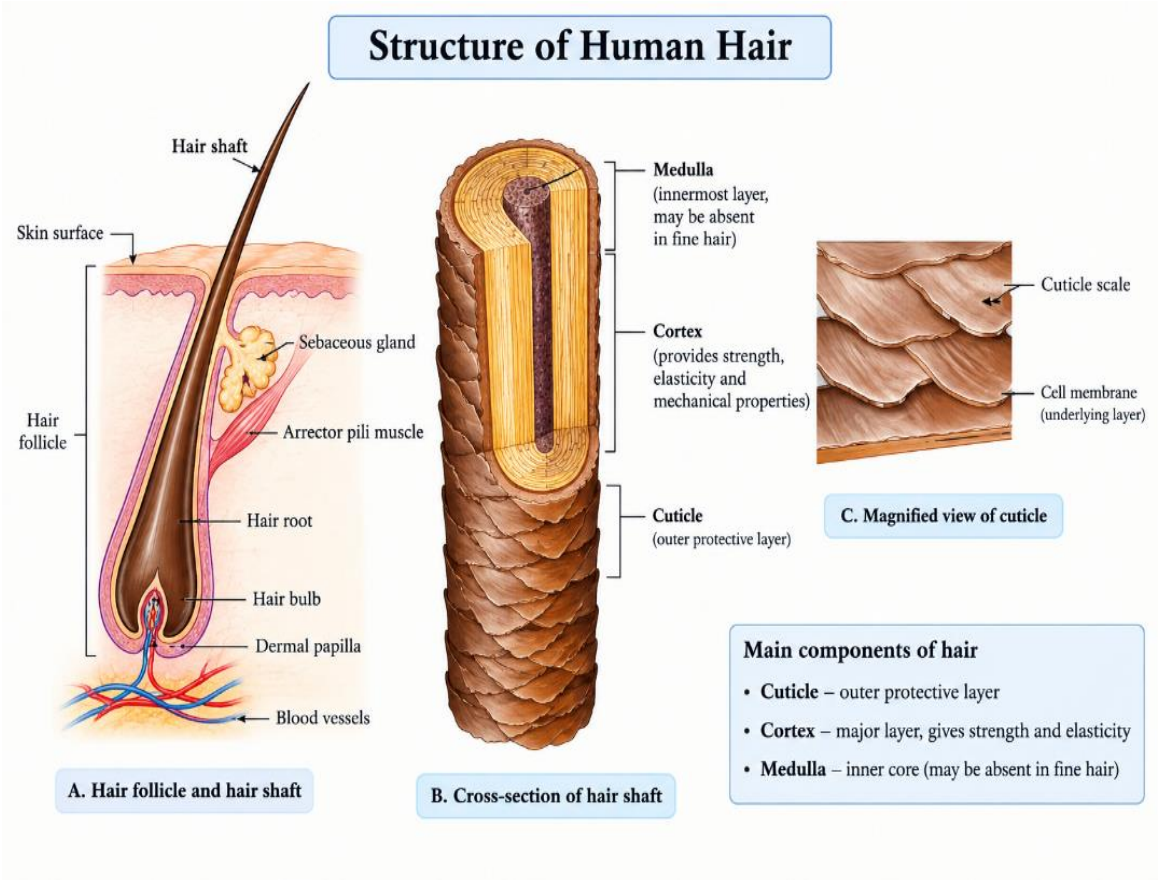
Herbal cosmetics provide an important source of naturally derived ingredients for cosmetic and skin-care formulations.[2,5] Herbal-derived products can therefore provide opportunities for developing multifunctional cosmetic preparations containing several naturally derived active materials.[2,5] Plant materials contain diverse constituents such as polyphenols, flavonoids, terpenoids, alkaloids and vitamins that may possess biological activities relevant to skin care.[5,6] Several botanical ingredients have demonstrated antioxidant activities that may help counter oxidative processes associated with environmental skin stress.[5] Some plant-derived substances have also demonstrated antimicrobial or anti-inflammatory activities in experimental studies.[5,6]

## HAIR

Hair is a keratinized structure composed mainly of proteins, particularly keratin, along with water, lipids and pigments. The hair shaft consists of three principal regions**: cuticle, cortex and medulla**. The cuticle is the outer protective layer formed by overlapping cells and helps protect the inner hair structure from environmental and chemical damage. The cortex forms the major portion of the hair shaft and contributes significantly to its strength, elasticity and mechanical properties. The medulla is the innermost region and may be absent in fine hair.[6,7]

Hair is continuously exposed to environmental conditions, grooming, friction and cosmetic treatments. These factors can alter the cuticle and lipid components of the hair, resulting in dryness, roughness, reduced shine and increased breakage.[6,7] Therefore, hair-care products should effectively cleanse the hair while minimizing undesirable effects on the hair fiber.[1,6]

Shampoo is primarily used to remove sebum, dirt, dead skin cells and other impurities from the hair and scalp. In addition to cleansing, an appropriate shampoo should help maintain desirable properties such as softness, shine, manageability and combability.[1,6] Solid shampoo bars provide an alternative form of shampoo and can be formulated with surfactants and conditioning ingredients to provide cleansing and conditioning effects.[2]




## FUNCTIONS OF HAIR

Hair performs several important biological and protective functions. The major functions of hair are:

1. **Protection:** Hair helps protect the scalp and skin from environmental factors such as sunlight, dust and minor physical injury.[6,7]

2. **Thermoregulation:** Scalp hair helps regulate heat exchange and reduces heat gain from solar radiation.[6]
3. **Sensory function:** Hair follicles are associated with sensory nerve endings and contribute to the perception of mechanical stimuli.[6,7]
4. **Reduction of environmental exposure:** Hair provides a physical barrier that can reduce direct exposure of the scalp to external environmental conditions.[6]
5. **Social and cosmetic function:** Hair contributes to personal appearance, identity and social communication.[2,6]
6. **Sweat-related function:** Scalp hair interacts with sweat and the scalp environment and can influence evaporative heat loss.[6]

These functions highlight the importance of maintaining the health, cleanliness and structural integrity of hair. Shampoo formulations are therefore designed to remove sebum and impurities while maintaining desirable hair properties.[1,6]

**HAIR CARE**

Hair care involves maintaining the cleanliness of the scalp and hair while preserving the structural integrity, softness, shine and manageability of the hair fiber. Shampoo is primarily used to remove sebum, dirt, dead skin cells, dandruff and environmental pollutants from the hair and scalp.[1,6]

An appropriate shampoo should provide effective cleansing without causing excessive removal of natural lipids or undesirable changes to the hair cuticle. Surfactant selection is therefore important because surfactants are responsible for cleansing and foaming, while their type and concentration can influence hair feel and scalp mildness.[1,3] Sulfate-free formulations commonly use alternative surfactant systems, including amphoteric and nonionic surfactants, to provide milder cleansing.[1]

Good hair care also includes maintaining a suitable pH, minimizing friction, and using conditioning ingredients to improve combability, softness and manageability.[1,6] Solid shampoo bars can incorporate cleansing and conditioning ingredients in a compact, water-free form. A study on solid shampoo bars reported that the formulations provided effective cleansing and conditioning, although hardness and resistance to breakage required careful formulation.[2] Therefore, a sulfate-free solid shampoo bar should be formulated to provide effective cleansing while maintaining acceptable pH, foaming, hardness, stability and conditioning properties.

## TYPES OF HAIR CARE

Hair care products are generally classified based on their main purpose, formulation type, and how they are applied. In formulation science, the primary goal is to address specific scalp and hair needs without damaging the hair fiber structure. The main types of hair care formulations include:

### 1. Cleansing Care

Cleansing care involves removing excess sebum, dirt, sweat, dead skin cells, and environmental pollutants from the scalp and hair. Shampoos are the most commonly used cleansing products. Surfactants present in shampoos help remove impurities and maintain scalp cleanliness. Mild cleansing agents are preferred to avoid excessive removal of natural oils and irritation of the scalp.[1]

### 2. Conditioning Care

Conditioning care aims to improve hair softness, smoothness, shine, and manageability. Conditioners contain ingredients that reduce friction between hair fibres, minimize tangling, and improve combability. Conditioning agents also help reduce static electricity and make hair easier to manage.[6]

### 3. Daily Hair Care

Daily hair-care products are formulated for regular cleansing and maintenance of the scalp and hair. Mild shampoos are commonly used to remove everyday dirt, sweat, and excess oil without causing excessive dryness. The selection of a suitable product depends on hair type, scalp condition, and frequency of washing.[1,3]

### 4. Dry Hair Care

Dry hair care focuses on improving moisture retention, softness, and flexibility. Dry hair may result from environmental exposure, frequent washing, heat styling, or chemical treatments. Shampoos and conditioners containing suitable conditioning agents and emollients can help reduce roughness, improve manageability, and minimize hair breakage.[6]

### 5. Oily Hair Care

Oily hair care focuses on controlling excess sebum produced by the sebaceous glands of the scalp. Suitable cleansing formulations help remove accumulated oil, dirt, and impurities. The cleansing strength should be sufficient to control oiliness without causing excessive dryness or irritation.[1]

### 6. Anti-Dandruff Care

Anti-dandruff hair care is intended to control dandruff, flaking, itching, and associated scalp discomfort. Dandruff is commonly associated with scalp conditions involving Malassezia yeasts and individual skin responses. Anti-dandruff shampoos may contain active ingredients such as ketoconazole, zinc pyrithione, or selenium sulfide, depending on the product and applicable regulations. Herbal ingredients are also investigated for their potential antimicrobial and scalp-conditioning properties.[8]

### 7. Damaged or Chemically Treated Hair Care

Damaged hair care is intended to improve the appearance and manageability of hair affected by colouring, bleaching, straightening, heat styling, or other chemical treatments. These products may contain conditioning agents, oils, and film-forming ingredients that reduce friction, improve smoothness, and help protect the hair fibre from further mechanical damage.[6,7]

### 8. Dry Shampoo Care

Dry shampoos are products designed to reduce the appearance of oily hair without conventional washing with water. They commonly contain absorbent materials that take up excess oil from the scalp and hair. Dry shampoos provide temporary freshness but do not replace regular cleansing of the scalp.[2]

### 9. Herbal or Natural Hair Care

Herbal hair-care products incorporate plant-derived ingredients such as extracts, oils, and powders into shampoos, conditioners, and other hair-care preparations. These ingredients are investigated for their potential cleansing, conditioning, antioxidant, and antimicrobial properties. The effectiveness of a herbal formulation depends on the selected ingredients, their concentrations, formulation characteristics, and scientific evaluation.[2,5]

### 10. Hair Growth and Hair-Fall Management

Hair-fall management products aim to improve scalp care, reduce hair breakage, and maintain hair condition. Shampoos and conditioners can help minimize mechanical damage and breakage, but they cannot treat every cause of hair loss. The effectiveness of ingredients promoted for hair growth should be established through appropriate scientific studies. Persistent or excessive hair loss may require medical assessment.[6,7]

### 11. Moisturizing Hair Care

Moisturizing hair-care products are designed to improve hair softness and reduce dryness and roughness. Ingredients such as glycerin, suitable vegetable oils, and conditioning agents may help improve moisture retention and hair feel. These products are particularly useful for dry, rough, or frizzy hair.[6]

### 12. Protective Hair Care

Protective hair care focuses on minimizing damage caused by sunlight, heat styling, pollution, friction, and chemical treatments. Protective products may contain conditioning agents, oils, or film-forming ingredients that help improve the hair surface and reduce mechanical damage. Appropriate hair-care practices also contribute to maintaining hair strength and appearance.[6,7]

For a sulfate-free solid shampoo bar, the main focus is gentle cleansing and conditioning, while maintaining suitable pH, hardness, foaming ability and stability. Sulfate-free formulations may use alternative mild surfactant systems to provide cleansing without conventional sulfate surfactants.[1,2]

## COMMON HAIR PROBLEMS

Common hair concerns typically stem from a mix of genetics, environmental stressors, improper hair care habits, or underlying scalp conditions. These issues generally manifest as structural damage like split ends and breakage, volume loss through thinning, or scalp imbalances such as dandruff and excessive oiliness. Identifying the specific root cause is the essential first step toward effectively restoring hair and scalp health. various common hair problems are:

- **Excessive oily scalp** – increased sebum production that may contribute to scalp discomfort and dandruff.[1,8]
- **Dry and brittle hair** – may result from excessive washing, heat styling, chemical treatments, environmental exposure, or inadequate conditioning.[6,7]
- **Hair fall / alopecia** – excessive shedding or loss of hair, including androgenetic alopecia and telogen effluvium.[6,9]
- **Split ends (trichoptilosis)** – longitudinal splitting of the hair shaft, often associated with physical or chemical damage.[6,7]
- **Dandruff** – flaking of the scalp commonly associated with Malassezia species and

seborrheic dermatitis.[8,9]

- **Seborrheic dermatitis** – an inflammatory scalp condition associated with erythema, scaling, and itching.[8,9]
- **Premature graying (canities)** – loss of natural hair pigmentation at an earlier-than-expected age.[9]
- **Scalp psoriasis** – a chronic inflammatory disorder producing well-demarcated, scaly plaques on the scalp.[9]
- **Tinea capitis** – a fungal infection of the scalp that can cause scaling, itching, broken hairs, and alopecia.[9]
- **Pediculosis capitis** – infestation of the scalp by head lice.[9]

## DIFFERENT HAIR-CARE FORMULATION

Hair-care formulations are cosmetic preparations designed to cleanse the scalp and hair, improve hair texture and manageability, protect the hair shaft, and enhance its appearance. Modern formulations may contain surfactants, conditioning agents, polymers, silicones, oils, proteins, botanical extracts, preservatives, fragrances and other functional ingredients. The selection and concentration of ingredients depend on the intended product and hair type.[1,6]

### 1. Shampoo

Shampoo is primarily formulated to remove sebum, sweat, dirt, environmental contaminants and residues of previously applied hair-care products. Modern shampoos generally contain primary surfactants, co-surfactants, conditioning agents, viscosity modifiers, preservatives, pH adjusters and other functional ingredients.[1,6] Surfactant selection is particularly important because it influences cleansing efficiency, foaming, mildness and deposition of conditioning ingredients.[1]

**Common types include**

- Herbal shampoo
- Anti-dandruff shampoo
- Moisturizing shampoo
- Protein-enriched shampoo
- Conditioning or 2-in-1 shampoo
- Baby/mild shampoo
- Volumizing shampoo

- Clarifying shampoo

**2. Hair conditioner**

Hair conditioners are formulated to improve hair manageability, softness, gloss and combability while reducing static electricity and friction between hair fibres.[6,10] Cationic surfactants, cationic polymers, silicones, fatty alcohols, proteins and emollients are frequently incorporated into conditioner systems. Conditioning materials can adsorb onto the negatively charged hair surface and improve the tactile and mechanical properties of the hair.[6,10]

**Common forms include**

- Rinse-off conditioner
- Leave-in conditioner
- Deep conditioner
- Cream conditioner
- Spray conditioner
- 2-in-1 shampoo-conditioner

**3. Hair serum**

Hair serums are usually lightweight preparations containing film-forming, smoothing and conditioning ingredients. Silicone-based materials and selected oils are commonly used to improve shine, reduce friction and provide a smoother appearance to the hair surface. Hair serums are particularly used for dry, frizzy or chemically treated hair.[6,10]

**4. Hair cream and hair lotion**

Hair creams and lotions are semi-solid or emulsion-based preparations intended to provide conditioning, lubrication, softness and manageability. They may contain oils, waxes, fatty alcohols, emulsifiers, humectant polymer.[6,10]

**5. Hair gel**

Hair gels are polymer-based preparations used primarily for styling and fixation. Common formulation components include gelling polymers, humectants, neutralizing agents, preservatives and aqueous vehicles. The concentration and type of polymer influence viscosity, spreading properties, film formation and holding ability.[6]

**6. Hair mask**

Hair masks are intensive conditioning preparations generally containing higher concentrations of conditioning and emollient materials than routine rinse-off products. They may contain plant oils, butters, proteins, silicones, fatty alcohols and botanical extracts and are commonly marketed for dry or damaged hair.[6,10]

**7. Hair tonic**

Hair tonics are usually liquid preparations applied directly to the scalp or hair. Depending on the formulation, they may contain alcohol or aqueous vehicles, humectants, botanical extracts, fragrance and other cosmetic ingredients. Their intended cosmetic functions may include scalp refreshing, hair conditioning and improving the appearance of the hair.[6]

**8. Hair dye formulations**

Hair-colouring products can be broadly categorized into temporary, semi-permanent and permanent formulations. Permanent oxidative hair dyes generally involve oxidation of dye precursors within the hair fibre, whereas temporary products mainly deposit colour on or near the hair surface.[6,12]

**9. Hair straightening and relaxing formulations**

Hair straightening formulations are designed to alter the physical properties and shape of the hair fibre. Conventional chemical straightening systems can modify disulfide bonds or other structural interactions within keratin fibres. Because these treatments can affect hair-shaft integrity, formulation safety and appropriate application are important considerations.[6,12]

**10. Hair oil**

Hair oils are preparations containing vegetable oils, mineral oils, silicones or combinations thereof. Coconut oil, mineral oil and sunflower oil have been investigated for their effects on hair protein loss and protection of the hair shaft. Coconut oil has been reported to penetrate the hair fibre more effectively than some other commonly used oils and may reduce protein loss from damaged and undamaged hair.[11]

**11. Herbal and plant-based hair-care formulations**

Herbal hair-care preparations may incorporate plant-derived materials such as Aloe vera, Hibiscus rosa-sinensis, Emblica officinalis, Azadirachta indica, Lawsonia inermis, Trigonella foenum-graecum and various plant oils. These formulations are commonly investigated as

shampoos, oils, gels, conditioners and hair masks.[2,5] However, claims concerning therapeutic efficacy should be supported by appropriate experimental or clinical evidence rather than based solely on traditional use.

## HERBAL SOLID SHAMPOO BAR

Herbal solid shampoo bars are concentrated hair-cleansing formulations containing surfactants, herbal powders or extracts, conditioning agents, emollients and suitable structuring materials. They are intended to cleanse the scalp and hair while improving softness, manageability and appearance and developed as an alternative to conventional liquid shampoos.[2,3] solid shampoo formulations offer advantages such as portability, reduced water content and reduced packaging requirements.[2]

The shampoo bar may be prepared by mixing the surfactant base with sieved herbal powders, followed by incorporation of conditioning and binding agents. The mixture is moulded and allowed to solidify. The prepared formulation can be evaluated for appearance, odour, pH, hardness, weight variation, wetting time, foamability, foam stability, cleansing ability and stability.[2,3]




## COMMON METHOD OF PREPARATION

The **hot-process method** is a commonly used approach for preparing solid shampoo bars. In this method, the fatty ingredients are weighed accurately and melted together in a water bath, followed by the gradual incorporation of the surfactant with continuous mixing. Sodium

Cocoyl Isethionate (SCI) is used as a mild, sulphate-free cleansing agent, while stearic acid helps improve the consistency and structure of the formulation. Sesame seed oil and coconut oil are incorporated as conditioning and emollient ingredients. The liquid phase, containing distilled water, glycerin and propylene glycol, is added gradually to obtain a uniform, mouldable mass. Guava leaf extract is incorporated as a herbal ingredient because studies have investigated its use in shampoo formulations and reported its potential antimicrobial activity.[1,2] Jasmine oil, natural colour and a suitable preservative are subsequently added under appropriate conditions. The resulting mass is transferred into suitable moulds and allowed to cool and solidify. The prepared shampoo bar is then evaluated for its physicochemical properties, foaming characteristics and stability.[2,3]

**Stepwise Method**

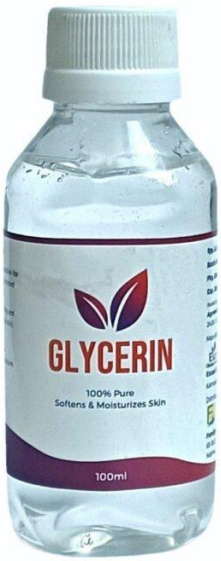
1. **Weighing:** Accurately weigh all the ingredients, including SCI, stearic acid, sesame seed oil, coconut oil, guava leaf extract and other excipients.
2. **Melting of fatty ingredients:** Transfer stearic acid, coconut oil and sesame seed oil into a suitable heat-resistant vessel. Heat in a water bath at approximately **65–70°C** until the stearic acid melts completely.
3. **Incorporation of surfactant:** Gradually add SCI to the melted fatty phase with continuous mixing to ensure uniform distribution of the surfactant.
4. **Preparation of liquid phase:** Mix distilled water, glycerin and propylene glycol separately. Add the liquid mixture gradually to the SCI-containing mass with continuous stirring.
5. **Hot-process mixing:** Continue gentle heating and mixing until a uniform, thick and mouldable mass is obtained. Avoid excessive heating to minimise moisture loss and degradation of temperature-sensitive ingredients.
6. **Incorporation of herbal extract:** Allow the mixture to cool to a suitable temperature before incorporating the concentrated ethanolic guava leaf extract. Mix thoroughly to ensure uniform distribution. Guava leaf extract has been investigated in shampoo formulations for its antimicrobial potential.[1,2]
7. **Addition of fragrance, colour and preservative:** Incorporate jasmine oil and a suitable cosmetic-grade natural colour. Add a compatible preservative according to the recommended concentration and temperature conditions.
8. **Moulding:** Transfer the homogeneous mass into clean, suitable moulds and press gently to minimise air pockets.

9. **Cooling and solidification:** Allow the moulded shampoo bars to cool and solidify at room temperature. Remove the bars from the moulds once sufficiently firm and allow further drying if necessary.
10. **Evaluation:** Evaluate the prepared shampoo bars for appearance, colour, odour, pH, hardness, foamability, foam stability, wetting time, moisture content, dirt dispersion and stability. These parameters are commonly investigated when assessing shampoo formulations.[2,3]

**Commonly used Ingredients**

| Materials | Description |
|---|---|
| **Guava leaves**  | Biological Name: *Psidium guajava* L.<br>Source: Fresh or dried leaves of the guava plant.<br>Family: Myrtaceae<br>Constituents: Quercetin (flavonoid), tannins, essential oils (caryophyllene), and triterpenoids.<br>Uses: Treating diarrhea/dysentery, managing oral health (gums/toothaches), supporting metabolic health, and wound healing. |
| **Sesame seed oil**  | Biological Name: *Sesamum indicum* L.<br>Source: Expressed or extracted oil from the seeds of the sesame plant.<br>Family: Pedaliaceae<br>Constituents: Lignans (sesamin, sesamolin, sesamol), and rich in unsaturated fatty acids (oleic and linoleic acids).<br>Uses: Used as a nutritive solvent/base for pharmaceuticals, emollient in cosmetics, traditional Ayurvedic oil massages (Abhyanga) for joint and skin health, and as a culinary oil. |
| **Sodium cocoyl isethionate** | Chemical name: Sodium salts of fatty acid esters of isethionic acid.<br>Source: SCI is produced from coconut-derived fatty acids and isethionic acid. Commercial SCI is available as a solid ingredient, commonly in powder, flake or noodle form.<br>Chemical constituents: SCI consists of sodium salts of fatty acid esters of isethionic |

| | |
|---|---|
|  | acid, with fatty-acid chains derived from coconut oil. Its chemical identity is commonly described as fatty acids, coco, 2-sulfoethyl esters, sodium salts.<br>Uses: SCI acts as a primary cleansing agent and foaming surfactant in solid shampoo bars, syndet bars and other personal-care formulations. It helps remove dirt and excess oil while producing foam. |
| **Propylene glycol**<br> | Chemical name: Propane-1,2-diol.<br>Source: Propylene glycol is a synthetically manufactured chemical, commonly produced by the hydration of propylene oxide. It is not obtained directly from a plant or animal source<br>Chemical constituents: Propylene glycol is a single chemical compound with the molecular formula $C_3H_8O_2$.<br>Uses: Propylene glycol is widely used in cosmetic and pharmaceutical formulations as a humectant, solvent, and moisturizing agent. |
| **Stearic acid**<br> | Chemical name: Octadecanoic acid.<br>Source: Obtained commercially from animal fats or vegetable oils through fat splitting and purification.<br>Constituents: Stearic acid is a saturated fatty acid with 18 carbon atoms. Its molecular formula is $C_{18}H_{36}O_2$.<br>Uses: Stearic acid acts as a thickening and structuring agent that can improve the hardness, firmness and consistency. It may also contribute to the creamy texture and help maintain the shape of the formulation. |
| **Glycerin** | Chemical name: Propane-1,2,3-triol.<br>Source: Common commercial sources include coconut oil, palm oil and other |

| | |
|---|---|
|  | vegetable oils.<br>Constituents: Glycerine is a single chemical compound containing carbon, hydrogen and oxygen. Its molecular formula is $C_3H_8O_3$, and it contains three hydroxyl (–OH) groups.<br>Uses: Glycerine is widely used in cosmetic and pharmaceutical formulations as a humectant, moisturizing agent and solvent. |
| **Coconut oil**<br> | Biological name: Cocos nucifera L. (coconut).<br>Family: Arecaceae (Palmae)<br>Biological source: Coconut oil is obtained from the mature kernel (endosperm) of the coconut, Cocos nucifera L.<br>Chemical constituents: It contains triglycerides of lauric, myristic, caprylic, capric, palmitic, stearic, and oleic acids. Lauric acid is generally the predominant fatty acid.<br>Uses: Coconut oil acts as an emollient and conditioning agent, helping lubricate the hair shaft, improve softness, and reduce the dry feel of hair |

## EVALUATION OF HERBAL SHAMPOO BAR

The prepared herbal sulfate-free shampoo bar can be evaluated for its physical, physicochemical, performance and stability parameters. These tests are commonly reported for herbal shampoos and solid shampoo bars.[2,14,15]

### 1. Organoleptic evaluation

The prepared shampoo bars are visually examined for colour, odour, appearance, texture, smoothness, cracks and uniformity. The formulation should have a uniform appearance

without visible cracks or separation. Organoleptic characteristics are also monitored during stability studies.[2,14]

**2. Shape and physical appearance**

The bars are examined for uniform shape, surface smoothness, absence of cracks, brittleness and ease of handling. These characteristics are particularly important for solid shampoo because excessive crumbling or poor mechanical strength can affect its usability.[2,3]

**3. pH determination**

The pH is determined by preparing an aqueous dispersion of the shampoo bar and measuring it using a calibrated digital pH meter. The pH should be appropriate for hair and scalp application. Herbal shampoo studies commonly evaluate pH as an important quality parameter.[14,15]

**4. Foamability**

Foamability indicates the ability of the shampoo bar to produce foam during washing. A measured quantity of the formulation is dispersed in water and shaken, after which the volume of foam produced is recorded. SCI contributes substantially to cleansing and foam formation in a sulfate-free bar.[1,2,14]

**5. Foam stability**

Foam stability is determined by measuring the foam volume immediately after shaking and after predetermined time intervals. A good shampoo formulation should produce reasonably stable foam during the washing process.[14,15]

**6. Wetting time**

Wetting time measures how quickly the shampoo formulation becomes wetted by water. A shorter wetting time generally indicates better wetting efficiency of the surfactant system. This test is commonly used for evaluating shampoo formulations.[14,15]

**7. Dirt dispersion test**

The dirt dispersion test evaluates the cleansing behaviour of the shampoo. A small quantity of shampoo solution and India ink are mixed with water and shaken. The distribution of ink between the foam and water is observed. Preferably, dirt should remain in the water rather than becoming concentrated in the foam, as dirt retained in foam may be more difficult to rinse away.[14,15]

**8. Moisture content**

Moisture content can be determined by measuring the loss in weight after controlled drying. Since solid shampoo bars contain little or no added water, moisture evaluation can help assess storage stability, hardness and susceptibility to softening.[2,3]

**9. Antimicrobial evaluation**

Because your formulation contains guava leaf extract, antimicrobial activity can be investigated using an appropriate microbiological method, such as the agar diffusion method. The activity may be expressed by measuring the zone of inhibition against selected microorganisms. This test should be performed using appropriate laboratory controls and validated methods.[5,13]

## ADVANTAGES

- Mild cleansing: Sulfate-free formulations using mild surfactants such as sodium cocoyl isethionate can provide cleansing while avoiding sulfate surfactants.[1,3]
- Natural active ingredients: Herbal shampoo bars can incorporate plant extracts containing bioactive phytochemicals, providing a botanical alternative for hair-care formulations.[2,5]
- Antioxidant and antimicrobial potential: Herbal ingredients can contribute biological activities relevant to scalp and hair care, depending on the plant and extract used.[5,13]

## LIMITATIONS

- Hard-water sensitivity: Water hardness can influence lathering and cleansing performance.[1]
- Residue or buildup: Inadequate formulation or insufficient rinsing may leave residues on the hair and scalp.[1,6]
- Formulation difficulty: Achieving the required hardness, smoothness, foaming and cleansing properties can be challenging in solid shampoo bars.[2,3]
- Risk of crumbling: Improper proportions of surfactants and consistency agents may produce bars with low hardness that break easily during use.[2,3]

## FUTURE PERSPECTIVES

The future of herbal shampoo bars is promising because they combine the growing demand for botanical hair-care products with the advantages of water-free and reduced-packaging formulations. Future research should focus on developing sulfate-free, biodegradable and skin-friendly shampoo bars containing standardized herbal extracts with demonstrated

cleansing, antioxidant, antimicrobial and conditioning activities. Advanced extraction, encapsulation and controlled-release techniques may improve the stability and effectiveness of herbal bioactive compounds. Further investigations are also required on long-term stability, scalp safety, microbiological quality, clinical efficacy, biodegradability and consumer acceptability before large-scale commercialization. Solid shampoo technology may also support sustainable cosmetic development by reducing water and plastic packaging requirements.[2,5]

## CONCLUSION

Herbal shampoo bars represent a promising alternative to conventional liquid shampoos because of their convenient, water-free format and potential for incorporating botanical ingredients.[2] The use of herbal ingredients such as Psidium guajava (guava) and sesame oil may provide beneficial antioxidant, conditioning, and scalp-care properties.[5,11] Sulfate-free herbal shampoo bars may offer effective cleansing while supporting the development of milder and more consumer-friendly hair-care formulations.[1,3] Their solid form may also contribute to sustainable cosmetic development by reducing water content and dependence on plastic packaging.[2] Further studies on stability, safety, antimicrobial activity, clinical efficacy, and consumer acceptability are necessary to establish their effectiveness and support commercial development.

## ACKNOWLEDGEMENT

I would like to express my sincere gratitude to God Almighty for providing me with the strength, wisdom, and guidance to complete this review article entitled **"A Review of Herbal shampoo bar."**

I sincerely express my gratitude to the Principal for providing the necessary facilities and support required for the successful completion of this work. I am also thankful to the Head of the Department of Pharmaceutics, for valuable guidance, encouragement, and continuous support throughout the preparation of this review article.

I am especially grateful to **Mrs. Reshma. K. J** Assistant Professor and Project Guide, for constant guidance, constructive suggestions, encouragement, and valuable assistance throughout the preparation of this article. I also extend my sincere appreciation to the faculty members, for their valuable suggestions and academic support during the course of this work.

I acknowledge the support of laboratory Staff for providing the necessary resources and facilities required for the completion of this review.

Finally, I express my heartfelt appreciation to my **parents and family members** for their constant encouragement, understanding, and support. I also thank my friends and classmates for their cooperation and encouragement, and everyone who contributed directly or indirectly to the successful completion of this review article.

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