2026 Volume: 02 Issue: 06 www.ijrpa.com ISSN 2456-9995 Review Article

International Journal Research Publication Analysis

Page: 01-07

A REVIEW ON FORMULATION AND EVALUATION OF HERBAL ANTI-DANDRUFF SHAMPOO

[*1]Ayush Kumar, [2]Shikha Singh, [3]Dr. R.B Goswami

[1]Student, Sagar Institute of Research and Technology & Science, Bhopal.

[2]Assistant professor, Sagar Institute of Research Technology & Science - Pharmacy, Bhopal.

[3]Director, Sagar Institute of Research Technology & Science - Pharmacy, Bhopal.

Article Received: 13 May 2026
Article Revised: 03 June 2026
Published on: 23 June 2026

***Corresponding Author: Ayush Kumar**
Student, Sagar Institute of Research and Technology & Science, Bhopal.

DOI: https://doi-doi.org/101555/ijrpa.2667

ABSTRACT

Dandruff is a common scalp disorder characterized by flaking, itching, and irritation, often caused by microbial infections, excessive sebum production, and environmental factors. Synthetic anti-dandruff shampoos, though effective, may cause side effects such as scalp dryness, irritation, and hair damage due to chemical ingredients. This review focuses on the formulation and evaluation of herbal anti-dandruff shampoos as a natural, safe, and effective alternative.

Herbal ingredients such as neem, tea tree, aloe vera, amla, reetha, shikakai, and tulsi possess antimicrobial, anti-inflammatory, and antioxidant properties that help reduce dandruff and promote scalp health. The review covers the role of various herbal extracts, selection of suitable excipients, formulation strategies, and evaluation parameters including physicochemical properties, foam ability, cleansing action, irritation test, and antimicrobial efficacy.

The studies suggest that herbal shampoos not only control dandruff effectively but also nourish hair, improve scalp condition, and reduce the risk of side effects. Herbal anti-dandruff shampoo can be considered a promising natural product for long-term use and better consumer acceptance.

KEYWORDS: Herbal Shampoo, Anti-dandruff, Formulation, Evaluation, Natural Ingredients.

1. INTRODUCTION & HAIR ANATOMY

1.1 Understanding Hair Physiology

Hair serves as a critical component of human aesthetics and biological protection. Anatomically, it is a keratinous filament emerging from specialized structures within the dermal layer of the skin known as follicles. Beyond its social and psychological significance as an indicator of health, hair functions to insulate the scalp, offer sensory feedback, and shield the skin from ultraviolet radiation.

1.2 Structural Breakdown of the Hair Unit

Hair does not emerge as isolated strands but grows in small clusters called follicular units. At the base of each hair follicle is the vital mechanism that regulates the lifecycle and production of new strands.

- **The Hair Bulb:** Situated at the base of the follicle within the subcutaneous fat layer, this is the active growth zone nourished by localized blood vessels. As cells rapidly divide here, they push upward and undergo keratinization, hardening into the visible hair shaft.
- **Dermal Papilla:** A specialized collection of cells at the base of the bulb responsible for orchestrating the hair growth cycle and mediating cellular signals.
- **The Matrix:** The cellular engine surrounding the papilla that produces the cells required for the hair shaft and its protective sheaths.
- **Outer & Inner Root Sheaths:** Concentric protective layers that secure, anchor, and guide the hair shaft as it grows toward the surface of the skin.
- **The Hair Shaft:** The visible part of the hair extending past the epidermis. It consists of the internal medulla (variable core), the highly structured cortex (which contains melanin pigments and provides tensile strength), and the outermost cuticle (a complex protective layer that helps repel external moisture).

1.3 The Hair Growth Cycle

The progression of hair growth follows three main physiological phases:

- **Anagen Phase:** The active growth period during which the follicle cells divide rapidly, lasting several consecutive years.
- **Catagen Phase:** A brief transitional window over a few weeks where growth slows down and the hair follicle shrinks.
- **Telogen Phase:** The resting state extending over months where growth stops entirely and the old strand detaches, eventually being pushed out by a new cycle.

Figure 1: The Three Physiological Phases of the Hair Growth Cycle

2. The Problem of Dandruff and the Role of Shampoos

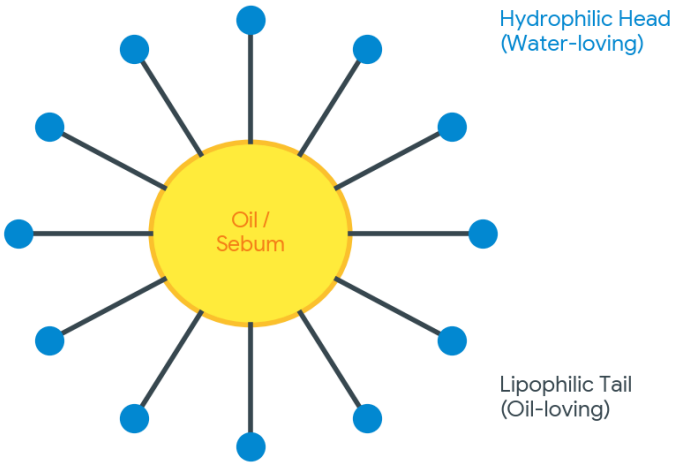
2.1 Etiology of Dandruff

Dandruff is a widespread, non-contagious scalp issue characterized by accelerated shedding of dead epidermal cells. When scalp oils mix with rapidly shedding skin, they form visible white flakes. This condition is primarily triggered by excessive dry skin, overactive sebaceous (oil) glands, or microbial imbalances—particularly the overgrowth of the yeast-like fungus Malassezia. Additionally, dermal sensitivity to specific heavy chemical additives in commercial products often compounds the irritation.

2.2 Mechanism of Action of Shampoos

A shampoo is fundamentally an emulsifying agent designed to cleanse the scalp. Because oil and water do not naturally mix, surfactants are introduced to bridge the gap. Surfactant molecules possess a hydrophilic (water-loving) head and a lipophilic (oil-loving) tail. When applied to wet hair, the tails bind to sebum and dirt particles, trapping them inside spherical structures called micelles. During rinsing, the water-loving heads pull the entire micelle away from the hair shaft, lifting away the trapped dirt and oil effectively.

Figure 2: Surfactant Micelle Mechanism Action on Scalp Sebum



2.3 Expanded Comparison of Commercial Shampoo Modalities

Modern hair care leverages diverse physical mechanisms depending on target demographics:

- **Powder Solutions:** Historic formulas utilizing dry synthetic or soap-based solids. Primarily used when water presence compromises chemical stability.
- **Liquid Emulsions:** Highly fluid, clear formulations incorporating detergents with a low cloud point for clarity and distribution uniformity.
- **Cream Lotions:** Modified opaque liquids utilizing solubilizing suspension chemicals like magnesium stearate to evenly disperse clouding agents.
- **Gel & Jelly Cleaners:** Thickened transparent solutions utilizing cellulose matrices to increase contact residence time on the hair shaft.
- **Aerosol Foams:** Pressurized packaging setups dependent on chemical propellants to instantly aerate liquid surfactants upon discharge.

3. Botanical Ingredients and Their Functions

To eliminate the adverse effects of heavy chemical formulas, specific natural ingredients were selected for their therapeutic properties:

Botanical Ingredient	Source / Family	Primary Function in Formula
Orange Peel	Citrus Aurantium Dulcis (Rutaceae)	Rich in Vitamin C and antimicrobials; soothes itchy scalps and adds a refreshing natural fragrance.

Soapnut (Reetha)	Sapindus Mukorossi (Sapindaceae)	Acts as a natural, biodegradable surfactant; generates stable foam and offers natural antifungal cleansing.
Hibiscus	Hibiscus rosa-sinensis (Malvaceae)	Contains mucilage and proteins that naturally condition the hair, smoothing the cuticle and reducing hair fall.
Ginger	Zingiber Officinale (Zingiberaceae)	Contains antiseptic properties to combat fungal dandruff triggers while balancing scalp pH.
Curry Leaves	Murraya Koenigii (Rutaceae)	Packed with antioxidants; moisturizes the dermis, prevents premature graying, and clears dead follicles.
Aloe Vera	Aloe Barbadensis Miller (Asphodelaceae)	Acts as a potent anti-inflammatory and cooling agent; restores natural moisture and balances pH.

4. Formulation and Laboratory Preparation

4.1 Master Batch Composition

The experimental herbal shampoo was compiled using the specific baseline ratios outlined below:

Ingredients	Quantity
Botanical Core Extract Blend	20 mL
Sodium Lauryl Sulfate (SLS) solution (7.5% concentration)	20 mL
Sodium Chloride solution (0.1 M NaCl)	20 mL
Acacia Gum Solution (Viscosity/suspension agent)	10 mL
Glycerine (Humectant / moisturizer)	2 mL
Vitamin E Capsules (Conditioning support)	2 capsules
Lemon Juice (Natural preservative)	2 mL
Essential Oil / Castor Oil	q.s. (Quantity Sufficient)
Pure Distilled Water	25 mL

4.2 Extraction Methodology

Dry botanical raw materials (peels, roots, and leaves) were ground into a coarse powder and filtered through a 60-mesh sieve. A decoction was prepared by combining the plant powders (5g Curry leaves, 5g Ginger, 10g Aloe vera gel, 20g Reetha, and 5g Orange peel powder) in a water bath, boiling the mixture until the total liquid volume concentrated down to one-quarter

of its initial state. The resulting concentrated fluid extract was filtered and stored as the active base for the shampoo.

5. Quality Control and Evaluation Standards

To ensure the physical safety and empirical performance of the formulation, several standardized tests were established:

- **Visual Clarity and Esthetics:** Assessment of the fluid's color, scent, uniformity, and overall appearance.
- **pH Measurement:** Evaluated using a digital pH meter on a 10% dilution to ensure it stays slightly acidic (under 7.0) to preserve the hair's natural disulfide bonds.
- **Solid Mass Percent:** Evaporating a 4g sample on a heating plate to calculate the percentage of active solid residue left behind.
- **Wetting Profile:** Measuring the exact seconds it takes for a standardized canvas disc to sink in a 1% shampoo solution.
- **Rheological Flow (Viscosity):** Calculated via capillary flow tracking (such as an Ostwald viscometer) against a water control standard.
- **Debris Dispersion:** Shaking the formula with a drop of India ink to observe whether the pigment stays suspended or gets trapped in the foam matrix.
- **Cleansing Efficiency:** Real-world performance testing on unwashed, oily hair to measure sebum removal.
- **Surface Tension:** Determined via drop-weight tracking using a stalagmometer to measure the fluid's ability to break surface tension and wet the hair evenly.
- **Foam Yield and Longevity:** Utilizing the cylinder-shake method to measure initial foam volume and tracking its retention rate over a 10-minute window.
- **Dermal Irritation Screening:** Patch testing on skin surfaces to evaluate the formulation for potential redness, inflammation, or allergic responses.
- **Microbiological Control:** Culturing a small sample on agar plates to verify zero bacterial or fungal contamination, ensuring shelf-life safety.

6. Discussion & Comparative Industrial Context

Conventional commercial cleansers typically market specialized functions using heavy loads of aggressive synthetic detergents. These chemical bases strip away all protective lipid boundaries, degrading structural keratin bonds and producing microscopic fractures along the

outer cuticle layer. Over time, this leads to split ends, brittleness, and accelerated dehydration.

The developed natural hair cleanser circumvents these degradation patterns by substituting the core foaming mechanisms with soapnut-derived saponins while utilizing a dramatically reduced surfactant concentration (7.5% SLS compared to standard industrial ranges of 10% to 40%). The inclusion of natural aloe polysaccharides replaces artificial plasticizing softeners, effectively smoothing the hair cuticles without building up impermeable chemical coatings over multiple washes.