

## A REVIEW OF POLYHERBAL POWDER SHAMPOO HAVING ANTIDANDRUFF AND ANTIFUNGAL EFFECT

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### ABSTRACT

Dandruff is one of the most common scalp problems, often causing continuous flaking, itching and discomfort. It is typically associated with overgrowth of *Malassezia* fungi, increased sebum production and scalp irritation. To address this, a poly-herbal anti dandruff shampoo powder was developed as a plant based alternative to traditional shampoos. The goal was to create a standardized natural formulation aimed at treating dandruff, which is mainly caused by fungus, *Malassezia furfur* herbal ingredients known for their benefits in scalp and hair care, such as Amla, Reetha, Shikakai, Hibiscus, rosemary leaves, rose petals, flax seeds and Meethi etc were chosen based on ayurvedic knowledge and scientific research. All the ingredients were shade dried, powdered and passed through 100 mesh sieve before being mixed in a specific

proportions to ensure consistency. The formulation was then tested for various physicochemical evaluation including pH moisture content, foaming ability, dirt dispersion, washability and sensory characteristics. The final product had an ideal pH of 5.75 which is good for scalp health, low moisture content. The herbal shampoo powder showed strong cleansing, conditioning and anti-dandruff properties without the use of synthetic chemicals, making it a safe and suitable option for regular use with a low risk of allergic reactions. The study concluded that the poly herbal shampoo powder is a safe, effective and environmentally friendly solution for managing dandruff while supporting overall scalp health.

**KEYWORDS:** Anti-dandruff, Anti-fungal, Herbal shampoo, *Malassezia furfur*.

## INTRODUCTION

Herbal formulations are becoming more popular in the global market. Natural remedies are preferred because they are safer and have fewer side effects. Anti-dandruff and nutritional shampoos often include ingredients like vitamins, amino acids, and protein hydrolysates. Currently, treatments for dandruff involve using ingredients such as zinc pyrithione, salicylic acid, imidazole derivatives, glycolic acid, steroids, and sulphur or coal tar derivatives. However, these treatments have certain limitations, either because they are not very effective or because people often stop using them. These drugs also fail to prevent dandruff from coming back. Synthetic shampoos contain a mix of cationic, anionic, and non-anionic surfactants. These surfactants create good foam but can be harmful and cause eye irritation. Hard water causes surfactants to leave deposits of sodium, calcium, and magnesium salts on the hair. This leads to side effects such as making the hair dry and hard to manage. To avoid these issues, herbal shampoos are a better option.<sup>[1]</sup>

## HAIR

Two effectively study and create hair products it is crucial to understand the nature of hair. Hair is an important body part that develops from the ectoderm layer of the skin and functions as a protective covering on the body it is considered an accessory structure alongside sebaceous gland, sweat glands and nails. These structures are referred to as epidermal derivatives because they originate from the epidermis during the embryonic development stage.<sup>[2]</sup> It also plays a sensory role, helping to enhance the feeling of the skin's surface in response to touch, and it has important functions in sexual and social communication. It also affects psychological well-being and quality of life, which can be seen in hair-related conditions like hirsutism and hair loss, among others.<sup>[3]</sup>

## STRUCTURE OF HAIR

Hair is composed of dead keratinized cells. In the visible part of the hair known as the shaft, has a rounded cross-sectional shape while the roots extend to the skin. The shaft and the roots are structured into three concentric layers: the medulla, cortex and cuticle. The medulla is innermost layer; the cortex is the largest part and contains pigment granules and air spaces and the cuticle is the outermost layer.<sup>[4]</sup> The hair shaft also includes melanin, a pigment produced by Melanocytes located in the germinativum layer of the hair bulb around the root of the hair is the hair follicle which consists of an external root sheath and an internal root

sheath the external root sheath continues downwards from there. The hair follicle is divided into three parts;

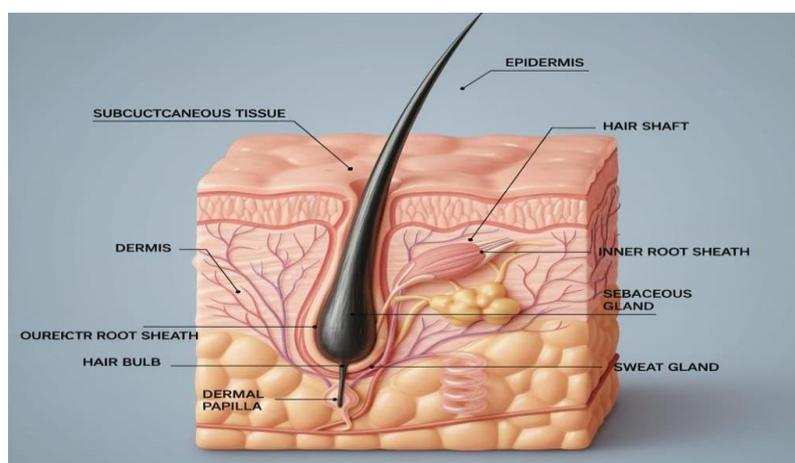
A: The Infundibulum which runs from the opening of the follicle on the skin surface to the point where the sebaceous gland begins.

B: The Isthmus which extends from the Infundibulum down to where the Arrector pili muscle attaches.

C: The Inferior segment which is part of the growing follicle and has a nearly uniform width, except near its base, where it expands to form the bulb. At the base of the bulb, a cluster of vascularized connective tissue called the dermal papilla is present.<sup>[5]</sup>

## HAIR ANATOMY

Hair grows from the hair follicles in the fat layer of the scalp. Contrary to the general belief that hair grows as individual strands, hair follicles grow in groups of 1-4 hairs called "follicular units". At the base of each hair follicle is a hair bulb where the growth mechanism for producing hair occurs. Hair follicles get their nourishment from the blood vessels within the dermis. The cells divide and develop to produce the hair shaft. It keeps its soft shape while the hair is still developing under the epidermis. As it passes through the epidermis its outer layer hardens to keratin.<sup>[6]</sup>



**Fig No. 1 Parts of Hair.**

### Parts of Hairs

**Dermal papillae:** This structure is responsible for regulating the hair cycle and growth. It contains androgen receptors that are sensitive to the hormone DHT.

**Matrix:** Surrounding the dermal papillae, the matrix is where all the active cells for hair growth are located. Together, the matrix and dermal papillae form the hair bulb.

**Outer root sheath:** This is the outermost, keratinized part of the hair. It covers the entire hair follicle and provides the opening for the hair to emerge from the skin's surface.

**Inner root sheath:** This part is made up of three layers: the Henley layer, Huxley layer, and cuticle. The Henley and Huxley layers stabilize the hair, while the cuticle protects the hair shaft.

**Hair shaft:** This is the only part of the hair that fully extends beyond the skin. It has three layers

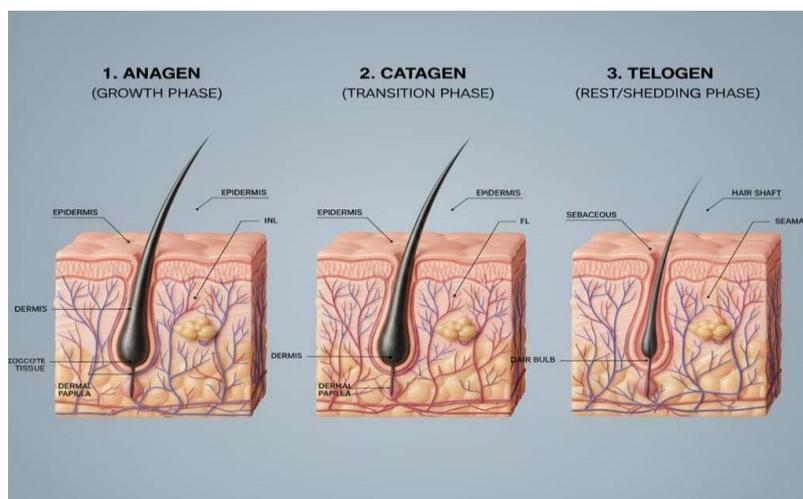
- **Medulla:** An unstructured area in the Centre of the hair shaft that is not always present.
- **Cortex:** A highly structured layer of keratin that provides the hair's strength, durability, and water uptake. It also contains melanin, which determines the hair's colour.
- **Cuticle:** The outermost protective layer of the hair shaft.<sup>[6]</sup>

## HAIR PHYSIOLOGY

A hair grows from the combined actions of multiple layers of keratinocytes in the hair follicle. The growth of hair is a continuous, repeating process where the length of each growth cycle is controlled by various hormones and signaling molecules. This process isn't the same everywhere on the body—it depends on where the hair is growing, as well as factors like a person's age, their developmental stage, what they eat, and even changes in the environment such as the amount of daylight. Cytokines, which are a type of hormone, play a key role in this cycle. These molecules tell the hair follicle what to do, allowing each hair to be at a different stage of its growth cycle compared to the hairs nearby. Hair follicles go through repeated cycles, alternating between periods of fast growth and hair shaft development and periods where the follicle shrinks through a process called apoptosis and becomes less active. Specifically, the hair growth cycle can be broken down into three clear stages.<sup>[3]</sup>

- **Anagen (Growth Phase):** This is the active growth phase, during which the hair shaft grows longer. Most hair follicles (85-90%) are in this phase at any given time, and it can last for several years, depending on the hair's location on the body.

- **Catagen (Transitional Phase):** A brief, short phase that lasts for about 1-2 weeks. During this transition, the hair stops growing, and the hair follicle begins to shrink.
- **Telogen (Resting Phase):** In this final stage, which can last for several months, the hair growth completely stops. The old hair detaches from the hair follicle.<sup>[6]</sup>

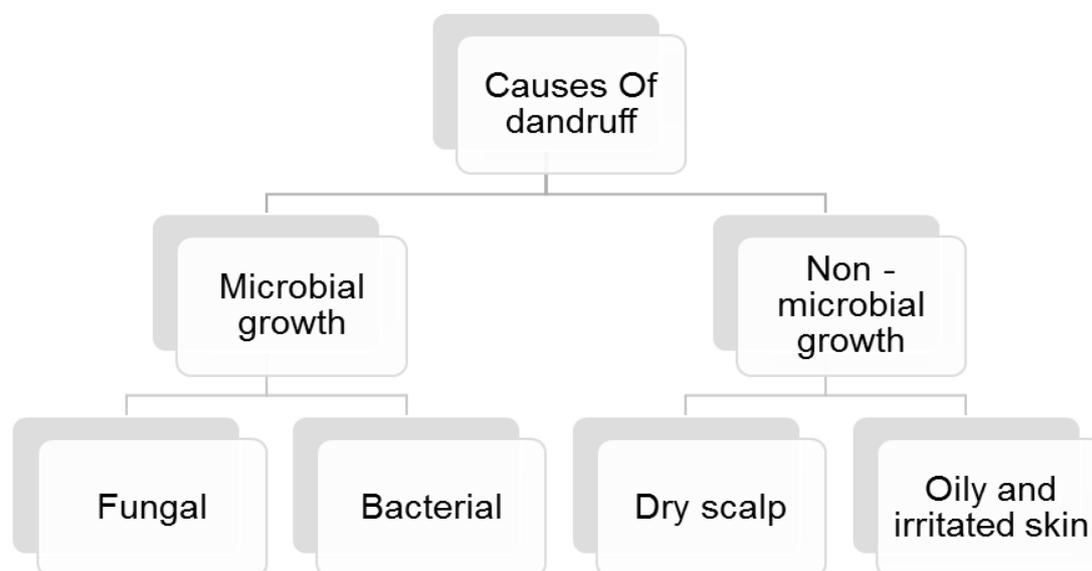


**Fig. No. 2: Phases of Hair Growth.**

## DANDRUFF

Dandruff is a common cosmetic issue and a big concern in both developed and developing countries. The word "dandruff" comes from "tan" meaning "tetter" and "drof" meaning "dirty." It's a long-term scalp condition that causes flaking, itching, and redness. The scalp naturally sheds dead skin cells, but sometimes these cells come off in visible flakes, which we call dandruff. Dandruff forms when clusters of dead skin cells, called coenocytes, stick together and come off the outer layer of the scalp. These flakes often include parakeratosis cells. In terms of how much skin is shed, about 487,000 cells per square centimeter are released after using a detergent. Over the past few decades, there has been a growing trend towards using natural products in cosmetics. These natural botanicals are often used in their raw or purified extract form.<sup>[7]</sup> Dandruff is a clinical condition caused by the *Malassezia* (*Pityrosporum*) species, which is a major cosmetic concern worldwide. *Pityrosporum ovale* is strongly suspected to be involved in the development of seborrheic dermatitis. Dandruff can be controlled using fungistatic ingredients found in anti-dandruff shampoos.<sup>[3]</sup> Dandruff has become a widespread issue for hair today. It is a condition that causes flaky patches on the scalp, often followed by itching. Dandruff is not an inflammatory condition and is considered

chronic. It is the most common skin problem in dermatology, specifically affecting the scalp. This condition is marked by an overgrowth of the scalp's skin tissue.<sup>[8]</sup>



### SIGNS AND SYMPTOMS

- Itchy scalp
- Flakiness
- Red and greasy patches of skin
- Tingly feeling on the skin.<sup>[9]</sup>

### TREATMENT

Dandruff can be managed with ingredients that stop fungi from growing in anti-dandruff shampoos. Herbal shampoos are becoming more popular in the global market. Natural remedies are preferred because they are safer and cause fewer side effects. Anti-dandruff shampoos often include nutrients like vitamins, amino acids, and protein hydrolysates. Both synthetic and herbal shampoos can help with dandruff. However, synthetic shampoos contain a mix of surfactants that create good lather but can be harmful and cause eye irritation. A herbal anti-dandruff shampoo can be made that is just as effective as traditional shampoos, but also healthier, more effective, and purer.<sup>[9]</sup>



**Fig. No. 3: Before and After Anti-Dandruff Treatment.<sup>[10]</sup>**

## SHAMPOO

Hair plays a significant role in how attractive a person appears. For a long time, people have connected hair with beauty and social status. There are many examples from different art forms showing how important hair has always been across various cultures and periods. While cutting, styling, and even dyeing hair have been common practices since ancient times, not much attention has been given to the process of washing and keeping it clean.<sup>[3]</sup> Herbal shampoo is a type of natural cosmetic that is often used to clean hair and the scalp as part of a daily routine. These days, herbal plants and products are becoming more popular in the world of natural cosmetics. When using herbal shampoo, it is applied to a wet scalp, massaged into the hair, and then rinsed off with water. Dandruff is a common cause of hair loss, and it is important to remove it from the scalp. The main purpose of herbal shampoo is to help get rid of dandruff. Herbal formulations are widely used in both developed and developing countries as a form of healthcare support.<sup>[11]</sup>

### • IDEAL PROPERTIES OF HAIR

1. Cleansing Effectiveness
2. Soft and gentle on skin
3. Creates a good lather
4. Provides a moisturizing benefits
5. Has a pleasant scent
6. Free from harmful substances and safe to use

• **TYPES OF SHAMPOO (Based on Purpose/Function)**

1. Powder Shampoo
2. Volumizing Anti-dandruff shampoo
3. Sulphate-free shampoo
4. Colour-protecting shampoo
5. Medicated shampoo
6. Dry shampoo
7. Liquid shampoo
8. Lotion shampoo
9. Baby shampoo
10. Two layer shampoo
11. Aerosol shampoo



**Fig No.3 Mechanism of Action of shampoo.**

**Table No.1: Herbal Liquid Shampoo and Herbal Powder Shampoo.**

| HERBAL LIQUID SHAMPOO  | HERBAL POWDER SHAMPOO   |
|--|---|
| 1.It comes in a Liquid form, which makes it easier for germs to grow               | 1. It is in powder form, so it is less likely to get dirty or contaminated. |
| 2. It doesn't last as long as other types.   | 2. It lasts longer than liquid shampoo.                                     |
| 3. It has a lot of water in it, so extra preservatives are needed to keep it safe. | 3. It has less moisture, so it doesn't need preservatives.                  |
| 4.It might cause skin irritation or make you feel uncomfortable                    | 4.It is easier to use   |
| 5.It is more likely to mix badly with other products                               | 5. It is less likely to mix badly with other products.                      |
| 6.It is not very stable  | 6. It is more stable.   |
| 7.It can be hard to transport because it might leak. <sup>[12]</sup>               | 7.It is easier to transport because it doesn't leak. <sup>[1]</sup>         |

## MATERIALS

| SR. NO. | INGREDIENTS         | BIOLOGICAL SOURCE   | USES  |
|---------|---------------------|---|---|
| 1       | Amla                | Dried Ripe Fruit of Ambelica Officinalis ( <i>Euphorbiaceae</i> )                           | Promoter Hair Growth, Preventing Premature Hair, and control dandruff <sup>[13]</sup> |
| 2       | Shikakai            | Dried Seeds of Acacia Rugate ( <i>Leguminosae</i> )   | Foam Base <sup>[14]</sup>   |
| 3       | Reetha              | Dried Fruits of Sapindus Mukorossi ( <i>Sapindaceae</i> )                                   | Foaming Agent, Natural Cleansing <sup>[13]</sup>                                      |
| 4       | Ashwagandha         | Ashwagandha Is a Short Woody Shrub Belonging to The Solanaceae Family.                      | Controls Hair Fall, Prevents Premature Greying <sup>[9]</sup>                         |
| 5       | Rose Petals         | A Rose Is Woody Perennial Flowering Plant of Genus Rosa ( <i>Rosaceae</i> )                 | Fragrance, Soothing and Also Nourish Your Scalp <sup>[15]</sup>                       |
| 6       | Lemon Grass         | Obtained From the Fresh Aerial Parts of Cymbopogon Flexosus ( <i>Poaceae</i> )              | Cleanses The Scalp, pH modifier <sup>[15],[16]</sup>                                  |
| 7       | Bahera              | Dried Ripe Fruit Terminalia Balerice ( <i>Combretaceae</i> )                                | Provides Nutrition to Growing Hairs <sup>[15]</sup>                                   |
| 8       | Tulsi               | Dried Leaves of Ocimum Santum ( <i>Labiatae</i> )   | Anti-Bacterial, Anti Microbial <sup>[13]</sup>  |
| 9       | Neem                | Dried Leaves of Azadirachta Indica ( <i>Miliaceae</i> )                                     | Fight Scalp infection, Anti lice agent, Antidandruff <sup>[14][3]</sup>               |
| 10      | Linseed Or Flaxseed | Obtained From Dried Ripened Seed of Linum Usitatissimum ( <i>Linaceae</i> )                 | Demulcent <sup>[15]</sup>   |
| 11      | Harda (Myrobalan)   | Dried Ripe Fruits of Terminalia Chebula ( <i>Combretaceae</i> )                             | Hair Growth Promoter <sup>[2]</sup>   |
| 12      | Heena               | Dried Leaves of Lawsonia Inermis ( <i>Lythraceae</i> )                                      | Conditioner <sup>[7]</sup>  |
| 13      | Aloe vera Dry       | Dried Leaves of Barbadensis Miller ( <i>Asphodelaceae</i> )                                 | Conditioning And Moisturizing Effect <sup>[7]</sup>                                   |
| 14      | Black Tea           | It Is Obtained from Camelli Sinensis ( <i>Theaceae</i> )                                    | Decreases Shedding <sup>[15]</sup>  |
| 15      | Meethi Or Fenugreek | Dried Seed of Trigonella Foenum-Graecum ( <i>Leguminosae</i> )                              | Conditioning And Nourishment Effect <sup>[17]</sup>                                   |
| 16      | Bhringraj           | It Is Obtained from Entire Herb Ecliptaalba ( <i>Asteraceae</i> )                           | Promotes Hair Growth and Treats Dry Scalp, Enhances Blood Circulation <sup>[13]</sup> |
| 17      | Ginger Root         | It Is Obtained from Zingiber Officinale ( <i>Zingiberaceae</i> )                            | Anti-Dandruff Agent, Is Also Hair Growth Promoter, Hair Conditioner <sup>[18]</sup>   |
| 18      | Cinnamon            | Dried Inner Bark of The Shoots Coppiced Trees of Cinnamomum Zeylanicum ( <i>Lauraceae</i> ) | Anti-Bacterial and Stimulating Properties <sup>[9]</sup>                              |

|    |                           |  |  |
|----|---------------------------|--|--|
| 19 | <b>Shatavari</b>          | It Consists of Dried Roots and Leaves of Plants <i>Asparagus Racemosus (Liliaceae)</i>                             | Strengthen The Roots of Hair and Help Maintain Colour and Lustre <sup>[15]</sup>     |
| 20 | <b>Babchi</b>             | These Are the Dried Ripe Fruits of the Plants of <i>Psoralea Corylifolia Linn (Leguminosae)</i>                    | Anti-Inflammatory Agent, Improves hair texture <sup>[4]</sup>                        |
| 21 | <b>Hibiscus Flower</b>    | It Contains Fresh Flower and Leaves of <i>Hibiscus Rosa-Sinensis (Malvaceae)</i>                                   | Prevent hair loss, Promotes Hair Growth <sup>[14],[7]</sup>                          |
| 22 | <b>Curry Leaves</b>       | Leaves Of Curry Tree, <i>Murraya Koenigii</i> or <i>Bergera Koenigii (Rutaceae)</i>                                | Antioxidant Property, Support Hair Health <sup>[19]</sup>                            |
| 23 | <b>Nagarmotha</b>         | Dried Ripe Fruits of <i>Syperus-Rotundus (Syperaceae)</i>  | Treat Scalp Disorder <sup>[16]</sup>   |
| 24 | <b>Kalonji</b>            | It Obtained from Dried Fruits and Seeds of <i>Centratherum Anthelinticum (Asteraceae)</i>                          | Promote Hair Growth, Prevent Premature Greying, Improves Scalp Health <sup>[9]</sup> |
| 25 | <b>Soapnut</b>            | It Is Obtained from The Fruits Pulp of The Plant <i>Sapindus Saponaria (Sapindaceae)</i>                           | Nourishes Dry and Rough Hair <sup>[11]</sup>   |
| 26 | <b>Jathamamsi</b>         | It Consists of Dried Rhizomes of <i>Nardostachys Jathmamsi (Valerianaceae)</i>                                     | Anti-Dandruff Agent, Prevents Scalp Infection <sup>[15]</sup>                        |
| 27 | <b>Ziziphus</b>           | Genus Of Spiny Shrubs and Small Trees in the Buckthorn ( <i>Rhamanaceae</i> )                                      | Natural Shining Agent <sup>[19]</sup>  |
| 28 | <b>Kapur Kachri</b>       | Obtained From Roots and Rhizomes of <i>Hedychium Spicatum (Zinigeraceae)</i>                                       | Heals The Scalp, Reduce Hair Loss, Conditioner <sup>[4]</sup>                        |
| 29 | <b>Brahmi</b>             | Dried Leaves of <i>Sentlla Asiatica (Umbelliferae)</i>   | Support Health of Hair <sup>[7],[3]</sup>  |
| 30 | <b>Rosemary Leaves</b>    | Obtained From Dried Leaves of <i>Salvia Rosmarinus (Lamiaceae)</i>   | Antioxidant And Antimicrobial Property <sup>[11]</sup> ,                             |
| 31 | <b>Orange Peel Powder</b> | It Is Obtained from Dried Fruit Peel of <i>Citrus Sinensis (Rutaceae)</i>  | Antioxidant, Keeps Healthy Scalp, Removes Oil from Hair <sup>[4]</sup>               |
| 32 | <b>Gokhru</b>             | Is obtained from dried ripe fruits of plant <i>Tribulus Terrestris</i> and <i>Pedaliium Murex (zygophyllaceae)</i> | Anti-inflammatory, antimicrobial and antioxidant properties <sup>[6]</sup>           |
| 33 | <b>Pomegranate seed</b>   | Dried seeds of <i>Punica granatum (Punicaceae)</i>   | Antidandruff agent <sup>[7]</sup>  |
| 34 | <b>Guava leaves</b>       | Dried leaves of <i>Psidium guajava (Myrtaceae)</i>   | Antidandruff agent <sup>[7]</sup>  |

## METHOD OF PREPARATION

The Following steps are followed sequentially for the formulation of polyherbal shampoo powder.

- 1) **Drying:** All the powder are in dry form and grinded.
- 2) **Weighing:** All the required herbal powders for shampoo preparation are weighed individually.
- 3) **Size reduction:** Crude ingredients are size reduced using a hand-driven mixer individually.
- 4) **Mixing:** All these fine ingredients are mixed thoroughly by the mixer to form a homogenous fine powder.
- 5) **Sieving:** Then this fine powder is passed through sieve no.80 to get enough fine powder.
- 6) **Packing and Labelling:** Then it is packed and labelled suitable.<sup>[16]</sup>

## EVALUATION PARAMETER OF POLYHERBAL POWDER SHAMPOO

### A) ORGANOLEPTIC PROPERTY

Organoleptic evaluation involves assessing parameters such as colour odour taste and texture. colour and texture are evaluated through visual inspection and tactile sensation, respectively for taste and odour, a panel of five trained individual is formed, and random sampling is conducted.<sup>[20]</sup>

### B) GENERAL POWDER CHARACTERISTICS

**1. Particle size:** Particle size is a factor that influences a number of characteristics, such as spreadability and grittiness. It was measured using I.P. Standard sieves and mechanical shaking for ten minutes.<sup>[13]</sup>

#### 2. Angle of repose

In Angle of repose the fixed funnel method was used to calculate the angle of repose. A vertically adjustable funnel was used to pour the mixture until the desired maximum cone height (h) was achieved. The following formula was used to determine the angle of repose and measure by the heap radius (r).

Angle of Repose ( $\theta$ ): The radius of the base pile is denoted by r, the height of the pile by h, and the angle of repose by ( $\theta$ ).<sup>[17]</sup>

**Table no 2: Angle of repose.**<sup>[17]</sup>

| Angle of repose ( $\theta$ ) | Type of flow |
|------------------------------|--------------|
| <25                          | Excellent    |
| 25-30                        | Good         |
| 30-40                        | Passable     |
| >40                          | Very poor    |

### Funnel method

Required quantity of dried powder is taken in a funnel placed at a height of 6cm from a horizontal base. On the horizontal plane, the powder was allowed to flow and accumulate over the paper in a mound. The formula can be used to compute the angle of repose ( $\theta$ ) based on the height and radius of the powder.<sup>[17]</sup>

### Open-ended cylinder

The open-ended cylinder method involves placing the necessary quantity of dried powder on a horizontal surface in a cylindrical tube that is open at both ends. The funnel should then be lifted to create a heap.<sup>[17]</sup>

### 3. Bulk density

The term for expressing the relationship between a substance's weight in solid form versus its total space occupied when packed together is called bulk density. The specified volume of dry powder is accurately measured using a 50 milliliter graduated container marked at its capacity point. Subsequently, the cylindrical object falls freely in mid-air for an interval measured as two seconds before impacting squarely on a solid wooden platform. A measurement of the substance's mass is taken. Subsequently, the substance undergoes weighing. In order to achieve satisfactory outcomes, such repetitions occur repeatedly. Herein lies the method for calculating volumetric mass specified formula.<sup>[21]</sup>

$$\text{Bulk Density} = \frac{\text{The herbal powder shampoo's mass}}{\text{The herbal powder shampoo's volume}}$$

### 4. Tapped density

A denser mass resulting from physically striking a vessel containing powdered material is referred to as the tapped density. After determining the powder's volume or weight through an initial measurement, the container holding it undergoes mechanical tapping for approximately one minute. During this period, continuous monitoring records any subsequent changes in either quantity until minimal further alterations occur. The standard measure is given in grams for each cubic centimeter ( $\text{g}/\text{cm}^3$ ).<sup>[20]</sup>

$$\text{Tapped density} = \frac{\text{weight of powder}}{\text{Tapped volume of powder}}$$

## 5. Hausner's ratio

Hausner's ratio is a measure of how well a powder flows. If the ratio is less than 1.25, it means the powder flows well. It is calculated using this formula.<sup>[17]</sup>

$$\text{Hausner's ratio} = \frac{\text{Tapped Density}}{\text{Bulk Density}}$$

**Table no. 3: Hausner's ratio.**<sup>[17]</sup>

| Hausner's ratio | property        |
|-----------------|-----------------|
| 0.1-1.25        | Free flowing    |
| 1.25-1.6        | Cohesive powder |

## 6. Carr's index

Carr's index is an important way to describe the behavior of powders and granules. It is calculated using this equation, and its categories are shown in the table.<sup>[17]</sup>

$$\text{Carr's Index (I)} = \frac{(\text{Tapped density (TD)} - \text{Bulk density (BD)}) \times 100}{\text{Tapped density (TD)}}$$

**Table no 4: Carr's Index.**<sup>[17]</sup>

| % Compressibility Index | Properties     |
|-------------------------|----------------|
| 5-12                    | Free Flowing   |
| 12-19                   | Good           |
| 19-21                   | Fair           |
| 23-31                   | Poor           |
| 33-38                   | Very Poor      |
| > 40                    | Extremely Poor |

## C) PHYSICOCHEMICAL PROPERTY

### 1. pH

The pH of a 10% shampoo solution in distilled water was tested at room temperature (25°C). The solution was made by mixing the shampoo powder with distilled water until it was fully dissolved. A digital pH meter was used to measure the pH.<sup>[17]</sup>

### 2. Washability

The ease with which the shampoo formulations could be washed off was tested by applying the prepared shampoo powder to the skin and then rinsing it with water. The washability was judged based on how quickly it rinsed off and whether there was any residue left on the skin. This test was done under standard conditions to make sure the results were reliable and consistent.<sup>[17]</sup>

### 3. Solubility

The capability of a fabric to dissolve in a particular solvent is called its solubility, and its miles typically measured in phrases of the volume of solvent had to One milliliter of liquid or one gram of cloth should be dissolved liquid. While a pharmacopeia's solubility the descriptive content material is tough to recognize terms are used to explain its approximate variety of solubility. Amongst those descriptive terms are extremely soluble, easily soluble, soluble, and sparingly soluble, quite soluble, very slightly soluble, and almost insoluble, depending on the amount of the solvent had to dissolve.<sup>[17]</sup>

**Table No. 5: Solubilty Classification.**<sup>[17]</sup>

| <b>Descriptive Term</b>      | <b>Relative Quantity of Solvent Required</b> |
|------------------------------|--|
| <b>Very Soluble</b>          | Less than 1 parts                            |
| <b>Freely Soluble</b>        | 1to 10 parts                                 |
| <b>Soluble</b>               | 10 to 30 parts                               |
| <b>Sparingly Soluble</b>     | 30 to 100 parts                              |
| <b>Slightly Soluble</b>      | 100 to 1000 parts                            |
| <b>Very Slightly Soluble</b> | 1000 to 10,000 parts                         |
| <b>Practically Insoluble</b> | More than 10,000 parts                       |

### 4. Loss On Drying

Loss on drying is the mass loss measured in percentage m/m. After precisely weighing grams of the powder, it changed into positioned onto a dry Petri plate. The Petri plate is protected with calcium chloride crystals and stored in a desiccators for 2 days. After that, the powder became carefully weighed to determine the weight loss throughout drying.<sup>[20]</sup>

### 5. Skin/ eye irritation test

An analysis of skin and eye irritation indicates that herbal shampoo powder has no terrible effects at the pores and skin or eyes. The absence of synthetic surfactants is the purpose of this the general public of those synthetic surfactants motive corneal soreness and eyelid irritation. However, all the factors used in this natural shampoo powder formula come from herbal sources therefore, it has no terrible outcomes on the pores and skin or eyes.<sup>[7]</sup>

#### **Skin Irritation Test**

It is counseled to carry out a patch test on your skin earlier than the usage of numerous cosmetics, whether they're hand-crafted or business. This is to make certain you won't revel in an allergic response to the product, and if you do, it'll best affect a small part of your pores and skin and be easily dealt with.

Step 1 - Pour or squeeze out a little of the cosmetic preparation onto your wrist.

Step 2 - Put a little of the product on the pulse of your wrist or the bend of your elbow.

Step 3 - Let the product stay on your skin for 15 to 20 minutes.

Step 4 - Check for any allergic reactions. Common signs of an allergic reaction include redness, rash, pimples, itching, pain, flaking, or other skin irritation. Some people might also feel sick or have trouble breathing. If any of these happen, stop using the product right away.

Step 5 - Keep using the product if you don't have any allergic reaction. If you don't have any symptoms, the product is probably safe for your skin type.<sup>[21]</sup>

## 6. Moisture Content Determination

10 g of each natural shampoo powder and heated (105°C) in an air oven. Repeated the drying manner till the constant weight reduction become cited following the a 1/2-hour hole. The quantity of moisture was computed for each pattern using formula.<sup>[20]</sup>

$$\text{Moisture Content\%} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

## 7. Foaming Capacity

Foam stability test was used to assess the foaming ability of herbal shampoo powder.<sup>[17]</sup> Specifically, two grams of shampoo 50 ml water mixed with powder in one Graduated cylinder. The mixture was shaken aggressively for a predetermined time to produce foam. The height of the foam was immediately noted, and then at a predetermined period to evaluate the foam Stability. Foaming capacity was determined using Calculating initial volume and retention of foam with time.<sup>[17]</sup>

$$\text{Foaming Capacity} = \frac{\text{Foam volume at time (t)}}{\text{Initial Foam Volume}} \times 100$$

## 8. Wetting Agent

The canvas became divided into discs with a median weight of 0.44 g and a diameter of one inch. The disc changed into floating at the 1%w/v shampoo solution's floor, and the stopwatch started. The amount of time wanted It changed into measured exactly when the disc started to sink and recorded because the time of wetness.<sup>[20]</sup>

## 9. Dirt Dispersion

A huge test tube containing 10 millilitres have become filled with drops of 1% every shampoo powder distilled water. India ink became installed one drop; The check tube come to be sealed and given ten shakes. It changed into predicted how an entire lot ink changed into inside the foam as Heavy, mild or None.<sup>[16]</sup>

## 10. Stability Study

Formulations had been proven to be chemically and physically solid with the aid of the stableness and acceptability of their organoleptic traits (colour and smell) for the duration of the garage term.<sup>[7]</sup>

## 11. Extractive values

### Determination of alcohol-soluble Extractive

Every air-dried herbal shampoo powder weighing 5 grams changed into macerated with 100 milliliters of Alcohol of the specified strength in a closed flask with frequent shaking for an entire day for six hours earlier than being left to face for eighteen hours. Filtered, by adopting safety measures towards lack of solvent, 25 milliliters of the filtrate had been dried out in a shallow bag with a flat backside dish, dry to a steady weight at 105 °C, and weigh the percentage of alcohol-soluble. Calculations were made for the extractive inside the air-dried medicine.

### Determination of water-soluble extractive

Determination of water-soluble extractive: Using chloroform water rather than ethanol, the procedure for determining alcohol-soluble extractive was followed. For every sample, the proportion of water-soluble extractive was determined.<sup>[20]</sup>

## 12. Ash value

The total inorganic content of the herbal shampoo powder was estimated using the ash value method. Two grams or so of the powdered mixture was put in a silica crucible that had been previously weighed and first burned at a low temperature. The warmth was progressively raised until the sample was fully scorched, turning red-hot. The After that, the crucible was let to cool in a desiccators and the amount of ash left was weighed. The entire amount of ash The following formula was used to determine content<sup>[17]</sup>

$$\text{Total Ash (\%)} = \frac{\text{Weight of Ash}}{\text{Initial Weight of Sample}} \times 100$$

### Acid-insoluble ash value

It is decided to evaluate whether the herbal shampoo contains silica, sand, and other insoluble contaminants powder. The total amount of ash from the prior The ash value test was cooked using 25 milliliters of diluted dissolve hydrochloric acid (HCl) for five minutes materials that dissolve in acid. The residue that was insoluble was then gathered and cleaned in a Gooch crucible completely with hot water to get rid of any residual acid, which was then ignited in a muffle furnace until a steady weight was reached. Then after allowing the crucible to cool in a desiccator, the final weight was noted. The insoluble in acid Ash was computed using the following formula<sup>[17]</sup>

$$\text{Acid Insoluble Ash (\%)} = \frac{\text{Weight of Acid Insoluble Ash}}{\text{Initial Weight of Sample}} \times 100.$$

### CONCLUSION

The formulation and evaluation of a poly herbal shampoo powder with antifungal and antidandruff activity aligns well with the growing demand for natural and eco-friendly products. Advances in herbal formulation technologies, scientific evaluation methods, and sustainable practices will enhance product efficacy, safety, stability, and consumer acceptance, supporting its future market potential. By removing harsh synthetic chemicals and using powerful natural ingredients like shikakai, hibiscus, and other traditional plant powders, the formulation provides several therapeutic benefits such as dandruff control, antifungal action, scalp nourishment, and hair strengthening. It has excellent cleansing properties, good foaming ability, and improved wetting time, while being gentle on the scalp and hair. Unlike synthetic shampoos that can damage the hair cuticle and cause dryness and breakage, this polyherbal powder shampoo supports healthy, smooth, and shiny hair. Overall, the formulation not only meets the expected performance but also exceeds many commercial products in terms of safety, effectiveness, and holistic hair care benefits.

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