

Formulation, Standardization, And In Vitro Evaluation of A Polyherbal Anti-Dandruff and Hair Growth Powder Shampoo Containing Mucuna Pruriens and Cyperus Scariosus (Nagarmatha)

Rutuja J. Thakre¹, Sofiya Naaz Mohd Bashir Ansari², Ayush Narendra Gaiki³, Mohammad Jafar Shaikh Ibrahim⁴, Aryan Sanjay Helonde⁵, Rohit Konge⁶, Ramsha Niyamat Khan⁷
^{1,2,3,4,5,6,7}Shri K. Pandav Institute of Pharmacy, Nagpur

Abstract—Common hair conditions that have a detrimental impact on the health of the scalp and the appearance of hair include dandruff and hair loss. Interest in herbal shampoos is rising as people become more conscious of the negative effects of synthetic shampoos. In this study, *Mucuna pruriens* and *Cyperus scariosus* (Nagarmatha) were combined with other medicinal herbs like Reetha, Shikakai, Amla, Hibiscus, Bhringraj, Henna, Onion, and Orange Peel to create, standardize, and assess a polyherbal anti-dandruff and hair growth powder shampoo. The organoleptic properties, flow characteristics, physicochemical parameters, foaming ability, washability, stability, and safety of three formulations (F1, F2, and F3) were prepared and assessed. With pH values between 5.11 and 5.90, all formulations showed acceptable color, odor, texture, and flow characteristics, making them appropriate for scalp application. The formulations demonstrated moderate to good foaming qualities, good washability, satisfactory cleansing action, and no indications of skin or eye irritation. With the highest foaming index (250), the shortest wetting time (92 s), and better hair manageability after washing, F3 outperformed the other tested formulations. Studies on stability verified that the formulations did not change while being stored. The results indicate that for managing dandruff and encouraging healthy hair growth, the developed polyherbal powder shampoo is a safe, efficient, affordable, and environmentally friendly substitute for synthetic shampoos.

I. INTRODUCTION

A person's hair is an essential component of their beauty. Since ancient times, people have used herbs to clean, beautify, and manage their hair. These factors drew the community to herbal products because they

are less costly and have few adverse effects. In addition to cleaning hair, it also gives it a glossy finish and keeps hair manageable and less oily. [1]

Shampoo is a hair care product used to clean hair; it usually takes the form of a viscous liquid. Shampoo is used to remove accumulated dirt from hair, nourish it, and give it a healthy appearance without removing too much sebum. Given that shampoos are a common cosmetic item, the shampoo industry is likely the biggest market for hair care products. Although there are many synthetic shampoos on the market today, both medicated and non-medicated, herbal shampoos are becoming more and more popular because of their natural origin, safety, rising consumer demand, affordability, and minimal side effects. [2]

A variety of ingredients, including surfactants, solvents, coloring agents, pH adjustments, binders, preservatives, and more, are included in the formulation of shampoo. The Indian word *cāpnā*, which means “push,” is where the word “shampoo” originated. It was expanded to refer to the process of washing hair. Market-available shampoos come in a variety of forms, including powder, liquid, lotion, cream, jelly, and aerosol. Shampoos may contain additional ingredients to customize their use [3].

Without hair, human beauty is lacking. Since ancient times, herbs have been used to manage, clean, and decorate hair. Although synthetic agents have grown in popularity over time, consumers are growing more aware of their detrimental effects on skin, hair, and eyes. Due to their lower cost and fewer side effects, these factors attracted consumers to herbal products. In addition to cleaning hair, hair cleansers and

shampoos are used to add luster and maintain manageable, oily hair. Powder shampoo, clear liquid shampoo, liquid shampoo, lotion shampoo, solid gel shampoo, medicated shampoo, liquid herbal shampoo, and so forth are the different types of shampoos.

Herbal shampoos meet the stability criteria. They can be antiseptic or antidandruff shampoo, simple or plain shampoo, or nutritional shampoo with proteins, vitamins, amino acids, and hydrolysate. Since the beginning of time, herbs have been used to treat illness and preserve health. Numerous works of literature provide a wealth of information about traditional aspects of functionally essential natural items and their application in skin and hair care, as well as folklore traditions in different parts of the nation.

In addition to providing the body with nutrients, phytochemicals hold great promise for hair care. Herbs are widely used in conditioners, shampoos, and rinses because they have long been linked to hair care. The active ingredients used in hair care powders are often chosen based on their capacity to both prevent skin damage and enhance the quality of the skin by cleansing, nourishing, and protecting the skin. We describe the creation and assessment of a polyherbal hair care shampoo in this paper.

Split ends, dandruff, white hair, and hair loss are examples of hair issues. Hair issues can be brought on by tension, scalp infections, hormone imbalances, low vitamin, food, and mineral intake, and overuse of chemical shampoos. Our project's primary objective was to find solutions for each of these issues. Consequently, we developed polyherbal antidandruff shampoo, a versatile shampoo for hair care. Nowadays, maintaining clean hair and scalp is one of the most crucial aspects of one's personal life. A major cosmetic concern worldwide, dandruff is a clinical condition caused by the *Malassezia* (*Pityrosporum*) species. Seborrheic dermatitis is believed to be influenced by *Pityrosporum ovale*. Dandruff is known to be controlled by fungistatic ingredients found in antidandruff shampoos.

Herbal formulations are becoming more and more popular worldwide. Because they are safer and have fewer side effects than antidandruff shampoo, natural remedies are more widely used. People are increasingly turning to herbal or ayurvedic remedies for a range of acute issues as well as chronic illnesses. Because Ayurvedic formulations guarantee therapy

with few side effects, they have shown promise for cosmetic use. Depending on the degree and circumstances of the environment, a variety of skin and hair disorders are encountered in the context of altering eating habits and stress.

Extraneous treatment is necessary because maintaining other factors won't satisfy the need. An appropriate selection of Ayurvedic ingredients with their properties is crucial for safe treatment of hair conditions like dandruff. The necessary dosage forms and amounts can be prepared as shampoo to fight dandruff. Natural components like Velvet Bean (*Mucuna pruriens*), Nagarmatha (*Cyperus scariosus*), Reetha (*Sapindus mukorossi*), Shikakai (*Senegalia rugata*), Amla (*Phyllanthus emblica*), and Aloe Vera (aloe) were used to create the herbal shampoo powder. They both have anti-dandruff and hair growth qualities. [4]

II. SHAMPOO'S IDEAL QUALITIES

1. To make the hair glossy and silky.
2. Generate a substantial amount of foam.
3. It shouldn't irritate the skin, scalp, or eyes.
4. Rinsing with water should make it easy to remove the shampoo.
5. Should produce manageable, silky, glossy, and non-dry hair.
6. The hand shouldn't get chapped or rough.
7. To create a smooth, glossy finish for the hair.
8. Produce a substantial amount of foam.
9. Apply a pleasing scent.
10. Dirt must be successfully and completely removed [7,3]

Shampoo's purposes

1. Dirt or soil should be completely and successfully removed.
2. The hair should be successfully cleaned.
3. To satisfy the user, a sufficient amount of foam should be produced.
4. It should be readily removed by rinsing with water.
5. It should give the hair a nice scent.
6. It shouldn't irritate the skin or eyes or have any negative effects.
7. It should be easily removed by rinsing with water.
8. Enough action should be produced to satisfy the user. [7,3]

Objective of Herbal Shampoo

1. Advance hair development.
2. Animates the arrangement of new and solid roots.
3. Biodegradable and earth-cordial.
4. Cost-cordial is not much costly.
5. Easily available and found in large variety and quality.
6. Effectively consolidate in skin and hair. [7]

Shampoo Categories

1. According to appearance.
 - 1) Shampoo in powder form
 - 2) Lotion or liquid shampoo
 - 3) Solid or gel shampoo
 - 4) Cream shampoo
 - 5) Oil shampoo
 - 6) Other medicated or anti-dandruff shampoos

2. According to Function or Use.

- 1) Conditioning shampoo
- 2) Antidandruff shampoo
- 3) Therapeutic shampoo
- 4) Baby shampoo
- 5) Shampoo that balances
- 6) Shampoo that clarifies

3. According to place of origin:

- 1) Herbal shampoo
- 2) Egg shampoo

Shampoo evaluation includes physiochemical controls like pH, density, and viscosity as well as quality control tests like visual evaluation. [3]

III. ANATOMY OF HAIR

About 95% of the structure of hair is composed of keratin, a type of fibrous protein. Every hair has a shaft that extends above the skin's surface and a root that is found in the scalp.

Dermal follicles are where hair leaves the body, and the shaft is made up of three layers:

- 1) Cuticle,
- 2) Cortex
- 3) Medulla.

The cortex provides elasticity and strength, the cuticle serves as the outermost protective layer, and the medulla, if it is present, adds to the internal structure. Dandruff, hair loss, split ends, and dryness are

common issues with hair. Dandruff can indirectly lead to hair loss because it is a non-inflammatory scalp condition marked by flaking of the scalp. Fall risk factors include stress, nutritional deficiencies, hormonal imbalances, and excessive use of harsh chemical products on hair. Split ends are caused by damage to the hair's cuticle from dryness, excessive combing, or chemicals.

The loss of natural oils in hair causes dryness, which is typically made worse by surfactants found in shampoos. An ideal shampoo should produce stable foam, clean hair and scalp efficiently without causing irritation or dryness; maintain a pH of roughly 5.5–6 (slightly acidic), be biodegradable, and be safe for repeated use. Herbal shampoos also maintain the hair's natural color, boost shine, lessen hair loss, and cause less irritation because they contain plant-based ingredients. These formulations typically rely on pure organic ingredients for both conditioning and cleaning, avoid the use of harsh surfactants like SLS, and are cruelty-free. [5]

A cross-section of the scalp and the structure of hair as it is rooted in the layers of skin are depicted in Figure 1, a diagrammatic representation of hair anatomy. It makes a clear distinction between the internal structures and the external Hair Shaft, which is made up of the central Medulla, the structural Cortex, and the protective Cuticle.

The Hair Follicle, which is necessary for growth, encloses the base of the hair, known as the Hair Root. Importantly, the diagram shows the Dermal Papilla, which is abundant in blood vessels that supply essential nutrition, along with auxiliary organs like the Arrector Pili Muscle and the Sebaceous Gland for natural lubrication. This image provides a basic point of reference for comprehending the biological processes and overall health of hair.[6]

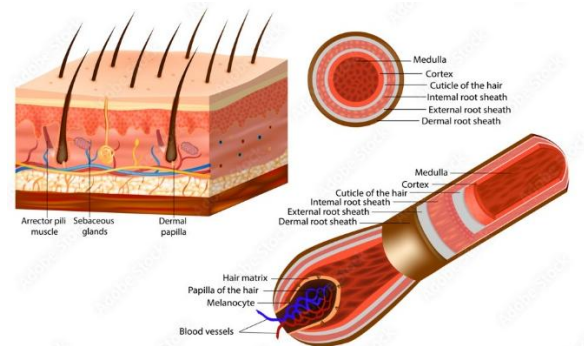


Figure 1: Hair anatomy diagram illustrating the structural elements of the hair shaft and follicle

Hair Problems

Numerous common issues can affect the health, appearance, and growth of hair. Dandruff, a mild, non-inflammatory scalp condition marked by flaky skin shedding, is one such problem. Dandruff is not dangerous, but it can be uncomfortable and may be linked to hair thinning because it irritates the scalp, with flakes frequently sticking to the roots. Hair loss is another common concern that can be brought on by hormonal imbalances, psychological stress, certain medications, or excessive use of hair-styling products. These elements cause thinning or excessive shedding by interfering with the regular cycle of hair growth. When the sebaceous glands overproduce sebum, the scalp and hair appear greasy even after frequent washing. This is referred to as greasy or oily hair. On the other hand, insufficient intake of essential nutrients or protein is frequently the cause of dry hair. Menopause, anemia, and the use of hormonal contraceptives are examples of hormonal changes that can affect it. The result of this dehydration is dull, brittle strands.

Last but not least, split ends indicate damage to the hair, which is frequently brought on by dehydration, excessive heat styling, chemical treatments, or environmental stressors. When exposed to harmful conditions, hair weakens and splits at the ends, impairing its general health and appearance [6].

Benefits of Using Herbal Shampoo

Because of their natural composition, gentle nature, and many advantages for the scalp and hair, herbal shampoos are becoming more and more popular. Herbal shampoos are made with plant-based

ingredients that support the body's natural functions, in contrast to conventional shampoos that often include parabens, sulphates, harsh chemicals, and artificial fragrances. [10].

All skin types, including those with sensitive or allergy-prone skin, can use these products because they are made with skin-friendly ingredients that are mild on the scalp. Herbal shampoos help maintain the scalp's natural oil balance, which is crucial for preventing dryness, flaking, and irritation. Ingredients such as aloe vera, neem, tea tree oil, and chamomile are frequently used for calming and anti-inflammatory properties. [11]

Advantages of Choosing Herbal Shampoo

Completely cruelty-free, created without using animals in any way during the production process. We make sure that no animals are harmed or used in our testing procedures because we are dedicated to upholding ethical standards. This strategy offers consumers safe and effective outcomes while demonstrating a commitment to compassionate practices [8]. It is specifically designed to be safe and gentle for skin types that are sensitive. It offers calming care while preserving skin comfort thanks to its gentle ingredients, which reduce the possibility of irritation or negative reactions. It works well without sacrificing safety or causing discomfort, making it perfect for people with sensitive skin [9].

IV. MATERIAL AND METHODS

1. INGREDIENTS

TABLE 3: - Selected herbal drugs in dried form were purchased from the authenticated agencies.

Sr. no	Ingredient	Common name	Biological source	Family	Activity
1	Reetha	Soapnut	Sapindus mukorossi	Sapindaceae	Natural saponin surfactant
2	Mucuna pruriens	Velvet Bean / Kaunch	Mucuna pruriens	Fabaceae	Anti-aging, radical scavenging, root strengthening
3	Nagarmatha	Nut grass	Cyperus rotundus	Cyperaceae	Scalp disorder
4	Shikakai	Soapbark	Acacia concinna	Mimosaceae	Foam base and anti-dandruff.
5	Amla	Indian Gooseberry	Phyllanthus emblica	Euphorbiaceae	Darkening of hairs and hair growth promoter.
6	Hibiscus	Gudhal / Jaswand	Hibiscus rosa-sinensis	Malvaceae	Prevents hair loss and growth promoter.

7	Bhringraj	False Daisy	Eclipta alba	Asteraceae	Nourish the roots and encourage hair growth
8	Heena	Mehendi	Lawsonia inermis	Lythraceae	Growth of hair, Conditioner
9	Onion	Pyaj	Allium cepa	Amaryllideace	Promote hair growth and reduce hair fall
10	Orange peel	Santra chilka	Citrus sinensis	Rutaceae	Perfuming agent

2. FORMULATION OF HERBAL POWDER SHAMPOO [15]

1. Drying

Every powder has been ground and is in dry form.



2. Weighing

Each of the necessary herbal powders for making shampoo was weighed separately.



3. Size reduction

After gathering the crude ingredients, each one was reduced in size using a hand-driven mixer.



4. Mixing

A mixer was used to thoroughly combine all of these fine ingredients to create a uniform fine powder.



5. Sieving

To obtain an adequate amount of fine powder, this fine powder was then run through sieve number 120.



6. Packing and labelling

Then it was packed and labeled suitably. The amount needed to prepare 100g of herbal powder shampoo



FIGURE 2: - ALL INGREDIENTS

TABLE 4: -FORMULA FOR HERBAL POWDER SHAMPOO

Sr.no	Ingredient	F1	F2	F3
1	Reetha	12gm	14gm	18gm
2	Mucuna pruriens	18gm	16gm	16gm
3	Nagarmatha	12gm	14gm	12gm
4	Shikakai	14gm	14gm	16gm
5	Amla	12gm	9gm	8gm
6	Hibiscus	14gm	13gm	12gm
7	Bhringraj	10gm	8gm	8gm
8	Heena	4gm	5gm	4gm
9	Onion	2gm	5gm	4gm
10	Orange peel	2gm	2gm	2gm
	TOTAL	100gm	100gm	100gm

3. EVALUATION FOR HERBAL POWDER SHAMPOO

1) Organoleptic evaluation

Color, odor, taste, and texture were all evaluated organoleptically. Vision and touch sensation were used to assess color and texture, respectively. A team of five taste and odor-sensitive individuals was assembled for the purpose of evaluating taste and odor, and random sampling was carried out. [16]

2) General powder characteristics

Evaluation of the factors that will influence the preparation's external characteristics, such as flow characteristics, appearance, packaging requirements, etc., is part of general powder characteristics. This section evaluates bulk density, angle of repose, and powder form. Three distinct levels—the top, middle, and lower levels—were used to collect samples for each of these evaluations. [18]

1. Particle size [18]

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.

2. Angle of repose [18]

It is described as the greatest angle that can exist between the powder pile's surface and the horizontal flow. A funnel positioned six centimeters above a horizontal base is used to collect the necessary quantity of dried powder. On the horizontal plane, the powder was allowed to flow and accumulate over the paper in a heap.

The formula can be used to determine the angle of repose (θ) based on the powder's height and radius.

$$\theta = \tan^{-1}(h / r)$$

Where,

θ – Angle of repose,

h – Height of the heap,

r – Radius of the base

3. Bulk density [17]

The bulk density of a powder is calculated by dividing the mass of an untapped powder sample by its volume, which includes the interparticulate void volume contribution. As a result, both the density of the powder particles and their spatial arrangement determine the bulk density. The unit of measurement for bulk density is g/cm³. The necessary quantity of herbal shampoo was taken in a graduated cylinder with a volume of 50 ml.

The graduated cylinder was filled with powder. This was transferred to a bulk density apparatus and bulk density was calculated. It is an important property for packaging and uniformity in the bulk of the product.

$$\text{Bulk Density} = \frac{\text{Mass of powder (M)}}{\text{Bulk volume of the powder (V}_b\text{)}}$$

4. Tapped density [17]

The tapped density is an increased bulk density attained after mechanically tapping container containing the powder sample. The measuring cylinder or vessel is mechanically tapped for one mined volume or mass after the initial powder volume or mass is observed. After that, measurements are made until there is very little change in the mass or volume.

The unit of measurement was grams per cubic centimeter (g/cm³).

$$\text{Tapped Density} = \frac{\text{Mass of powder (M)}}{\text{Tapped volume of the powder (V}_t\text{)}}$$

3)Physicochemical evaluation

1. Moisture content [17]

The formulation's moisture content is crucial because it contains herbs that the weather may attack. Two grams of powder were dried in an oven for two continuous readings, and the percentage moisture content was calculated as w/w.

2. Dirt dispersion [17]

Two drops of herbal shampoo were added in a large test tube contain 10 ml of distilled water. 1drop of India ink was added; the test tube was stoppered and shakes it ten times. Light was used to estimate the amount of ink in the foam.

3. pH [17]

At room temperature (25°C), the pH of a 10% shampoo solution in distilled water was measured. A digital pH meter was used to measure the pH.

4. Water Solubility [17]

The ability of a substance to dissolve in a solvent is known as its solubility. After precisely weighing one gram of the powder, it is put into a beaker with 100 milliliters of water. To improve the solubility, this was thoroughly shaken and heated. After cooling and filtering, the residue is weighed and recorded.

5. Foaming Index [17]

After precisely weighing one gram of the powder, it was put into a 250 ml conical flask with 100 ml of boiling water. After 30 minutes of gentle heating, it is cooled, filtered, and the volume is increased to 100 milliliters in a standard volumetric flask. Ten test tubes are filled with this extract in successive portions of 1, 2, 3, 10 ml, and the remaining volume is filled with 10 ml of water. After that, the test tubes were shaken at a speed of two frequencies per second in a longwise direction for fifteen seconds. After that, the tubes are left to stand for fifteen minutes. The foam's height was measured.

$$\text{Foaming Index} = \frac{\sqrt{1000}}{A}$$

Where, A is the volume in ml of the decoction used for preparing the dilution in the tube where foaming to a height of 1 cm is observed.

6. Washability [18]

After applying formulations to the skin, the degree and ease of washing with water were manually assessed.

7. Loss on drying [18]

Loss on drying is the mass loss measured in percent m/m. After precisely weighing two grams of the powder, it was put into a dry Petri dish. The Petri dish is covered with calcium chloride crystals and kept in a desiccator for two days. After that, the powder was precisely weighed to determine the amount of weight lost during drying.

8. Extractive values [18]

Determination of alcohol-soluble extractives

In a closed flask, 5 g of each air-dried herbal shampoo powder was weighed and macerated with 100 ml of alcohol of the designated strength for 24 hours. The flask was then shaken frequently for six hours and left to stand for eighteen hours. After filtering, 25 milliliters of the filtrate were evaporated to dryness in a shallow dish with a flat bottom, dried at 105 degrees Celsius to a constant weight, and weighed while taking precautions to prevent solvent loss. In relation to the drug that had been air-dried, the percentage of alcohol-soluble extractives was computed.

Determination of water-soluble extractive

Followed the instructions for determining the alcohol-soluble extractive, substituting ethanol with chloroform water. For every sample, the percentage of water-soluble extractives was computed.

9. Ash value [18]

The inorganic contents, which are typical of a herb, are determined by calculating the ash value.

A silicon dish containing about 2 grams of powdered medication was weighed after it had been ignited. The temperature was raised by progressively raising the heat without turning it red. Ash is cooled and weighed once it has finished burning.

10. Wetting time [18]

The canvas was cut into discs with an average weight of 0.44 g and a diameter of 1 inch. The stopwatch

began when the disc floated on the surface of a 1% w/v shampoo solution. The wetting time was defined as the amount of time needed for the disc to start sinking.

11. Stability Study [18]

Stability and acceptability of the formulations' organoleptic characteristics (color and odor) throughout the storage period demonstrated their chemical and physical stability.

12. Nature of hair after washes [18]

By gathering volunteer responses, one can determine the nature of hair after washing.

13. Swelling index [18]

The volume in milliliters that one gram of a drug, including any adhering mucilage, takes up after swelling in an aqueous liquid for four hours is known as the swelling index. 1 g of the powder was precisely weighed and then put into a glass stopper measuring cylinder with 25 ml of water. After that, it is vigorously shaken every ten minutes for an hour. It was then stored at room temperature for three hours. The volume was expressed in milliliters.

14. Skin / eye irritation test [18]

The tests for skin and eye irritation showed that the herbal shampoo powder has no negative effects on the skin or eyes. The lack of artificial surfactants is the cause of this. The majority of synthetic surfactants cause corneal irritation and eyelid inflammation. However, all of the ingredients in this herbal shampoo powder formulation come from natural sources. Therefore, it has no negative effects on the skin or eyes.

V. RESULT

Evaluation of polyherbal shampoo powder

1) Organoleptic evaluation: -

Table no 5: Organoleptic evaluation

Sr.no	Organoleptic evaluation	Result		
		F1	F2	F3
1	Colour	Faint brown	Faint brown	Light brown
2	Odour	Characteristic	Characteristic	Characteristic
3	Taste	Slight pleasant	Slight pleasant	Slight pleasant
4	Texture	Fine and smooth	Fine and smooth	Fine and smooth

2)General powder characteristics:

Table no 6: Angle of Repose calculation of herbal powder

Sr. no	Method		Height of cone (cm)	Diameter of cone (cm)	radius	Mean radius of cone	Tan θ = (h/r)	$\theta = \tan^{-1}(h/r)$	Flow property
1	Funnel Method	F1	2cm	5.1	2.55	2.48	0.80	38.66	Fair
				4.8	2.4				
				5	2.5				
		F2	2cm	5.2	2.6	2.75	0.72	35.75	Good
				5.5	2.75				
				5.8	2.9				
		F3	2cm	5.2	2.6	2.56	0.78	37.95	Fair
				5.3	2.65				
				5.5	2.45				

Table no.7: Bulk density calculation of herbal powder

Sr.no	Bulk volume(ml)	Mass of the powder(g)	Bulk Density(g/ml)	Average bulk density(g/ml)
F1	5.5 ml	2 gm	0.364	0.359
	5.8 ml	2 gm	0.345	
	5.4 ml	2 gm	0.370	
F2	5.9 ml	2 gm	0.339	0.347
	5.8 ml	2 gm	0.345	
	5.6 ml	2 gm	0.357	
F3	5.7 ml	2 gm	0.351	0.341
	6.1 ml	2 gm	0.328	
	5.8 ml	2 gm	0.345	

Table no.8: Tapped density calculation of herbal powder.

Sr.no	Tapped volume	Mass of the powder(g)	Tapped Density(g/ml)	Average tapped density(g/ml)
F1	3.5 ml	2 gm	0.571	0.538
	4.1 ml	2 gm	0.488	
	3.6 ml	2 gm	0.556	
F2	3.9 ml	2 gm	0.513	0.513
	3.8 ml	2 gm	0.526	
	4.0 ml	2 gm	0.500	
F3	3.9 ml	2 gm	0.513	0.492
	4.2 ml	2 gm	0.476	
	4.1 ml	2 gm	0.488	

Table no 9: Physicochemical Property

Sr.no	Physiochemical evaluation	Result		
		F1	F2	F3
1	Ph	5.9	5.11	5.18
2	Washability	washable	washable	washable
3	Solubility	Freely soluble	Freely soluble	Freely soluble
4	Skin/Eye irritation	Non-Irritant to skin	Non-Irritant to skin	Non-Irritant to skin
5	Foaming values	Moderate foaming	Moderate foaming	Good foaming

6	Extractive values a) Alcohol soluble b) Water soluble	25.8 % 31.2 %	23.8 % 25 %	22.4 % 21.8 %
7	Ash value	6.2 %	5.8 %	5.4 %
8	Dirt dispersion	moderate	moderate	moderate
9	Moisture content	5.8 %	5.4 %	4.9 %
10	Wetting time	128 sec	115 sec	92 sec
11	Stability	stable	stable	Stable
12	Nature of hair after washes	Soft manageable	Soft and shiny	Soft manageable

Table no 10: Foaming index calculation for herbal powder

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
1.	-	-	0.2	0.4	0.5	0.5	1.0	1.3	1.5	1.8
2.	-	-	0.2	0.5	0.7	1.0	1.1	1.4	1.7	1.9
3.	-	0.2	0.5	1.0	1.1	1.2	1.4	1.7	1.9	2.1

T1 - T10 Test tube numbers 1 to 10

Where 'A' represents the exact volume (in ml) of the herbal decoction in the specific test tube where a stable foam height of exactly 1 cm is measured
foaming index = $1000/a$

1. For formula 1 (F1)

The 1 cm threshold is reached in T7 (A = 7 ml).
foaming index = $1000/7$
=142.85

2. For formula 2 (F2)

The 1 cm threshold is reached in T6 (A = 6 ml).
foaming index = $1000/6$
=166.66

3. For formula 3 (F3)

The 1 cm threshold is reached in T4 (A = 4 ml).
foaming index = $1000/4$
=250.00

SKIN IRRITATION TEST FOR F1



FOR F2



FOR F3



HAIR WASH TEST



BEFORE



DURING



AFTER

VI. DISCUSSION

The present research focused on the formulation, standardization, and evaluation of a polyherbal anti-dandruff and hair growth powder shampoo containing *Mucuna pruriens* and *Cyperus scariosus* (Nagarmatha). The prepared formulations were evaluated for various organoleptic, physicochemical, and performance parameters to determine their suitability as an herbal hair care product.

The organoleptic evaluation showed that all formulations possessed acceptable color, odor, texture, and appearance, indicating good consumer acceptability. The angle of repose, bulk density, and tapped density results confirmed satisfactory flow properties of the powder formulations. The pH values of all formulations were found to be within the acceptable range for scalp application, suggesting that the formulations are safe and non-irritating to the skin and scalp.

The formulations demonstrated good washability,

moderate to good foaming ability, and satisfactory cleansing action. Among all formulations, F3 exhibited comparatively better foaming index, wetting time, and hair feel after washing, indicating better overall performance. The stability studies showed no significant changes in color, odor, or texture during storage, confirming the stability of the prepared formulations.

The herbal ingredients such as Reetha and Shikakai provided natural cleansing and foaming properties, while Amla, Hibiscus, Bhringraj, and Onion contributed to hair nourishment and hair growth promotion. *Mucuna pruriens* and *Cyperus scariosus* played an important role in controlling dandruff and maintaining scalp health due to their antioxidant and antifungal properties.

Overall, the study indicates that the formulated polyherbal powder shampoo is effective, safe, economical, and eco-friendly, and can serve as a promising alternative to synthetic shampoos for the management of dandruff and healthy hair care.

VII. CONCLUSION

The present study successfully formulated and evaluated a polyherbal anti-dandruff and hair growth powder shampoo containing *Mucuna pruriens* and *Cyperus scariosus* (Nagarmatha). The prepared formulations showed satisfactory physicochemical properties such as good flowability, acceptable pH, good foaming ability, washability, stability, and non-irritant nature.

Among all formulations, the optimized formulation demonstrated better cleansing action, moderate to good foaming properties, and maintained the hair in a soft, smooth, and manageable condition after washing. The herbal ingredients used in the formulation contributed to anti-dandruff, scalp cleansing, and hair nourishing activities.

Therefore, the developed polyherbal powder shampoo can be considered a safe, effective, eco-friendly, and economical alternative to synthetic shampoos for maintaining healthy hair and scalp conditions.

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