

Formulation and Evaluation of Polyherbal Powdered Shampoo for Healthy Hair

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www.jrasb.com || Vol. 4 No. 2 (2025): April Issue

Received: 03-04-2025

Revised: 13-04-2025

Accepted: 18-04-2025

ABSTRACT

Herbal powder shampoos have gained popularity as natural alternatives to chemical-based hair cleansers. They offer nourishment and cleansing without harmful additives. This study focuses on the formulation and evaluation of three herbal powder shampoo variants, each composed of carefully selected botanical ingredients known for their beneficial effects on hair health. The key ingredients include “Hibiscus, Amla, Reetha, Shikakai, Flaxseed, Henna, Rosemary, and Rose Petals”. Each ingredient contributes unique properties such as cleansing, conditioning, strengthening, and promoting hair growth. Hibiscus enhances shine and reduces hair fall, Amla is rich in antioxidants, Reetha provides natural cleansing, and Shikakai aids scalp health. Flaxseeds retain moisture, Henna conditions hair, Rosemary stimulates growth, and Rose Petals offer a soothing fragrance. The study involves preparation, phytochemical screening, and evaluation of the formulated shampoo in terms of pH, foaming capacity, solubility, washability and stability. The formulations differ slightly in ingredient proportions to optimize effectiveness for different hair types and concerns. Formulation 1 focuses on balanced cleansing and conditioning. Formulation 2 enhances cleansing properties, and Formulation 3 emphasizes scalp nourishment and hair strengthening. While Formulation 3 has the highest cleansing power due to increased Reetha and Amla, its lower conditioning agents make it less suitable for dry or normal hair. In contrast, Formulation 1 offers a balanced mix of cleansing and hydration, making it ideal for most hair types. Therefore, Formulation 1 is considered the best for maintaining scalp health and hair softness, while Formulation 3 is better suited for oily hair.

Keywords- polyherbal shampoo, it clears dirt, anti-dandruff, promote hair growth, conditioning, strengthens.

I. INTRODUCTION

Hairs are the integral part of human beauty. It is made up of a hair shaft, hair root, and hair follicle. The hair shaft is the visible part of the hair, while the hair root is in the skin.^[1]

Hair shaft

- The hair shaft is made up of three layers: the cuticle, cortex and medulla.
- The cuticle protects the inner layers of hair.
- The cortex is the middle layer that gives hair its strength, elasticity and color.
- The medulla is not always present, especially in the thinner hairs.

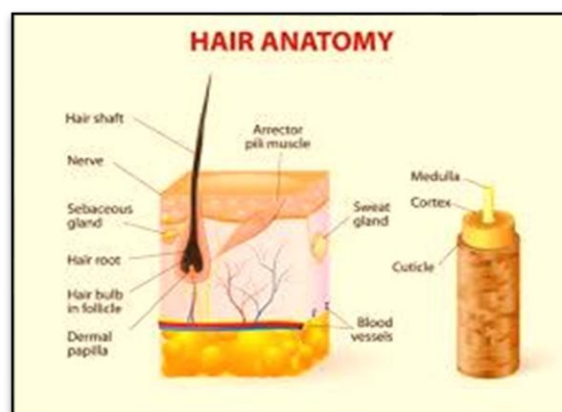


Fig. No. 01: Anatomy of Hair

Hair root

- The hair root widens to a hair bulb at the base of hair.
- The hair papilla, which supplies blood to the root, is located inside the button of the hair bulb.
- New hair cells are constantly being made in the hair bulb.

Hair follicle

- The hair follicle is a sheath of skin and connective tissue that surrounds the hair root.
- The hair follicle is connected to a sebaceous gland.
- The hair follicle also contains a tiny muscle called the arrector pili, which can make the hair stand up.

Hair color

- Hair color is determined by the pigment melanin, which is produced by melanocytes in the hair matrix.^[1]

1.1 Common Problems Related to Hair:-

Hair-related problems are common and can affect people of all ages. They may result from environmental factors, poor hair care, genetics, or underlying health issues.

Common causes that can responsible for hair related problem:-

1. Hair fall
2. Premature graying
3. Dry and frizzy hair
4. Dandruff (flaky scalp)
5. Split ends and breakage

1.2 Shampoos

People are using herbs for cleaning, beautifying and managing hair since the ancient era. Whereas the hair has been trimmed, shaped and even colored since the most ancient times, relatively little emphasis has been placed on the process of cleaning it.^[3] Only in this century has a real technology in the cleaning of the hair and scalp been developed.

First came the mass distribution of cake soap and sanitary facilities to make bodily cleanliness and personal hygiene practice.

Next came the specialization of branded shampoo products for the hair and scalp, offered in multiplicity of types and forms.^[4-6] Now, washing the hair and scalp with shampoo has become a nearly universal practice. Shampoos are probably the most widely used hair products today, based on synthetic ingredients as well as herbal ingredients.

1.2.1 Composition of Shampoo:-

- Surfactant
- Antidandruff agent
- Conditioning agent
- Pearlescent agents
- Sequestrants
- Thickening agents
- Colors, perfume and preservatives

1.2.2 Types of Shampoo

Shampoos are of the following types:

- Powder Shampoo
- Liquid Shampoo
- Lotion Shampoo
- Cream Shampoo
- Jelly Shampoo
- Aerosol shampoo
- Specialized shampoo
- Conditioning shampoo
- Anti-dandruff shampoo
- Baby shampoo
- Two Layer Shampoo etc.^[7]

Herbal formulation have growing demand in the world market. The natural remedies are more acceptable in market because it's safe and fewer side effect anti-dandruff shampoo and nutritional shampoo containing vitamin, amino acids proteins hydrolysate.^[13] Currently available treatment of dandruff include therapeutic use of zinc pyrithione, salicylic acid, imidazole derivatives, glycolic acid, steroids, and Sulphur and coal tar derivatives. However, these agents show certain limitations, either due to poor clinical efficacy or due to the Further more compliance issues, these drugs are unable to prevent recurrence.

The synthetic shampoo contains cationic, anionic and non-anionic surfactant mix in this surfactant having good foaming character but its toxic and caused irritation of eye. Hard water the surfactants leave a deposit of sodium, calcium and magnesium salts on the hair shaft. So, these synthetic shampoos are found to have side effects like drying effect on the hair. These shampoos leave the hair too dry to handle (or) comb, to avoid these problems, herbal shampoos will be useful.^[8]

1.3 Powder Shampoo:-

Definition: Powder shampoo is a waterless, dry version of liquid shampoo, designed to clean and revitalize hair without the need for water, often marketed as an eco-friendly and travel-friendly alternative.

Herbal powder shampoos are made from natural plant-based ingredients and are known for their gentle cleansing properties. They are free from synthetic chemicals, sulfates, and parabens, making them a popular choice for those seeking a more holistic and eco-friendly hair care option.

The herbal shampoo powder was formulated using natural ingredients with Hibiscus Flower, Amla, Reetha, Shikakai, Flaxseed, Heena, Rosemary leaves, Rose Petal.

1.3.1 Benefits of Each Ingredient:

- 1) Hibiscus Powder – Conditions hair, prevents dryness, and strengthens roots.
- 2) Amla (Indian Gooseberry) – Strengthens hair follicles, prevents premature graying, and adds shine.
- 3) Reetha (Soapnut) – Natural cleanser that removes excess oil and dirt while maintaining scalp health.

- 4) Shikakai – Gentle cleanser that promotes hair growth and prevents dandruff.
- 5) Flaxseed – Rich in omega-3 fatty acids, which nourish the scalp and improve hair elasticity.
- 6) Henna – Conditions the hair, adds a natural tint, and helps repair damaged strands.
- 7) Rosemary Leaves – Stimulates hair growth, improves scalp circulation, and reduces dandruff.
- 8) Rose Petals – Soothes the scalp, hydrates hair, and adds a natural fragrance.

1.3.2 Ideal Characters of Shampoo

- Should effectively and completely remove the dust, excessive sebum.
- Should effectively wash hair.
- Should produce a good amount of foam
- The shampoo should be easily removed by rinsing with water.
- Should leave the hair non dry, soft, lustrous with good, manageability.
- Should impart a pleasant fragrance to the hair.
- Should not make the hand rough and chapped.
- Should not have any side effects cause irritation to skin and eye.^[9]

✓ Advantages

1. Natural Cleansing

Reetha and Shikakai act as natural cleansers (mild surfactants), removing dirt, oil, and product buildup without stripping natural oils.

2. Promotes Hair Growth

Rosemary leaves stimulate blood circulation to the scalp, encouraging hair growth. Amla is rich in Vitamin C, strengthening hair follicles and reducing hair fall.

3. Strengthens and Conditions Hair

Flaxseed is packed with omega-3 fatty acids, which improve hair elasticity and prevent breakage.

Hibiscus powder deeply conditions, softens hair, and prevents dryness.

4. Prevents Dandruff and Scalp Issues

Shikakai and rosemary have antimicrobial properties that reduce dandruff and soothe itchy scalps.

Rose petals calm inflammation and balance the scalp's pH.

5. Delays Premature Graying

Amla and henna help maintain natural pigment and slow the graying process.

6. Eco-Friendly and Chemical-Free

Free from sulfates, parabens, and artificial chemicals, making it safe for regular use.

7. Suitable for Most Hair Types

Works well for oily, normal, and dry hair when used correctly.

✗ Disadvantages

1. Mild Lathering

Herbal powders like reetha and shikakai provide a gentle cleanse but do not produce a rich lather like synthetic shampoos.

2. Time-Consuming Preparation

Requires mixing with water or other liquids (like rose water) before application, which takes more effort than ready-to-use shampoos.

3. Dryness with Overuse

Shikakai and reetha can cause dryness if used too frequently, especially on already dry or curly hair.

Balance with moisturizing oils (like coconut or almond oil) if dryness occurs.

4. Storage and Shelf Life

Needs to be stored in an airtight container to prevent moisture absorption and spoilage.

II. AIM AND OBJECTIVE

2.1 Aim:-

The aim of herbal powder shampoo preparation is to create a natural, eco-friendly, and chemical-free hair cleanser that provides effective cleaning while nourishing the scalp and hair.

3.2 Objective:-

- ❖ Develop a Natural Alternative.
- ❖ Utilize Herbal Benefits.
- ❖ Promote Scalp Health.
- ❖ Enhance Hair Quality.
- ❖ Support Sustainability.
- ❖ Provide Safe Usage.
- ❖ Encourage Traditional Practices.
- ❖ Eco-Friendly Product.
- ❖ Customizable Formulation.
- ❖ Avoiding Harmful Chemicals.

III. PLANT PROFILE

1. Amla



Fig. No. 02 : Amla

- Synonyms: Indian gooseberry, Emblica
- Biological source: Amla consists of dried, as well as fruits of the plant *Emblica officinalis*.
- Family: Euphorbiaceae
- Taxonomy:
 - Kingdom: Plantae
 - Order: Sapindales
 - Family: Euphorbiaceae
 - Genus: *Emblica*
 - Species: *E. officinalis*

- General description:
 - Time: It grows mainly in places with temperature about 20 to 35 °C in month of May to June.
 - Colour: light greenish yellow.
 - Height: 8-18m
 - Part of plant use: fruits.
- Chemical constituents: vitamin c, fat, phyllembelin, tannin, phosphorus, iron, calcium.
- Use: hair growth promoter.
- Collection: The plant *Emblica officinalis* is collected from local area of Gondia, Maharashtra, India. The fruit is removed. Fruit is washed with water and cut into small pieces and shed dried.
- Cultivation: The plant *Emblica officinalis* is cultivated in various areas of Maharashtra Plant thrives in dry climate with annual rainfall. It prefers well-drained, loamy soil.
- Authentication: The plant *Emblica officinalis* is collected from local area of Gondia and plant is self authenticated.

2. *Hibiscus*



Fig. No. 03 : *Hibiscus*

- Synonyms: Tropical Hibiscus
- Biological source: this is obtained from the *Hibiscus rosa-sinensis* L. (Tropical Hibiscus)
- Family: Malvaceae
- Taxonomy:
 - Kingdom: Plantae
 - Order: Malvales
 - Family: Malvaceae
 - Genus: *Hibiscus*
 - Species: *rosa-sinesis*
- General description:
 - Time: It grows mainly in places with temperature about 15 to 30 °C in month of March to May
 - Colour: Red
 - Height: 2.5-5m
 - Part of plant use: Flower.
- Chemical constituents: flavonoids Amino acids, Vitamins.

- Use: Promotes Hair Growth Conditions and Softens Hair Reduces Dandruff and Itchiness Protects Hair from Damage.
- Collection: The plant *Hibiscus rosa sinensis* is collected from local area of Gondia, Maharashtra, India. The flower is removed. Flower is washed with water and shed dried and grind powder is prepared.
- Cultivation: The plant *Hibiscus rosa sinensis* cultivated in various areas of Maharashtra Plant thrives in warm, sunny climate. It prefers well-drained, slightly acidic soil.
- Authentication: The plant *Hibiscus rosa sinensis* is collected from medicinal garden of Manoharbhay Patel Institute of Pharmacy (Pharmacy), Kudwa, Gondia. College and authenticated from department of botany, Dhote Bandhu science College, Gondia.

3. *Reetha*



Fig. No. 04 : *Reetha*

- Synonyms: soapberry, washnuts, soapnuts.
- Botanical source: It is obtained from the plant of *Sapindus mukorossi* Gaertn.
- Family: Sapindaceae.
- Taxonomy:
 - Kingdom: Plantae
 - Order: Sapindales
 - Family: Sapindaceae
 - Genus: *Sapindus*
 - Species: *Sapindus mukorossi*
- General description:
 - Time: It grows mainly in places with temperature about 20 to 30 °C in month of November or December.
 - Colour: Brownish-yellow
 - Height: 12 to 20m.
 - Part of plant use: Fruit
- Chemical constituents: sapindoside A, B, and C, flavonoids, phenolic acids, and terpenoids.
- Use: Foaming Agent
- Collection: The plant *Sapindus mukorossi* is collected from local area of Gondia, Maharashtra, India. The fruit is removed. Fruit is washed with water and cut into small pieces and shed dried and grind powder is prepared.

- Cultivation: The plant *Sapindus mukorossi* is cultivated in various areas of Maharashtra Plant thrives in dry climate with annual rainfall. It prefers well-drained, loamy soil.
- Authentication: The plant *Sapindus mukorossi* is collected from local area of Gondia and plant is self authenticated.

4. Shikakai



Fig. no. 05 : Shikakai

- Synonyms: Saptals, shitala.
- Biological source: It is the dried gummy exudation of stem and branches of *Acacia concinna*
- Family: Leguminosae.
- Taxonomy:
 - Kingdom: Plantae
 - Order: Fabales
 - Family: Leguminosae
 - Genus: *Acacia*
 - Species: *Acacia concinna*
- General description:
 - Time: It grows mainly in places with temperature about 20 to 35 °C in month of April to May.
 - Colour: Dark brown or greyish brown.
 - Height: 3 to 10 meters
 - Part of plant use: Stem and branches
- Chemical constituents: Eugenol, caracol, and eugenol-methyl-ether, Caryophyllene
- Use: Foam base
- Collection: The plant *Acacia concinna* is collected from local area of Gondia, Maharashtra, India. The fruit is removed. Fruit is washed with water and shed dried and grind powder is prepare.
- Cultivation: The plant *Acacia concinna* is cultivated in various areas of Maharashtra Plant thrives in warm climate with dry plains. It prefers well-drained sandy or loamy soil slightly acidic to neutral pH
- **Authentication:** The plant *Acacia concinna* is collected from local area of Gondia and plant is self authenticated.

5. Rosemarry



Fig. No. 06 : Rosemarry

- Synonyms: Rosemary, Garden Rosemary, Romarin
- Biological source: It consist of all aerial parts of plant known as *Rosmarinus officinalis* L. belonging to
- Family: Lamiaceae
- Taxonomy:
 - Kingdom: Plantae
 - Order: Myrtales
 - Family: Lamiaceae
 - Genus: *Rosmarinus*
 - Species: *Rosmarinus officinalis*
- General description:
 - Time: It grows mainly in places with temperature about 15 to 25 °C in month of m June to July or September to October.
 - Colour: light greenish yellow.
 - Height: 1 m
 - Part of plant use: Leaves
- Chemical constituents: Essential oils (camphor, borneol, and bornyl acetate)
- Use: Improves Hair Growth, Enhances Shine and Softness.
- Collection: The plant *Rosmarinus officinalis* is collected from local area of Gondia, Maharashtra, India.
- Cultivation: The plant: *Rosmarinus officinalis* is cultivated in various areas of Maharashtra Plant thrives in warm and sunny climate. It prefers well-drained, loamy soil, slightly acidic soil.
- Authentication: The plant *Rosmarinus officinalis* is collected from local area of Gondia and plant is self authenticated.

6. Henna



Fig. No. 07 : Henna

- Synonyms: Egyptian privet
- Biological source: Henna consists of fresh or dried leaves of the plant *Lawsonia inermis*.
- Family: Lythraceae
- Taxonomy:
 - Kingdom: Plantae
 - Order: Myrtales
 - Family: Lythraceae
 - Genus: *Lawsonia*
 - Species: *Lawsonia inermis*
- General description:
 - Time: It grows mainly in places with temperature about 21 to 38 °C in month of July and to august.
 - Colour: light greenish yellow
 - Height: 2-8 meters
 - Part of plant use: Leaves
- Chemical constituents: lawsone, gallic acid, white resin, sugars, tannin, xanthones.
- Use: conditioner, natural hair dye
- Collection: The plant *Lawsonia inermis* is collected from local area of Gondia, Maharashtra, India. The leaves are removed. Leaves are washed with water and shed dried and grind powder is prepare.
- Cultivation: The plant *Lawsonia inermis* is cultivated in various areas of Maharashtra Plant thrives in warm, arid to arid climate. It prefers well-drained, deep fine or sandy medium textured soil with neutral pH.
- Authentication: The plant *Lawsonia inermis* is collected from local area of Gondia and plant is self authenticated.

7. Rose



Fig. No. 08 : Rose

- Synonyms: Bloom, Blossom.
- Biological source: Rose consists of fresh or dried flower of the plant *Rosa rugosa*.
- Family: Rosaceae
- Taxonomy:
 - Kingdom: Plantae
 - Order: Rosales
 - Family: Rosaceae
 - Genus: *Rosa*
 - Species: *Rosa rugosa*
- General description:
 - Time: It grows mainly in places with temperature about 15 to 24 °C in month of May to October.
 - Colour: Red
 - Height: 0.6 to 1.5m
- Chemical constituents: citronellol, geraniol, nerol and phenyl ethyl alcohol.
- Use: fragrance, moisturizes and conditions.
- Collection: The plant *Rosa rugosa* is collected from local area of Gondia, Maharashtra, India. The flower is removed. Flower is washed with water and shed dried and grind powder is prepare.
- Cultivation: The plant *Rosa rugosa* is cultivated in various areas of Maharashtra Plant thrives in warm climate. It prefers well-drained, loamy soil.
- Authentication: The plant *Rosa rugosa* is collected from local area of Gondia and plant is self authenticated.

IV. PLAN OF WORK

- The work will be executed as follow:
- 1) Review of literature.
 - 2) Material and method.
 - 3) Experimental method.
 - a) Collection and Identification.
 - b) Authentication.
 - c) Powder extract.

- d) Preliminary phytochemical screening of extract.
- 4) Optimization and formulation of herbal powder shampoo
- 5) Evaluation of herbal powder shampoo

V. MATERIALS

5.1 List of Drugs and Excipients

Table No. 01: List of drugs and excipients

Sr No.	Ingredients	Source
1	Embilica officinalis	MIBP, Gondia
2	Sapindus mukorossi	MIBP, Gondia
3	Linum usitatissimum	MIBP, Gondia
4	Acacia concinna	MIBP, Gondia
5	Rosamarinus officinalis	Local Herb Shop, Gondia
6	Hibiscus rosa – sinensis	Local Area of Gondia
7	Rosa indicia	Local Area of Gondia
8	Lawsonia inermis	Local Area of Gondia

5.2 Instruments

Table No. 02 : Instruments

Sr. No	Instrument	Manufacturer
1	Ph meter	Systronics globe Instruments
2	Digital balance	KERRO 3
3	Mixer Grinder	JYOTI
4	Hot Air Oven	Metalab Scientific Industries
5	Heating Mantle	Biotechnics India
6	Mortar Pestle	Labline
7	Desiccator	Nikam Scientific Industries

VI. EXPERIMENTAL METHOD

6.1 Preformulation Study

6.1.1 Collection of Herbs

- CHARACTERIZATION AND IDENTIFICATION OF HERBS
 - A. PHYSICAL PROPERTIES: Color, Odor and appearance was studied.
 - B. SOLUBILITY STUDIES: Solubility in Distilled water, Warm water, Rice water was determined.
- PRELIMINARY PHYTOCHEMICAL SCREENING
 - A. TEST FOR ALKALOIDS [MAYER'S TEST]: 1.36gm of mercuric chloride dissolved in 60ml and 5gm of potassium iodide were dissolved in

10 ml of distilled water respectively. These two solvents were mixed and diluted to 100ml using distilled water. To 1ml of acidic aqueous solution of samples few drops of reagent was added. Formation of white or pale precipitate showed the presence of alkaloids.^[10]

B. TEST FOR FLAVONOIDS:[SHINODA TEST]:

In a test tube containing 0.5ml of alcoholic extract of the samples, 5 to 10 drops of diluted HCl and small amount of Zn or Mg were added and the solution was boiled for few minutes. Appearance of reddish pink or dirty brown color indicated the presence of flavonoids.^[11]

C. TEST FOR GLYCOSIDES:[AQUEOUS NAOH TEST]:

A small amount of alcoholic extract of samples was dissolved in 1ml water and then aqueous sodium hydroxide was added. Formation of a yellow color indicated the presence of glycosides.^[12]

D. TEST FOR STEROIDS [SALKOWSKI'S TEST]:

About 100mg of dried extract was dissolved in 2ml of chloroform. Sulphuric acid was carefully added to form a lower layer. A reddish-brown color at the interface was an indicative of the presence of steroidal ring.

E. TEST FOR CARDIAC GLYCOSIDES [KELLER KILLIANI'S TEST]:

About 100mg of extract was dissolved in 1ml of glacial acetic acid containing one drop of ferric chloride solution and 1ml of concentrated sulphuric acid was added. A brown ring obtained at the interface indicated the presence of a de oxy sugar characteristic of cardenolides.^[12]

F. TEST FOR SAPONINS:[FOAM TEST]:

A drop of sodium bicarbonate was added in a test tube containing about 50ml of an aqueous extract of sample. The mixture was shaken vigorously and kept for 3min. A honey comb like froth was formed and it showed the presence of saponins.^[13]

G. TEST FOR RESINS: [ACETIC ANHYDRIDE TEST]:

To 2ml of chloroform or ethanolic extract 5 to 10ml of acetic anhydrite was added and dissolved by gentle heating. After cooling, 0.5ml of H₂SO₄ was added. Bright purple color was produced. It indicated the presence of resins.

H. TEST FOR PHENOLS:[FERRIC CHLORIDE TEST]:

To 1 ml of alcoholic solution of sample, 2ml of distilled water followed by a few drops of 10%aqueous ferric chloride sol'n was added . Formulation of blue green colour indicated the presence of phenol.^[14]

I. TEST FOR TANNINS [LEAD ACETATE TEST]:

In a test tube containing about 5 ml of an aqueous extract, a few drops of 1% solution of lead acetate were added. Formation of yellow or red precipitate indicated the presence of tannins.

J. TEST FOR TERPENOID [SALWOSKI'S TEST]:

To ml of chloroform and 1 ml of concentrated H₂SO₄ was added to 1 mg of extract and observed for reddish brown color that indicated the presence of terpenoids.

K. TEST FOR PROTEINS [NINHYDRIN TEST; ACETONE]:

Ninhydrin was dissolved in Acetone. The powder extract was treated with ninhydrin and observed for the formation of purple colour

6.2 Method of Preparation

- DRYING :- All the powder are in dry (Sun Dry) form and grinded.
- SIZE REDUCTION :- The crude ingredients were collected and these ingredients were size reduced using driven individually.
- SIEVING :- Then this fine powder was passed through sieve no.:44, to get the sufficient quantity of fine powder.
- WEIGHING:- All these required herbal powders for shampoo preparation were individually.
- MIXING:- All these fine ingredients were mixed thoroughly by hand mixing to form a homogenous fine powder.
- PACKING AND LABELING:- Then it was packed and labeled suitably.^[15]

6.2.1 Batches Prepared:

Table No. 03: Formula of preparation of herbal powder shampoo.

Sr. No.	Ingredients	Uses	F1 (60g)	F2 (60g)	F3 (60g)
1	Hibiscus powder	Hibiscus flower is used for conditions such as high blood pressure, high cholesterol, hair regrowth.	14	16	18
2	Amla	Hair growth promoter.	8	6	8
3	Reetha	Foaming agent.	8	10	12
4	Shikakai	Foam base.	8	9	6
5	Flaxseed	Demulcent, Poulitice.	6	4	4
6	Henna	Conditioner.	6	7	8
7	Rosemary	Improves Hair Growth, Enhances Shine and Softness.	3	3	2
8	Rose petal	Fragrance, ease	7	5	2

		your pain, Soothe and Nourish your pain.			
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6.3 Evaluation Of Herbal Powdered Shampoo

1. PH :-

The pH of 10 % shampoo solution in distilled water was determined at room temperature 25 % °C. The pH was measure by using digital by using pH paper.^[16]

2. Solubility :-

Solubility is defined as the ability of the substance to soluble in a solvent. One gram of the powder is weighed accurately and transferred into a beaker containing 100 ml of water. This was shaken well and warmed to increase the solubility. Then cooled and filter it, the residue obtained is weighed and noted.^[16]

3. Washability :-

Formulations were applied on the skin and then ease and extent of washing with water were checked manually.^[16]

4. Moisture Content Determination :-

10 g of each herbal shampoo powder was weighed in a tare evaporation dish and kept in hot air oven at 105°C. Repeated the drying until the constant weight loss was observed after the interval of 30 minutes. The moisture content was calculated for each sample.^[16]

$$\text{Formula : MC} = \frac{w_1 - w_2}{w_1} \times 100 \dots \dots \dots (1)$$

5. Appearance and Texture :-

The developed individual and polyherbal powder shampoo were evaluated for physical appearance and texture by visual observation.

6. Skin/Eye Irritation Test :-

The eye and skin irritation tests revealed that the herbal shampoo powder shows no harmful effect on skin and eye. This is due to the absence of synthetic surfactants. Most of the synthetic surfactants produce inflammation of the eyelid and corneal irritation. But in this formulation of herbal shampoo powder, the uses of all ingredients are obtained naturally. So, it does not produce any harmful effect on skin and eye.^[17]

7. Dirt Dispersion :-

Two drops of 1% each shampoo powders were added in a large test tube. About 10 ml of distilled water was added to test tube. About 1 drop of India ink was added; the test tube was stoppered and shaken for 10 times. The amount of ink in the foam of was estimated as None, Light, Moderate, or Heavy.^[18]

8. Loss On Drying :-

Loss on drying is the loss of mass expressed in present m/m. Two gram of the powder was weighed accurately and transferred into a dry petri dish. The petri dish is placed in a desiccator for 2 days over calcium chloride crystals. Then the powder was taken and weighed accurately to find out the weight loss during drying.^[17]

9. Foamability Test :-

One gram of powder was weighed accurately and transferred into 250 ml conical flask containing 100 ml of boiling water. Then it is warmed gently for 30

minutes, cooled and filtered and make up the volume to 100 ml in standard volumetric flask. This extract is taken in 10 test tubes in a series of successive portion of 1, 2, 3.....10 ml and remaining volume is made up with water to 10 ml. Then the test tubes were shaken in longwise motion for 15 seconds at speed of 2 frequencies/second. Then the tubes are allowed to stand for 15 minutes. The height of the foam was measured.^[18]

10. Stability Study :-

Formulation of polyherbal powder shampoo became stored in the refrigerator and oven. Also stored beneath room temperature for three weeks modifications acquired if any are noted.

11. Ash Value :-

Total ash content Ash value is calculated to determine the inorganic contents which is characteristic for a herb. About 2gm of powder drug was taken in silicon dish previously ignited and weighed. Temperature was increased by gradually increasing the heat not exceeding to red colour. After complete burning, ash is cooled and weighed.^[19]

12. Angle of Repose :-

Angle of repose affects the flow properties of a powder. It was determined by fix glass funnel method; a distance of 2 cm is maintained between the graph paper and the bottom of a powder. Flowing was continued till the top of the heap touches the bottom tip of funnel.^[20]

$$\text{Formula: } \theta = \tan^{-1} \left(\frac{h}{r} \right) \dots \dots \dots (2)$$

13. Bulk Density :-

Bulk density is the ratio between the given mass of powdered and its bulk volume. Required amount of powder is dried and filled in a 50 ml measuring cylinder up to 50 ml mark. The volume of powder is measured. Then the powder is weighed.^[21]

$$\text{Formula: } \text{Bulk Density} = \frac{\text{Mass of powder}}{\text{Volume of powder}} \dots \dots \dots (3)$$

14. Tapped Density :-

The tapped density is an increased bulk density attained after mechanically tapping a container containing the powder sample. After observing the initial powder volume or mass, the measuring cylinder or vessel is mechanically tapped for 1 min and volume or mass readings are taken until little further volume or mass change was observed. It was expressed in grams per cubic centimeter (g/cm³).^[22]

$$\text{Formula: } \text{Tapped Density} = \frac{\text{Mass of Powder}}{\text{Tapped volume of powder}} \dots \dots \dots (4)$$

15. Compressibility/ Carr's index :-

This is calculated using the formula;

$$\text{Bulk density (Tapped)} - \text{Bulk density (untapped)} \\ \text{Carr's index} = \frac{\text{Bulk density (Tapped)} - \text{Bulk density (Untapped)}}{\text{Bulk density (Tapped)}} \times 100 \dots \dots \dots (5)$$

VII. RESULT AND DISCUSSION

7.1 Pre-Formulation Evaluation

7.1.1 Preparation of Herbal Powder

The dried plant material (leaves/ flowers/ fruits) is used for extraction various herbs such as amla, hibiscus, shikakai, reetha, rose, flaxseed, henna, rosemary, were collected and dried to retain their active property this dried ingredient are then size reduced using a grinder or pulverizer to obtain a fine powder. these powders are sieved through mesh (typically 120# sieve) to ensure uniform particle size. Finally, the ingredients are blended uniformly in the required proportion to form a homogeneous powder and stored in an air tight container for future evaluation.^[23]

7.1.1.1 Characterization And Identification Of Herbal Powders

a) Physical Properties : Colour and odor was studied.

Table No. 04: Physical properties of all Ingredients

Ingredients	Colour	Odor
Hibiscus powder	Deep Reddish-Purple	Floral, slightly sweet and fruity
Amla powder	Pale Yellow	Slightly sour and earthy
Reetha powder	Creamy White	Mild, slightly sweet and earthy
Shikakai powder	Light Brown	Earthy and slightly bitter
Flaxseed powder	Golden Yellow	Nutty and slightly earthy
Henna powder	Dark Greenish-Brown	Earthy, slightly bitter, herbal
Rosemary powder	Dark Greenish-Brown	Piney, herbaceous and slightly bitter
Rose petal powder	Soft Pink	Sweet, floral and slightly perfumy

b) Solubility Studies: Solubility in water, boiling water and rice water was studied.

Table No. 05: Solubility study of all Ingredients

Ingredients	Distilled Water	Warm Water	Rice Water
Hibiscus powder	Partially soluble	Partially soluble	Partially soluble
Amla powder	Poorly soluble	Partially soluble	Partially soluble
Reetha powder	Soluble	Highly soluble	Soluble
Shikakai powder	Poorly soluble	Partially soluble	Partially soluble
Flaxseed powder	Partially soluble	Forms a gel	Forms a gel
Henna powder	Forms a thick paste	Forms a paste	Forms a paste

Rosemary powder	Poorly soluble	Partially soluble	Partially soluble
Rose petal powder	Poorly soluble	Partially soluble	Partially soluble

7.1.2 Preliminary Phytochemical Screening of Herbal Powder

Preliminary phytochemical test for identification of phytoconstituent in all ingredients which are used to prepared herbal powdered shampoo.

1. Alkaloids Test (Mayer's Test):

- Hibiscus: Positive
- Amla : Negative
- Reetha: Negative
- Shikakai: Negative
- Flaxseed: Negative
- Heena: Negative
- Rosemary: Negative
- Rose petal: Negative

2. Flavonoids (Shinoda test):

- Hibiscus: Positive
- Amla : Positive
- Reetha: Negative
- Shikakai: Positive
- Flaxseed: Negative
- Heena: Negative
- Rosemary: Positive
- Rose petal: Positive

3. Tannins Test (Lead acetate Test):

- Hibiscus: Positive
- Amla : Positive
- Reetha: Negative
- Shikakai: Positive
- Flaxseed: Negative
- Heena: Negative
- Rosemary: Positive
- Rose petal: Positive

4. Saponins Test (foam test):

- Hibiscus: Positive
- Amla : Negative
- Reetha: Positive
- Shikakai: Positive
- Flaxseed: Negative
- Heena: Negative
- Rosemary: Negative
- Rose petal: Negative

5. Phenol test (ferric chloride test):

- Hibiscus: Positive
- Amla : Positive
- Reetha: Negative
- Shikakai: Positive
- Flaxseed: Positive
- Heena: Positive
- Rosemary: Positive
- Rose petal: Positive

6. Stroids test (salwoskis test):

- Hibiscus: Negative
- Amla : Positive

- Reetha: Positive
- Shikakai: Positive
- Flaxseed: Positive
- Heena: Negative
- Rosemary: Positive
- Rose petal: Negative

7. Protein test (ninhydein test):

- Hibiscus: Positive
- Amla : Positive
- Reetha: Negative
- Shikakai: Negative
- Flaxseed: Positive
- Heena: Negative
- Rosemary: Positive
- Rose petal: Negative

8. Resins test (acetic anhyd. Test):

- Hibiscus: Negative
- Amla : Negative
- Reetha: Negative
- Shikakai: Negative
- Flaxseed: Negative
- Heena: Negative
- Rosemary: Negative
- Rose petal: Negative

9. Cardiac glycosides test (keller kelanis test):

- Hibiscus: Negative
- Amla : Negative
- Reetha: Negative
- Shikakai: Negative
- Flaxseed: Negative
- Heena: Negative
- Rosemary: Negative
- Rose petal: Negative

10. Glycoside (Aq. NaoH test):

- Hibiscus: Positive
- Amla : Positive
- Reetha: Positive
- Shikakai: Positive
- Flaxseed: Positive
- Heena: Negative
- Rosemary: Positive
- Rose petal: Positive

7.1.3 Evaluation of herbal powder shampoo



Fig. No. 09 : Formulation F1, F2, F3

7.1.3.1 pH Of Shampoo: The pH of polyherbal powder shampoo was found to be-

Table No.07: pH of Shampoo

Sr. no.	Tests	Formulation		
		F1	F2	F3
1	pH	6	6	6

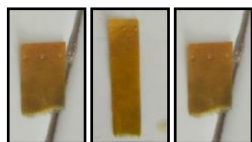


Fig. No. 10 : pH test of Formulation of F1,F2,F3

7.1.3.2 Physical Appearance: Color, odor, State, Texture was studied.

Table No. 08: Physical Appearance of Preparation

Sr. no.	Tests	Formulation		
		F1	F2	F3
1	Appearance	Reddish Brown	Reddish Brown	Reddish Brown
2	Odor	Characteristic	Characteristic	Characteristic
3	State	Solid	Solid	Solid
4	Texture	Fine	Fine	Fine

7.1.3.3 Solubility: Solubility of herbal shampoo in distilled water, warm water, rice water was found to be-

Table No. 09: Solubility of Shampoo

Formulation	Distilled water	Warm water	Rice water
F1	Partially Soluble	Partially Soluble	Partially Soluble
F2	Partially Soluble	Partially Soluble	Partially Soluble
F3	Partially Soluble	Partially Soluble	Partially Soluble

7.1.3.4 Skin Irritation Test: The skin irritation test of given formulation F1, F2, F3 show no reaction.

Table No.10: Skin irritation test

Sr. no.	Skin Irritation test (Time)	Formulation		
		F1	F2	F3
1	10 min	No reaction	No reaction	No reaction
	1 hour	No reaction	No reaction	No reaction
	2 hours	No reaction	No reaction	No reaction



Fig. No. 11: Skin Irritation Test of formulation F1,F2,F3

7.1.3.5 Foaming Capacity: Foaming capacity of the shampoo was found to be-

Table No. 12: Foaming capacity

Sr. no.	Foaming test	Formulation		
		F1	F2	F3
1	5 min	32%	36%	30%
	15 min	20%	21%	37%
	30 min	10%	11%	28%

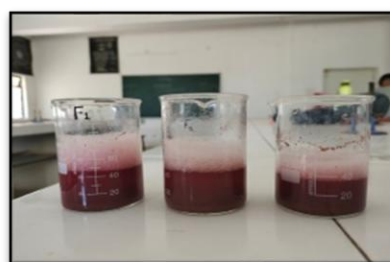


Fig. No. 12 : Foaming test of F1,F2,F3

7.1.3.6 Washability: Washability of the powder shampoo was found to be-

Table No. 13: Washability of Shampoo

Test	Formulation		
	F1	F2	F3
Washability	Easily Washable	Easily Washable	Easily Washable

7.1.3.7 Loss on Drying: Loss on Drying of powder shampoo was found to be-

Table No. 14: Loss on Drying

Formulation	F1	F2	F3
Initial weight	46.31 gm	31.6 gm	35.7 gm
Final weight	46.19 gm	30.86 gm	35.55 gm
Loss on Drying(%)	0.25 %	2.34 %	0.42 %



Fig. No. 13 : Loss on Drying of F1, F2, F3 by Desiccator

7.1.3.8 Angle of Repose: Angle of repose of powder shampoo was found to be-

Table No. 15: Angle of Repose

Formulation	F1	F2	F3
Height of pile(h)	5.5 cm	7.1 cm	6.8 cm
Radius of the base of the pile(r)	5.55 cm	5.05 cm	5.4 cm
Angle of repose (θ)	50°	60.5°	99.4°

7.1.3.9 Moisture Content: Moisture content of the powder shampoo was found to be-

Table No. 16: Moisture Content

Formulation	F1	F2	F3
Initial weight	78.69 gm	75.22 gm	77.03 gm
Final weight	78.13 gm	74.65 gm	76.47 gm
Moisture Content(%)	0.71 %	0.75%	0.72%

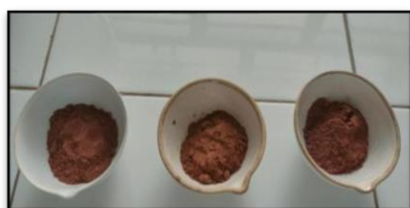


Fig. No. 14 : Moisture Content test of formulation F1,F2,F3

7.1.3.10 Bulk Density: Bulk density of the powder shampoo was found to be-

Table No. 17: Bulk Density

Formulation	F1	F2	F3
Mass of Powder(g)	60	60	60
Volume of Powder(cm ³)	120	142.01	138.46
Bulk Density(g/cm ³)	0.5	0.423	0.433

7.1.3.11 Tapped Density: Tapped density of powder shampoo was found to be-

Table No. 18: Tapped Density

Formulation	F1	F2	F3
Mass of Powder(g)	60	60	60
Tapped volume of powder(cm ³)	100	142.01	138.46
Tapped Density(g/cm ³)	0.6	0.473	0.483

7.1.3.12 Carr's Index/Compressibility (Ci): Compressibility of the powder shampoo was found to be-

Table No. 19: Compressibility of Shampoo

Formulation	F1	F2	F3
Bulk density(g/cm ³)	0.5	0.423	0.433
Tapped density	0.6	0.473	0.483
Carr's Index(%)	16.67%	10.58%	10.34%

7.1.3.13 Ash Value: Ash value of the powder shampoo was found to be-

Table No. 20: Ash value

Formulation	F1	F2	F3
Weight of Ash	0.20 gm	0.12 gm	0.18 gm
Weight of Sample	2	2	2
Ash Value(%)	10%	6%	9%



Fig. No. 15 : Ash value of formulation of F1, F2, F3

7.1.3.14 Stability Study:

Table No. 21: Stability Study of Shampoo^[24]

Evaluation	F1		
	R.T.	Ref.	Oven
Temperature	25°C ± 2°C	5°C ± 3°C	40°C ± 2°C
Color	Reddish Brown		
Odor	Characteristic		
P.H.	6		

Evaluation	F2		
	Ref.	Oven	R.T.
Temperature	$5^{\circ}\text{C} \pm 3^{\circ}\text{C}$	$40^{\circ}\text{C} \pm 2^{\circ}\text{C}$	$25^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Color	Reddish Brown		
Odor	Characteristic		
P.H.	6		

Evaluation	F3		
	R.T.	Ref.	Oven
Temperature	$25^{\circ}\text{C} \pm 2^{\circ}\text{C}$	$5^{\circ}\text{C} \pm 3^{\circ}\text{C}$	$40^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Color	Reddish Brown		
Odor	Characteristic		
P.H.	6		

7.1.3.15 Comparison Between Herbal Formulation and Marketed Formulation

Table No. 22: Comparative studies formulated preparation and marketed preparation^[25]

Sr. No.	Physicochemical Parameters	F1	F2	F3
1	Color	Reddish Brown	Reddish Brown	Reddish Brown
2	Taste	Characteristic	Characteristic	Characteristic
3	Odor	Aromatic	Aromatic	Aromatic
4	Texture	Fine	Fine	Fine
5	pH	6	6	6
6	Washability	Easily washable	Easily washable	Easily washable
7	Solubility	Partially soluble	Partially soluble	Partially soluble
8	Foaming capacity	32%	36%	30%
9	Skin irritation	Non-irritant	Non-irritant	Non-irritant
10	Ash value	10%	6%	9%

Sr. No.	Physicochemical Parameters	Marketed Formulation
1	Color	Light to Dark Brown
2	Taste	Characteristic
3	Odor	Aromatic
4	Texture	Fine
5	pH	6.5
6	Washability	Easily washable
7	Solubility	Partially soluble
8	Foaming capacity	33.3%
9	Skin irritation	Non-irritant
10	Ash value	16%

7.2 Discussion

The colour of all the formulated herbal powder shampoo was reddish brown and all the shampoos were good in homogeneity the pH of shampoo was in between the range 6.1 to 6.6 matching with the skin and scalp pH

range. Tapped density and Bulk density of the herbal shampoo was ranging from 0.4 – 0.6 gm/ cm³ measured with tapped density and bulk density apparatus respectively. All the formulation were easily washable with no skin and scalp irritancy. All the formulations show good foaming activity.

7.3 Usage Instruction of Polyherbal Powder Shampoo

1. Mix 2-3 tablespoon of the powder with warm water or rice water to form a paste.
2. Apply to wet hair, massage gently into the scalp and hair strands.
3. Leave it on for 5-10 minutes, then rinse thoroughly with lukewarm water.
4. Use 1-2 time a week for best results.

VIII. CONCLUSION

The herbal powder shampoo developed in this study offers a natural, skin-friendly alternative to conventional shampoos, providing various benefits for hair health without causing irritation or allergic reactions. By utilizing essential herbs like hibiscus, amla, reetha, shikakai, flaxseeds, henna, rosemary, and rose petals, our shampoo formulations cater to different hair care needs, ensuring safe and effective results for diverse users. The three formulations created in this project each serve a distinct purpose. Formulation 1, which provides a balanced combination of ingredients, is ideal for those seeking a gentle yet effective hair care solution. It promotes healthy hair with moderate conditioning, mild cleansing, and nourishing properties, especially due to the presence of amla and flaxseeds, which are known to hydrate the scalp and hair. Formulation 2, with a focus on scalp nourishment, is formulated to enhance scalp circulation through the inclusion of rosemary, while the shikakai content provides a delicate cleansing effect. This formulation is most suited for individuals looking to target scalp health and promote hair growth. Formulation 3 stands out for its deep cleansing properties, thanks to the high concentration of reetha, which effectively removes buildup and impurities. The conditioning effects of hibiscus and henna make this formulation particularly strong in providing hair tightening and enhanced texture. The comparison between the formulations highlights their distinct advantages: Formulation 1 is the most balanced, offering mild cleansing and hydration; Formulation 2 excels in scalp care; and Formulation 3 provides the most thorough cleaning and conditioning. Additionally, incorporating fermented rice water with any of these formulations significantly improves foaming and enhances smoothing properties, resulting in softer, shinier hair after washing. In contrast to marketed shampoos, which often contain harsh chemicals such as sulfates, parabens, and artificial fragrances, our herbal powder shampoo provides a gentler, more natural option. Many commercial shampoos rely on synthetic detergents that can strip hair of its natural oils, leading to dryness

and irritation, while our herbal formulas nourish the hair and scalp without compromising their natural integrity. Furthermore, marketed shampoos tend to be laden with preservatives and chemicals that can cause allergic reactions or sensitivities in some individuals, whereas our herbal shampoo is free from such additives, ensuring a safer, more skin-friendly alternative. In conclusion, the herbal powder shampoo formulations developed in this study present a promising option for those seeking a healthier, natural hair care routine, emphasizing the importance of using eco-friendly and skin-friendly ingredients. The careful selection and balance of herbal ingredients in each formulation demonstrate the potential of herbal-based hair care products in revolutionizing personal grooming practices. When paired with fermented rice water, the results are further enhanced, offering a holistic and effective solution to modern hair care challenges.

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