

# Preparation and Evaluation of Herbal Anti Dandruff Shampoo

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**Abstract:** *Dandruff is becoming the major and common problem of hair nowadays. It is the condition that produces flakes on scalp skin, followed by itching on skin. Dandruff is a non-inflammatory and chronic condition which is characterised in the most common dermatological skin problem, related to the scalp that is eminent by an excessive range of scalp tissue being affected. The main cause of dandruff is not visible properly, but there are multiple factors such as, oily scalp, poor hygiene leading to fungal infection and it appears more often if the hair is not washed for a week. The use of dirty water and at poor families where anti-dandruff tools are expensive, it occurs frequently. A yeast-like fungus, Malassezia, feeds on oils on the scalps of most adults, dry skin, sensitivity to hair care ducts or contact dermatitis, other skin conditions, such as psoriasis and eczema are also the causative factors behind dandruff. It causes embarrassment in public places and hair loss. A high level of sebum occurs by dandruff on the skin in various areas. Its symptoms are redness, flakes, and itching of the scalp, hair breakage, and unexpected hair colour and skin discoloration. The ducts or contact dermatitis, other skin conditions, such as psoriasis and eczema are also the causative factors behind dandruff. It causes embarrassment in public places and hair loss. A high level of sebum occurs by dandruff on the skin in various areas. Its symptoms are redness, flakes, and itching of the scalp, hair breakage, and unexpected hair colour and skin discoloration. Dandruff is becoming the major and common problem of hair nowadays. It is the condition that produces flakes on scalp skin, followed by itching on skin. Dandruff is a non-inflammatory and chronic condition which is characterised in the most common dermatological skin problem, related to the scalp that is eminent by an excessive range of scalp tissue being affected.*

**Keywords:** Scalp, Hair, Dandruff, skin

## I. INTRODUCTION

In the Indian medicine system, various plants are used in the dandruff treatment as Reetha, Hibiscus, neem. These formulations are herbal based, with viable substitutes for synthetic drugs. Over the last few decades, natural products have shown a tremendous increase in herb based cosmetics. There are many herbal shampoos available nowadays, containing herbal ingredients like essential oils and extracts of plants. Many plants have beneficial effects on hair. Traditional medicine in India is endowed with magical and religious beliefs and the World Health Organisation is engaged in setting up definite guidelines for appraisal of traditional medicine of major effectiveness. Medicinal plants are rich in antioxidants, known to treat different diseases. The antioxidant potential is tested at various levels. Preparations used in hair care are available in the form of creams, dyes, pomades, powders, tonics, etc. Hence, the knowledge from Ayurveda and herbals will be enhanced by information on the evidence-basis of these plants. Drugs from the herb resources are quickly accessible, cheap, safe, efficient and rarely have side effects. The need for herb based natural medicines is vastly increasing due to the lack of side effects and natural goodness. The underlying research deals with the preparation and assessment of Poly-herbal anti-dandruff formulation containing the goodness of Amla, Reetha, Hibiscus, Neem, Tulsi and Ginger, green tea, shikakai<sup>2</sup>.

Shampoo plays an important role in the removal of surface grease and dirt from the hair shaft and scalp. The primary role of shampoo is to carry out cleansing or detergent action. However, the foaming characteristic of shampoo plays a significant role in its acceptability. The shampoo sector is probably the largest scale amongst hair care products since they are one of the important cosmetic products used in daily life. Hair cleansers play an important role not only in cleansing but also in imparting glossy nature to hair. With the emerging role of ayurveda, several herbs and florals have

been identified for their impacting role in the cosmetic industry. The word herbal signifies a symbol of safety in contrast to the synthetic one which has adverse effects on human health.

## II. METHODS

### 2.1 Ingredients

#### A. Amla

**Biological source:** amla consists of dried, as well as fresh fruits of the plant *Emblica*

**Synonym:** Indian gooseberry, emblicmyrobalam, Malacca tree officinalis Gaerth (*Phyllanthus emblica* Linn.), belonging to family Euphorbiaceae.

**Chemical constituents:** The fruit of Amla is rich in vitamin C (ascorbic acid) and contains several bioactive phytochemicals, of which majority are of polyphenols (ellagic acid, chebulinic acid, gallic acid, chebulagic acid, apeigenin, quercetin, corilagin, leutolin, etc.)



Figure 1: Amla

### Applications

Amla has always been a part of hair care rituals in the olden days. An elixir of hair, this wonder fruit is loaded with Vitamin C and tannins. The nourishing properties in amla make it a natural conditioner for hair, giving it an extra smooth texture.

- **Hair growth:** The phyto-nutrients, vitamins and minerals present in *amla* help in increasing the scalp circulation and stimulate healthy growth. Vitamin C of amla produces collagen protein. This helps in stimulating hair growth, both length and volume wise. Collagens replace the dead cells of hair follicles with new hair cells.
- **Serves as a natural hair conditioner:** Amla can nourish, strengthen and condition your hair thereby making it shiny and adding volume to your hair. One amla contains up to 81.2 percent of moisture content in it. Those with dry hair, now you know what to do. Moreover, if you have an oily hair, then use amla powder, it will soak in all the excess oil present on your scalp, along with conditioning it.
- **Treats Dandruff:** Dandruff is usually the result of dryness. This vitamin C rich juice cures the dryness and prevents the accumulation of dandruff. Amla's Vitamin C, its anti-inflammatory plus its anti-bacterial properties can stop dandruff and also the itching caused by it, on the scalp.
- **Scalp cleanser:** Amla juice is great for cleansing the scalp. It nourishes the scalp and makes the hair shiny. The antioxidants present in amla, shields our hair from various hair damages, caused due to it by dust, pollution, smoke, and hair styling tools, etc.
- **Improves pigmentation:** Most of the hair coloring packs contain *amla* in them as it helps in fighting pigmentation. It also helps in discoloration making the hair long and luscious. Moreover, it is important to keep our hair and scalp clean to avoid pigmentation. Amla and its anti-microbial properties, will not just banish hair odour but it will also remove the germs sticking on your hair. (Also read: 10 Wonderful Benefits of Amla Powder)
- **Reduces graying of hair:** According to Ayurveda premature graying usually occurs due to excess pitta in the body. Some of the signs of excess pitta include skin rashes, burning sensations, peptic ulcers, excessive body heat, and heartburn. Amla, a natural coolant, is an excellent remedy for fixing the pitta condition, which reduces graying.

- **Strengthens hair:** Amla juice serves as a beneficial tonic for both skin and hair. It strengthens your hair follicles thereby facilitating hair growth and strengthening of the hair. Plus, strengthens the roots, maintains colour and improves lustre. Eating fresh gooseberry or applying its paste on the roots of your hair improves hair growth and colour.
- **Antioxidant :** Amla has twice the antioxidant power of acai and around 17 times of pomegranate. It has the power to eliminate toxins in the body and serves as a great antioxidant. Due to its antioxidant potential, it is often used as a nutritional supplement in chyavanprash and other Ayurvedic medicines.
- **Natural shine:** Amla powder can be added to the home-made hair masks to add a natural shine to your hair. Make sure to apply it regularly to have better results. The surplus of vitamin C in amla can help halt pre-mature greying. If you want to enhance the natural colour of your hair, all you have to do is mix amla powder with henna powder
- **Thickening of hair:** With its nutrients and other beneficial properties, drinking *amla* juice regularly or simply applying it can make your hair thicker and bouncier. Amla has vitamin C, which is assisted by various minerals, nutrients, amino acids, and antioxidants, etc. That helps Amla in fighting against all the hair weakening factors and thickens hair.
- **Prevents frizzy hair :** It prevents dryness and helps in restoring moisture. It also removes the dead cells. The essential fatty acids present in amla strengthen hair follicles and add lustre to the hair. With regular use of amla, you may get rid of those unmanageable frizzy hair.
- **Enhances hair color:** Amla is commonly used with henna in order to enhance the hair color making it look natural. You can use amla in various forms like in oil, juice, pickle and even in candy form to give back your hair, its natural colour <sup>4</sup>

#### B. Drug Name - Hibiscus



Figure 2: Hibiscus

**Synonym:** shoeblack plant mahagua, mahoe, cotton rose, roselle.

**Biological Source:** hibiscus, (genus *Hibiscus*), genus of numerous species of herbs *rosa sinensis*, belonging to the family (Malvaceae) that are native to warm temperate and tropical regions. Several are cultivated as ornamentals for their showy flowers, and a number are useful as fibre plants.

**Chemical Constituents:** The phytochemical analysis showed that *Hibiscus rosa-sinensis* contained tannins, anthraquinones, quinines, phenols, flavanoides, alkaloids, terpenoids, saponins, cardiac glycosides, protein, free amino acids, carbohydrates, reducing sugars, mucilage, essential oils and steroids. <sup>2</sup>

#### Applications

- **Stimulates hair growth:** Lost hair volume and luster over the years? The naturally occurring amino acids in hibiscus flowers provide the hair with the nutrients help in promoting hair growth. These amino acids produce a special kind of structural protein called keratin, which is the building block of hair. Keratin binds the hair makes them less prone to breakage. It also promotes the overall thickness of hair strands and makes hair more manageable. So, instead of turning to expensive keratin treatments that damage hair, you can start using Hibiscus on your hair.

- **Conditions hair:** The chemicals present in most of the shampoos strip the hair away from its natural oils. Hibiscus flowers and leaves contain a high amount of mucilage which acts as a natural conditioner. It's because of this naturally occurring conditioner that crushed Hibiscus flowers and leaves feel slimy to the touch.
- **Prevents baldness:** Many research papers have been published after studying the use of hibiscus extract for treating baldness. All of these papers suggest that using hibiscus is a safe way for regrowing hair. The use of hibiscus is as effective as the drugs used to treat baldness (Minoxidil and Finasteride). In addition to being equally effective, Hibiscus doesn't cause any of the harmful side effects associated with these drugs!
- **Treats dandruff and itchy scalp:** Hibiscus acts like an astringent and reduces the oil secretion by the glands. Using Hibiscus leaves for hair maintains the pH balance of hair in addition to providing an overall soothing and cooling effect.
- **Prevents premature greying:** Traditionally, Hibiscus was used as a natural dye to mask grey hair. The antioxidants and vitamins present in Hibiscus help in producing melanin, the naturally occurring pigment that gives hair its natural color.

### C. Drug Name: Reetha



Figure 3: Reetha

**Synonym:** Soapnut, Sapindus mukorossi, Haithaguti, Ritha, Aritha, Dodan, Kanmar, Rithe, Thali, Phenila, Urista, Kunkudu, Krishvarn, Arthsaadhan, Rakhtbeej, Peetfan, Phenil, Garbpatan, Guchfaal, Areetha, Ita, Kunkute kayi, Ponnankottai, Rithegach, Rittha, Dodan, Soapnut tree, Chinese soapberry.

**Biological Source:** Sapindus mukorossi, commonly known as Indian soapberry, washnut, or ritha, is a species of tree in the family Sapindaceae.

**Chemical Constituent:** The major constituents present in Reetha are saponins, sugars and mucilage. The seed kernels of Reetha are a rich source of proteins and show a balanced amino acid composition as per the World Health Organization. In addition to proteins, sugars and fibres are also present. <sup>1</sup>

### Applications

- **Anti-hairfall:** Reetha, when combined with some ingredients, serves as an excellent and natural way of curing hair fall. When regularly used with ingredients such as shikakai, lime peel and even amla, reetha is known to nourish the scalp and significantly reduce hair fall.
- **Is a Homemade Shampoo:** Most of the shampoos available in the market have some chemical and preservative essence, which can prove to be detrimental later on. On the other hand, reetha is 100% natural and can be used daily as a natural cleanser that only benefits and has no adverse effects whatsoever.
- **Prevent Dandruff:** Reetha is also extremely good at preventing dandruff. It has antibacterial properties that help keep the scalp fresh and clean and treats conditions like dandruff over time.
- **Antifungal in Nature:** Reetha is antibacterial and antifungal in nature. Thus, any scalp infection such as dandruff is taken care of, with regular usage. It is also beneficial in getting rid of headlice that often happen

when there is residue dirt and soap left to fester. Reetha ensures that the hair and scalp get cleansed thoroughly and prevents head lice from happening

- **Gives Shine:** Reetha is a natural conditioner that is known to soothe the scalp and make the hair shiny. It gives a natural lustre and shine to the hair which can otherwise get damaged by pollution and lifesthine. Reetha or Soapnuts is also called as Arishtak in Ayurveda and “Soap nut tree” in India. It is well known for its traditional medicinal uses and is commonly used as a hair cleanser.
- **Dandruff:** According to Ayurveda, dandruff is a condition marked by flakes of dry skin on the scalp. This may be due to an aggravated Vata and Pitta dosha. Reetha helps to control dandruff and promotes hair growth due to its Tridosha balancing property.
- **Skin itching:** Itching may be due to dryness (Vat) and can also be due to cyst formation (Kapha). The skin may feel itchy due to excessive sweating (Pitta). This means all the three Doshas (Vat-Pitta-Kapha) are involved in itching. Reetha helps to reduce itching as well as inflammation because of its Tridosha balancing property.
- **Head Lice:** Lice are small insects which reside on the scalp. Head lice develop and survive when they get a favorable conditions like excess sweat, dirt on the scalp or any shampoo/soap residue on the scalp. Reetha helps to remove lice by destroying the favorable conditions and cleans the scalp due to its Tikshna (sharp) nature
- **Arthritis:** Reetha helps to manage bone and joint pain when applied to the affected area. According to Ayurveda, the bones and joints are considered a site of Vata in the body. Pain in the joints is mainly due to Vata imbalance. Applying Reetha helps to reduce joint pain due to its Ushan (hot) potency.

#### D. Drug Name: Neem



Figure 4: Neem

**Synonym:** Neem tree; nim tree; margosa; arishth; Azadirachta indica; Melia Azadirachta; tree.

**Biological Source:** Neem consists of the fresh or dried leaves and seed oil of Azadirachta indica J. Juss (Melia Indica or M. azadirachta Linn.).

**Chemical Constituents:** The chemical constituents are found in the leaves of neem as nimbin, nimbanene, 6-desacetylnimbinene, nimbandiol, nimbolide, ascorbic acid, n-hexacosanol and amino acid, 7-desacetyl-7-benzoylazadiradione, 7-desacetyl-7-benzoylgedunin, 17-hydroxyazadiradione and nimbiol<sup>15</sup>

#### Applications:

- **Relieves itchy scalp:** Neem has antifungal properties that may help within the treatment of dandruff. The effective use of neem to your hair can relieve the itchiness, inflammation, and irritation associated with dandruff.
- **Intensify hair growth:** The regenerative properties of neem help in reducing hair fall. Gently, massaging your scalp with neem oil can increase the blood circulation in the scalp and help in enhancing the speed of hair growth.
- **Avert premature greying of hair:** Neem is rich in antioxidants that curb the action of free radicals that cause premature greying of hair. Regular usage of neem powder or neem oil for the same is useful.
- **Conditions under nourished hair:** Neem contains a significant ingredient, fatty acids like linoleic, oleic, and stearic acid which help the scalp to nourish thereby keeping the hair smooth.

**E. Drug Name: Tulsi**



Figure 5: Tulsi

**Synonym:** HOLY BASIL

**Biological Source :** *Ocimum tenuiflorum*, also known as *Ocimum sanctum*, Tulsi, or Holy Basil from the family Lamiaceae has been described as the “Queen of plants” and the “mother medicine of nature” due to its perceived medicinal qualities

**Chemical Constituent:** There are many chemical constituent present in *ocimumsanctum* such as, oleanolic acid, rosmarinic acid, ursolic acid eugenol, linalool, carvacro<sup>18</sup>

**Applications**

- Tulsi benefits hair by rejuvenating the hair follicles and strengthening the roots, which in turn curbs hair loss. And that's not all! This herbal treatment also promotes circulation in your scalp and keeps it cool.
- Basil oil is extremely beneficial to speed up hair growth. Massaging basil oil improves scalp circulation, that stimulates hair follicles and promotes the production of new healthy hair all over again.
- Keeps Scalp Healthy: If you want healthy hair, it is very important to keep the scalp healthy. Dandruff and various types of other scalp infections often trouble us with excessively dry and itchy scalp as well as severe hair fall. Tulsi or basil can be our one stop solution to treat all the scalp infections and get rid of hair fall. The anti bacterial and anti fungal benefits of Basil help to keep the scalp healthy by eliminating dandruff and other scalp infections. Furthermore, the anti inflammatory Benefits of Basil help in giving relief from dryness and itchiness of the scalp. Also basil helps in improving blood circulation in the scalp. This leads to optimal nourishment of the hair follicles, rejuvenate them and induce new hair growth.
- Prevents Premature Graying of Hair: This is one of the best beauty Benefits of Basil. The anti oxidant present in tulsi can be attributed to for this benefit. Grind a few dry basil leaves and prepare basil powder. Soak some basil powder as well as amla powder in water overnight and then use the mixture to wash your hair the next morning. This remedy is very useful in treating premature graying of hair as well as hair fall.
- Anti Oxidant Benefits of Basil: Researches suggest that tulsi contains a range of natural anti oxidant. This anti oxidant components helps in preventing the free radicals from causing oxidative stress to our body cells. Tulsi contains phenolics and anthocyanins, which are powerful anti oxidant. Along with that, tulsi or basil also contain two important water soluble anti oxidants known as orientin and viceninare. They help in protecting the white blood cells in our body, which are responsible for our immune function. The anti oxidants present in basil is useful in keeping the chromosomes from being altered and resulting in cancerous cell growth. These anti oxidants also help in slow down the effects of aging.<sup>17</sup>

**F. Drug Name: Ginger**



Figure 6: Ginger

**Synonym:** Amber.bay.beige. bister.brick. bronze

**Biological Source:** Ginger consists of the rhizomes of *Zingiber officinale*, Roscose and dried in the sun.

**Chemical Constituents:** Bioactive Components. Ginger is abundant in active constituents, such as phenolic and terpene compounds. The phenolic compounds in ginger are mainly gingerols, shogaols, and paradols. In fresh ginger, gingerols are the major polyphenols, such as 6-gingerol, 8-gingerol, and 10-gingerol

**Applications:**

- Ginger Promotes Hair Growth
- Ginger boosts blood circulation to the scalp. As a result, ginger stimulates hair growth and strengthens the hair root and follicles. Additionally, the many fatty acids, vitamins, and minerals present in ginger can strengthen hair strands, which prevents hair loss <sup>11</sup>

**G. Drug Name: Shikakai**



Figure 7: Shikakai

**Synonym:** **Ban ritha**, English: Shikakai (India), Soap pod, Soap pod wattle, Soap acacia, Soap-nut acacia.

**Biological Source:** It consists the fruits of the plant *Acacia concinna* Linn. (Leguminosae), It is a medicinal plant that grows in tropical rainforests of southern Asia and is used for washing hair

**Chemical Constituents:** Lupeol, spinasterol, acacic acid, lactone, and the natural sugars glucose, arabinose and rhamnose. It also contains hexacosanol, spinasterone, oxalic acid, tartaric acid, citric acid, succinic acid, ascorbic acid, and the alkaloids calyctomine and nicotine <sup>15</sup>

**Applications:**

- Natural surfactant soap pods have been used for cleansing the scalp, strengthening the hair from the roots, offering relief from scaling, and reducing irritation, dryness, greasiness, and scaling of the scalp since ancient times. Shikakai means “fruit for hair”.
- Shikakai is a powerful plant that can help with a variety of diseases.
- Shikakai is recognised for naturally softening and smoothing hair by releasing essential oils and vitamins that are important for hair growth.
- It encourages hair development and maintains hair silky and lustrous. Hair loss can cause stress, which leads to even more hair loss. <sup>7</sup>

**Shikakai for Dandruff**

1. With its antifungal, antibacterial, and nutritious characteristics, shikakai is an excellent remedy for dandruff. It has no negative effects and can be used to treat the scalp and get rid of annoying dandruff problems.
2. Shikakai is a common ingredient in hair masks. These cooling packs, which are usually made up of Shikakai, amla, yoghurt, and soap nut, can provide welcome relief during hot weather, a nagging headache, or simply for a peaceful experience on a leisurely day.
3. Hair greying can be slowed and prevented by using a hair pack containing shikakai, soap nut, and other herbal components such as amla.
4. Benefits of Shikakai for Hair Lice
5. Benefits of Shikakai for Dry Scalp

**H. Drug Name: Green Tea**



Figure No. 8: Green Tea

**Synonym:** herb tea, herbal tea.

**Biological Source:** Green tea comes from the plant **Camellia sinensis**. Black tea, green tea, and oolong tea are all made from the same plant but are prepared using different processing methods. Green tea extract contains polyphenols. These include the most active type, epigallocatechin gallate.

**Chemical Constituents :** The chemical composition of green tea is complex: proteins (15-20% dry weight), whose enzymes constitute an important fraction; amino acids (1-4% dry weight) such as theanine or 5-N-ethylglutamine, glutamic acid, tryptophan, glycine, serine, aspartic acid, tyrosine, valine, leucine, threonine, arginine, and lysine

**Applications**

- Green tea effects on hair growth
- It is beneficial for healthy hair due to the presence of **vitamin B** (panthenol), epigallocatechingallate (EGCG), **vitamin C**, theanine and anti-oxidants.
- Green tea supports both growth and re-growth of hair. Elements such as carotenoids, tocopherols, **zinc**, **ascorbic acid**, and **selenium** present in green tea encourage the re-growth of hair. ECGC present in green tea promotes hair growth by preventing damage to the hair cells and also by hair **follicle** stimulation.
- Working as a damaged controller the primary task of green tea is to soften the hair and to control the split ends. Green tea also helps in making hair shiny and lustrous. The presence of natural vitamin C also protects hair and scalp from sun damage.
- It can be used in many ways which include shampoo, conditioner, hair mask or you can simply drink it. All these products should be cautiously applied to the hair roots and scalp to promote hair growth.

**Composition of Anti – dandruff hair pack**

Sr. No	Name	Biological Name	Quantity
1.	Amla	Phyllanthus Emblica	30gm
2.	Shikekai	Acacia concinna	30gm
3.	Neem	Azadirachta indica	10gm
4.	Reetha	Sapindus mukorossi	30gm
5.	Hibiscus	Hibiscus rosa-Sinensis	30gm
6.	Tulsi (Holy Basil)	Ocimum sanctum	20gm
7.	Ginger	Zingiber Officinale	10gm
8.	Green tea	Camellia sinensis	10gm

Table 2: Composition of anti-dandruff hair pack





Figure 9: Prepared Herbal Shampoo

### Quantity of the Constituents

Amla and Hibiscus were taken in the maximum amount, as they have proven hair nourishment property, as on dandruff treatment, the scalp becomes dry, so it is essential to nourish it. Shikakai, Reetha, were taken 30 grams each, as they improve blood circulation and are capable of revitalizing the hair follicles and facilitating hair growth. Reetha and tulsi are anti-bacterial and anti-fungal in nature. Neem and Ginger contain pungent active principles, in concentrated forms, therefore taken in minimal amounts.

### Formulation

- The parts of herbs were collected and dried in the sunlight.
- The dried herbs were powdered and weighed accurately.
- All the materials, as shown in Table 1 and Fig. (1), were mixed homogeneously in the mortar and pestle.

### Novelty of Formulation

- It is in the form of a pack.
- No artificial additive has been incorporated. The constituents are easily accessible, so they can be prepared easily at home.
- It can be made freshly before use.

### Application of Anti-dandruff Hair Care Formulation

The pack or coarse pack should be applied on a weekly basis on hair, as a semi-solid paste in lukewarm water, as it increases the efficiency of the constituents, with required consistency. It should be spread evenly on the hair with the help of a brush, from roots to the hair tip. It should be left for 30 minutes for full drying. Then it should be removed by treating with plain water. <sup>12</sup>

### Use

- As an Anti-Dandruff Hair shampoo
- Nourishes Hair
- Stops graying of hair
- Reduces hair loss
- Induces shine and luster to the hair
- After the formulation of the anti-dandruff hair pack, the evaluation is done as follows;

### Organoleptic Evaluation

By utilizing sensory organs like eyes or nose, the examination of the formulation is performed under this evaluation, and it includes macroscopic characteristics of the drug or product, such as colour, odour, and taste. The texture and appearance are also included under macroscopic features, as elaborated in Table 3.

Table 3. Features and Observations of Ingredients.

Sr. No.	Organoleptic features	Observation
1.	Color	Greenish Brown
2.	Odor	Characteristic
3.	Texture	Fine
4.	Appearance	Coarse Powder

### Physicochemical Studies

The physicochemical studies of the formulations were performed as per Table 4, to analyse the physical and chemical aspects, including pH of the formulation, ash value, and loss on drying

Table 4. Physicochemical Studies.

Sr. No.	Physicochemical Test	Observation
1.	pH	6.9
2.	LOD (Loss on Drying)	1.26% w/w
3.	Ash Value	3.0% w/w

### Phytochemical Evaluation

Various tests were performed, as mentioned in Table 5, to identify the phytoconstituents present in the products and their effect is shown on the body. Every plant exhibits certain phytochemical properties, which show a number of beneficial effects

Sr. No.	Test	Purpose for Detection	Result
1.	Molisch's Test	Presence of Carbohydrate	Positive
2.	Fehling's Test	Presence of Carbohydrate	Positive
3.	Hager's Test	Presence of Alkaloid	Positive
4.	Mayer's Test	Presence of Alkaloid	Positive
5.	Volatile Oil Test	Presence of Volatile Oil	Negative
6.	Biuret Test	Presence of Proteins	Negative

Table 5. Phytochemical Evaluation.

### Rheological Evaluation

In Rheological evaluation, the physical properties of the powdered formulation are examined, as shown in Table 6. Powder Rheology is the determination of flowability of powders. In this, bulk density, tapped density, angle of repose, Hausner's ratio, Carr's Index are measured.

Table 6. Rheological Evaluation

1.	Bulk Density	0.5
2.	Tapped Density	0.6
3.	Angle of Repose	41.7°
4.	Carr's Index	20
5.	Hausner's Ratio	1.2

### Patch Test

In this, the tiny amount of moistened formulation is applied on the surface of the hand and the effects have been observed for irritancy and itchiness caused by formulation (Table 7).<sup>16</sup>

1.	Swelling	Nil
2.	Redness	Nil
3.	Irritation	Nil

### Stability Test

The powdered formulation was stored for some time under different temperatures (35°C and 40°C) and humidity conditions, and the change in the physical properties was observed (Table 8).

1.	Change in Colour	Nil
2.	Change in Odour	Nil
3.	Change in pH	Nil
4.	Change in Texture	Nil
5.	Change in Smoothness	Nil

### Surface characterization using SEM analysis

For comparison, two commercially available market shampoos equation: were purchased and named as Shampoo A and B respectively. Digital pictures were obtained by SEM, by which the surface characterization of the treated hair and untreated hair was studied shown in Figure 1. It's important to understand the cleansing action of shampoos by removal of deposited artificial sebum on hairs. The SEM photographs compare untreated hair and hair treated with formulated and marketed shampoos. The untreated hair had a scaled appearance due to desquamation of the hair cuticle. SEM observations provided the evidence for cleansing action. Formulated as well as marketed shampoos possessed good cleansing property as reviewed by micro photographs. Hence the treatment of hairs with shampoos containing natural conditioners protects hair morphological integrity, provided consistency and shine to the hair and easy combing. The cleansing action in the herbal shampoos was provided by active natural foam forming agents.

It can be concluded from SEM studies that natural plants extract present in formulation play an important role in protecting hair structures along with cleansing and conditioning effects

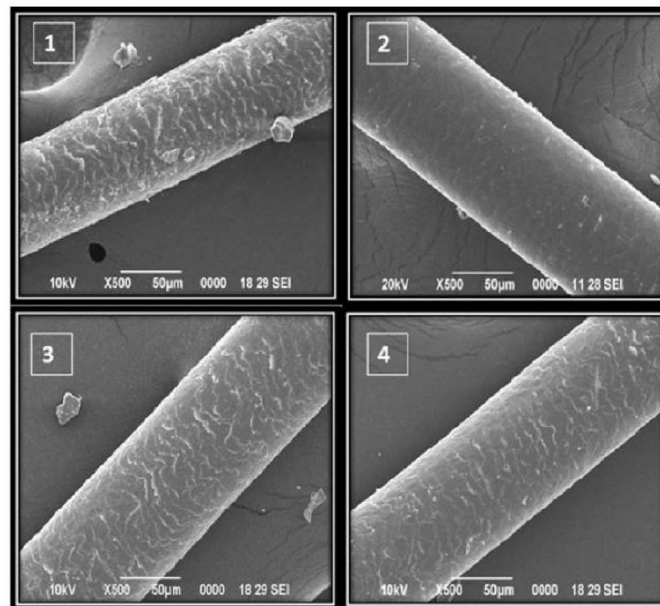


Figure 10: SEM analysis of hair sample

## II. RESULTS AND DISCUSSION

The synthesized anti-dandruff herbal hair formulation is loaded with the goodness of natural herbs along with the active phyto-constituents. It nourishes hair mildly by acting as an anti-dandruff agent. It effectively removes excess oil from the scalp, which is the major root cause behind dandruff. Include natural ingredients like amla, reetha, shikakai, green tea, neem, Tulsi, hibiscus etc. for your hair care and forget about hair troubles. The formulated shampoos were not only safer than the synthetic shampoo, but also greatly reduce the hair loss during combing as well as strengthen the hair growth. The pH value plays an important role in minimizing damage to the hair. pH of the shampoo is slightly acidic and which is near to skin pH. The herbal formulation has a cleaning percentage similar to that of synthetic shampoo. Foaming also called lathering does not have much to do with the cleaning process. The natural shampoo is not comparable with synthetic shampoo, but the study proves that herbal shampoo can generate sufficient foam due to the presence of shikakai and reetha. It can be used as a natural cleanser for washing hair as it contains saponins that act as foaming agents. Amla supplies more nutrients and antioxidant content to nourish hair, also prevents free radical damage to hair follicles because of dandruff. Amla with its vitamin C, anti-inflammatory and anti-bacterial properties can stop dandruff formation. Neem treats clogged pores and increases hair growth. The anti-fungal properties of neem do wonders in fighting dandruff. Tulsi reduces itchiness caused by dandruff and is an excellent anti-microbial plant. Ginger is a treatment for itchy scalp caused mainly by dry scalp and dandruff. It helps to keep scalp healthy and clean. Reetha improves blood circulation and is capable of revitalizing the hair follicles and facilitating hair growth, to cope with the hair loss caused by dandruff. <sup>17</sup>

## III. CONCLUSION

This herbal shampoo was not only safer than the synthetic shampoo but it also reduces the dandruff. The main purpose behind this preparation was to develop stable and effective anti-dandruff shampoo by excluding all types of synthetic additives, which are used in normally such type of shampoo formulations. The ingredient used in this shampoo preparation is neem. Neem has strong antibacterial, anti-fungal and anti-inflammatory properties that can work together to help you get rid of dandruff. It can also prevent the regular onset of dandruff. To provide the effective conditioning effects the present study involves the use of shikakai, amla, tulsi, green tea, hibiscus, reetha are used. These products are safe and free from side effects.

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