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# Formulation and Assessment of Polyherbal Multipurpose Hair Mask

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**ABSTRACT**

This study focuses on developing and testing a polyherbal hair mask made from natural substances such as strawberry, amla, Brahmi, fenugreek, neem, and avocado. The mask intends to give a multi-purpose hair care solution by encouraging hair growth, strengthening hair follicles, and treating dandruff, dryness, and hair loss. The herbal components were ground and blended into a fine powder before being evaluated for organoleptic and physicochemical qualities such as pH, moisture retention, and microbiological stability. According to the study, the hair mask is an effective, non-toxic alternative to chemical hair products that provides considerable benefits for scalp nourishing, hair conditioning, and overall hair health. The mask also displayed outstanding washability and stability, making it a practical and beneficial choice for regular use.

**Keywords**: Hair mask, Amla, Neem, Hair growth.

## I. INTRODUCTION

Cosmetics are the words derived from the Greek word'kosmesticos' which meaning to embellish.Cosmetics are products that are used to the human body to cleanse, beautify, promote attractiveness, or change appearance without harming the body's structure or functions. However, most cosmetics, hygiene, and personal care items are today utilized by customers without regard for the likelihood of undesirable skin effects, such as skin allergy and irritation. Components in those products, such as surfactants and parabens, can pose a harm to skin components[1].

For the ancient hunter-gatherers. It may involve smearing mud and urine to their skin or coloring their cheeks with ash from burnt snail shells. Cosmetic ingredients and production procedures have changed over millennia, from small-scale use of natural components to mass production with synthetics. According to a 2015 study of consumer purchasing behaviour for cosmetic products in Pune, 60% of 200 cosmetic product users preferred to buy organic cosmetics, while 42.5% used cosmetic items for beauty[2].

Figure 1: Cosmetics

## CATEGORIES OF COSMETICS

Cosmetics can be classified according to the body part on which they are applied. Cosmetics are primarily designed to be applied externally to the face (on the skin, lips, Eye brows, and eyes), body (on the skin, particularly the hands and nails), and hair. The cosmetics have been grouped into four[3].

1. Cosmetics for hair
2. Cosmetics for nails
3. Decoration for Dental Care

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4. Cosmetics for Skin

**SKIN COSMETICS**

Skin care cosmetics include face washing cosmetics, lotions, milky lotions, creams, gels, essences (beauty lotions), packs and masks, shaving cosmetics, and a variety of additional products. Skin care cosmetics clean the skin, maintain moisture balance, stimulate skin metabolism, and protect the skin from damaging ultraviolet radiation. Skin care cosmetics contain ingredients that allow the skin to operate normally. They promote its homeostatic function so that it is kept in a beautiful and healthy condition or regains such a state if it is not.

**NAIL COSMETICS**

Nails are translucent protective coverings for the fingers and toes of the foot. They emerge from the cuticle or horny layer of skin in the nail matrix. These cells are made up of granular layers with the powder constantly increasing or developing. The nail does not receive direct blood supply, but it is connected to blood vessels via the nail bed. Nail growth rates vary depending on the individual and the season of the year. Manicuring is the process of caring for nails. They consist of nail lacquer or enamel, enamel remover, powder polish, paste, and nail cream[4].

**DECORATION FOR DENTAL CARE**

Keeping your teeth clean and healthy is critical for everyone. This can be accomplished by utilizing a variety of dental care preparations, also known as dentifrices, which are used to clean the surfaces of teeth, keep them glossy, and maintain the health of the teeth and gums. These preparations may also assist to prevent the formation of unpleasant odours and freshen the breath. Regular use of dentifrices helps to prevent tooth decay. Good oral health raises the likelihood of good overall health.

**HAIR COSMETICS**

Hair has an essential role in the overall appearance of the human body. The epidermal and dermal layers of the skin interact to form hair follicles. The average human head contains approximately 100,000 hair follicles. Human hair has a diameter of 17–181 µm. Melanin is the pigment responsible for the black or brown colour of hair. Melanin is produced by epithelial cells in the matrix. Because of the change in metabolism, melanin is not generated and hence is not carried with the cells, resulting in grey hair. The study of hair is referred to as trichology. Hair is 97% protein and 3% moisture. Keratin is a tough, fibrous protein[5].

**STRUCTURE OF HAIR**

Hair is a complex structure that plays a crucial role in both protection and sensory functions in mammals. It is composed of a protein called keratin, which gives hair its strength and resilience. The hair is divided into two main parts. The hair shaft, which is the visible portion above the skin's surface and the hair follicle, embedded within the skin.

- **Shaft:** It consisting of three layers:
  - **Cuticle:** A protective outer layer, similar to shingles, that varies in structure across different hair types.
  - **Cortex:** The main layer, rich in protein and containing melanin for color.
  - **Medulla:** The inner layer (may be absent in some hair).

- **Follicle:** The embedded part responsible for hair growth through cycles of growth, rest, and shedding. The follicle, which houses the root of the hair, is responsible for hair growth through a dynamic cycle that includes growth, rest, and shedding phases [6]

**HAIR GROWTH CYCLE**

The hair growth cycle is a dynamic and ongoing process, characterized by several distinct phases that all mature hair follicles experience. This cycle consists of four primary stages:

1. **Anagen Phase (Growth)**: This is the active growth phase, where the hair follicle is producing new hair.
2. **Catagen Phase (Regression)**: This transitional phase follows the anagen phase and lasts for a few weeks. During this period, the hair follicle begins to shrink, and hair growth slows down. The hair detaches from the blood supply, preparing for eventual shedding.
3. **Telogen Phase (Rest)**: In this resting phase, which can last several months, the hair remains in the follicle but does not grow. The hair is effectively in a dormant state, awaiting the next cycle to begin.
4. **Exogen Phase (Shedding)**: This phase involves the shedding of the old hair, making way for new growth. This process can occur simultaneously with the anagen phase, as some hairs enter the

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growth stage while others are being shed.

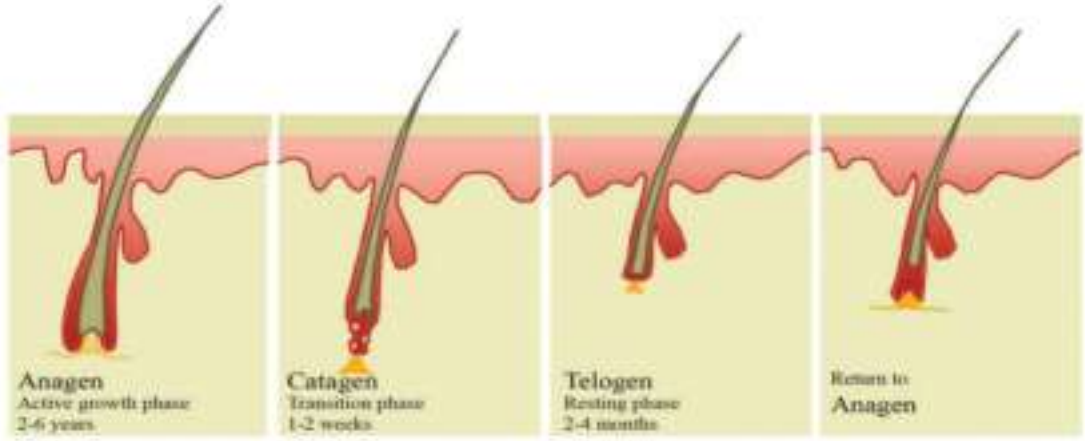


Figure 2: The hair cycle

The length and characteristics of these phases can be influenced by various factors, including the specific location of the hair on the body, nutritional status, hormonal levels, and age. Understanding these phases can provide insight into hair growth patterns and potential hair loss issues[7].

**HAIR MASK**

A hair mask is a treatment that hydrates, strengthens, and restores hair to health. A hair mask, also known as a deep conditioning treatment, is a form of hair conditioner that moisturizes and improves overall hair health. Natural oils, butters, and plant extracts are used in hair masks to moisturize the hair and nourish the hair follicles[8].

In a world when our hair is subjected to constant environmental stress and chemical treatments, it is critical that we provide it with the care and nourishment it requires. Herbal hair masks use the power of plant-based ingredients to deliver a natural treatment that will revitalize and repair your hair from roots to tips. We commended the hair and scalp nourishing, strengthening, and renewing effects of herbal hair masks, which are manufactured from a blend of natural substances such as herbs, oils, and plant extracts. This inquiry will examine at the various botanicals employed in these masks and their alleged impact on hair health[9].

Figure 3: Hair Mask Powder

**ADVANTAGES OF HAIR MASK**

- Benefits include increased hair moisture.
- Improved luster.
- Minimized breakage and damage.
- Improves hair softness and smoothness.
- Protects against environmental factors.

**DISADVANTAGES OF HAIR MASK**

- Over-moisturizing can create greasiness.
- It may cause allergic reactions or irritation.
- It may weigh down fine hair.
- It can produce buildup of residue.
- It may not be suitable for all hair types.

**AIM AND OBJECTIVES**

**AIM**

To formulate and assessment of polyherbal multipurpose hair mask.

**OBJECTIVES**

- Prepare the herbal hair mask using natural powdered materials.
- Create a non-toxic, natural herbal hair mask that promotes hair growth, conditioning, and

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nourishment.

❖ To assess the effectiveness of a designed herbal hair mask.

❖ Create an easy hair mask.

❖ To address safety concerns with synthetic hair care products.

❖ It nourishes both the skin and the hair on the scalp.

## II. MATERIALS AND METHODS

**Collection and authentication of plant materials:**

The plant specimen for the proposed study Neem (Phyllanthus emblica L.) was commercially obtained from local market in Thiruvananthapuram district, Kerala. The herbariums of these plants were identified and authenticated by a botanist Dr. N. Maybel Starlin, PG and Head of Research Dept. of Botany, Nesamony Memorial Christian College, Marthandam, Tamil Nadu India.

**1. STRAWBERRY**

**Botanical name:** Fragaria ananassa

**Family:** Rosaceae

Strawberries were originally cultivated in France in the 1300s, according to historical records. Itare currently farmed commercially in numerous nations throughout the world, with the United States, Spain, and Mexico being the top producers. Other notable manufacturers are Turkey, Egypt, South Korea, and China.Strawberries include a variety of beneficial chemical components for hair, including:

**1. Vitamin C**: Strawberries contain vitamin C, which strengthens and promotes hair development.

**2. Antioxidants:**Strawberry antioxidants, including ellagic acid and anthocyanins, protect hair follicles from oxidative stress and free radical damage.

**3. Biotin:** Strawberries contain biotin, a B-vitamin essential for healthy hair. Biotin deficiency can cause hair loss and brittle hair.

**4. Silica:** Strawberries are a natural source of silica, a mineral that helps to strengthen and elasticity hair[10].

Figure 4: Strawberry

**2. BRAHMI**

**Botanical name:** Bacopa monnier

**Family:** Scrophulariaceae

Brahmi grows along the banks of streams. Brahmi is located in the rainy, soggy, and damp regions of northern India. Brahmi contains basic oils, sterols, flavanols, glycosides, and triterpenoid saponins. It is also known as Brahmi powder Ras Ayana in Ayurveda, and as such, it has the potential to prevent physical ageing symptoms such as hair loss. It has a variety of chemical elements that add to its potential hair health advantages. Here are several major chemical elements found in Brahmi, along with their potential advantages for hair:

**1. Bacosides:** Bacosides are a class of active chemicals discovered in Brahmi. They are thought to contain antioxidant qualities, which could help protect hair follicles from damage caused by free radicals and oxidative stress.

**2. Alkaloids:** Brahmi includes alkaloids like brahmin and herpestine. These alkaloids may improve hair development by activating hair follicles and encouraging hair regeneration.

**3. Saponins:** Brahmi includes saponins such bacosides and bacopa sides. Saponins cleanse and promote scalp health by eliminating excess oil, grime, and debris. **4. Flavonoids:** Brahmi contains flavonoids, such as apigenin and luteolin, which have antioxidant and anti-inflammatory properties. They may minimize scalp irritation and provide a healthy scalp environment, leading to better hair development. **5. Essentialoils**: Brahmi includes essential oils such as monoterpenoids and sesquiterpenoids. Brahmi's aromatic components contribute to its unique scent and may have a relaxing and calming impact on the scalp[10].

Figure 5: Brahmi

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**3. CALCIUM BENTONITE (FULLER'S EARTH)**

It is also called Fuller's earthpowder does not come from a single plant. It is a clay mineral, more precisely a sedimentary clay known as montmorillonite. It is found in deposits all over the world and is often utilized in cosmetics and haircare products due to its absorbent and cleaningcharacteristics. It contains a variety of minerals and chemicals that may have hair-related effects. Fuller's earth contains several essential elements that may help hair.

**1. Aluminum silicates:** Fuller's earth is mostly made up of hydrated aluminium silicates, which give it absorbent and cleaning characteristics. It can assist to eliminate excess oil, debris, and pollutants from the hair and scalp.

**2. Minerals:** Fuller's earth contains minerals such as magnesium, calcium, and iron. These minerals can nourish and strengthen the hair, improving overall hair health. **3. Silica:** Fuller's earth contains silica, a mineral that has been shown to increase hair texture and luster. It can help your hair look smoother and glossier.

**4. Absorbent characteristics:** Fuller's earth has good absorbent capabilities, which can aid in removing excess oil from the scalp. This can be useful for people who have oily hair or scalp issues.

**5. Scalp balancing:** Fuller's earth may assist to balance the pH of the scalp, reducing inflammation. It can soothe and relieve itching or irritation[10].

Figure 6: Calcium bentonite

**4. FENUGREEK**

**Botanical name:** Trigonella frenum-graecum

**Family:** Fabaceae

Fenugreek, a plant native to southern Europe and the Mediterranean region, is grown throughout central and southeastern Europe, western Asia, India, and northern Africa.

Here are several major chemical elements identified in fenugreek, along with their potential advantages for hair:

**1. Saponins:** Fenugreek seeds contain saponins, such as diosgenin. These substances have been claimed to have anti-inflammatory and scalp-soothing characteristics, which could help reduce scalp irritation and itching.

**2. Proteins:** Fenugreek seeds are high in proteins, which may help nourish and strengthen hair strands, boosting overall hair health.

**3. Nicotinic acid:** Fenugreek seeds contain nicotinic acid (niacin), which is thought to boost blood circulation in the scalp. Increased blood flow can deliver important nutrients to the hair follicles, potentially fostering healthy hair growth.

**4. Steroids:** Fenugreek seeds contain steroidal substances such as trigonelline and diosgenin. These chemicals have been suggested to have hair growth-promoting effects.

**5. Minerals and vitamins:** Fenugreek seeds include a variety of minerals and vitamins. For maintaining the scalp and hair[10].

Figure 7: Fenugreek

**5. AMLA**

**Botanical name:** Phyllanthus emblica

**Family:** Phyllanthaceae

Amla, or Indian gooseberry, has been cultivated in India from 3000 BCE and is mentioned in ancient books such as the Ayurveda and the Charaka Samhita (400 CE). It is celebrated for its health advantages and has had an impact on traditional medicine practices in Southeast Asia and China. Amla, known for its high vitamin C and antioxidant content, is still an important element in Ayurvedic formulations. Its impact on wellness is still seen today.

**1. Vitamin C** : It is a potent antioxidant that improves collagen formation, strengthens hair follicles, and stimulates hair growth.

**2. Tannins:** These substances prevent hair loss and improve hair texture, making it shinier and smoother.

**3. Polyphenols :** It has anti-inflammatory

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compounds that soothe the scalp, reducing dandruff and inflammation.

**4. Iron:** Helps to improve blood circulation in the scalp, which promotes healthy hair development.

**5. Fatty acids:** It nourish and hydrate the hair, reducing dryness and brittleness[11].

Figure 8: Amla

**6. NEEM**

**Biological Source:** Azadirachta indica

**Family:** Meliaceae

**1. Azadirachtin:** This compound has antibacterial and antifungal properties, making it effective against dandruff and scalp infections**.**

**2. Nimbidin:** Nimbidin promotes hair growth and strengthens hair follicles, reducing hair fall.

**3. Nimbin**: It helps soothe irritated scalp conditions and reduces inflammation. **4. Vitamin E:** An antioxidant that promotes healthy hair growth and protects against damage.

**5. Essential Fatty Acids:** Nourish hair and scalp, improving overall health and texture. **6. Flavonoids:** Help in reducing oxidative stress on hair, supporting a healthy growth environment[12]**.**

Figure 9: Neem

**7. AVOCADO**

**Biological Source:**Persea americana

**Family:**Lauraceae

It is indigenous to the Americas and was initially cultivated by Mesoamerican people around 5,000 years ago.

Avocado includes a number of helpful chemical components for hair, including:

**1. Fatty Acids:** Avocado contains monounsaturated fatty acids, such as oleic acid, which moisturizes and nourishes the hair, leaving it silky and lustrous.

**2. Vitamins:** Avocado is high in vitamins, particularly vitamin E, which aids in hair restoration and protects against free radical damage. It also contains vitamin B, which stimulates hair development and strengthens the strands.

**3. Minerals:** Avocado includes minerals such as copper and magnesium, which are necessary for keeping healthy hair and avoiding hair loss.

**4. Antioxidants:** Avocado includes antioxidants such as polyphenols, which help minimize oxidative stress on the hair, protecting it from damage and improving general health.

Figure 10: Avocado

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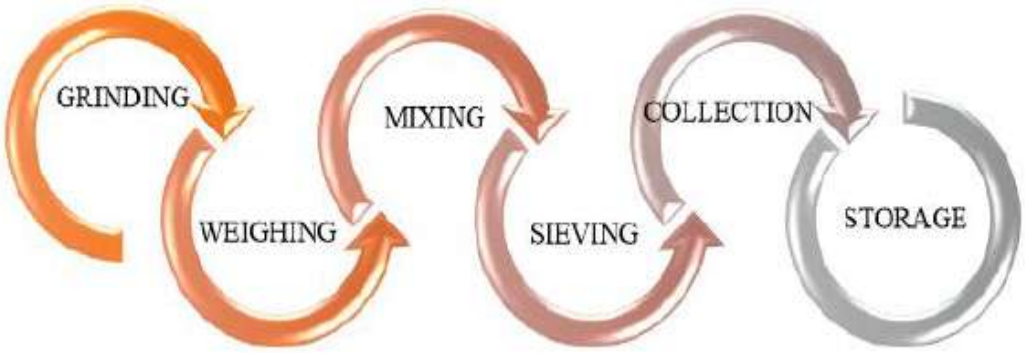
| SL.NO | CONSTITUENTS NAME | BIOLOGICAL SOURCE/ FAMILY | USE |
|---|---|---|---|
| **1** | StrawberryPowder | Fragaria ananassa (Rosaceae) | Removes Excess Oil, Prevent Hair Loss |
| **2** | Amla powder | Phyllanthus emblica (Phyllanthaceae) | Antioxidant, Promote Hair Growth |
| **3** | Brahmi Leaves Powder | Bacopa monneri | Cleanser, Strenghthen |
| | | (Plantaginaceae) | Colour, Hair Growth |
| **4** | Fuller's Earth Powder | Calcium Bentonite | Conditioning, Remove Excess Oil &Dirt |
| **5** | Fenugreek Seeds Powder | Trigonella foenumgraecum (Fabaceae) | Antifungal, Fight Scalp Problem |
| **6** | Neem leaves powder | Azadirachta indica (Meliaceae) | Promote Hair Growth, Relief from Dandruff |
| **7** | Avocado Powder | Persea americana (Lauraceae) | Boost Shine, Nourishing |

**ROLE OF INGREDIENTS**

Table 1: Role of ingredients

**METHOD OF PREPARATION:**



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**FORMULATION OF HERBAL HAIR MASK**

To make an herbal hair pack, Grind all of the dried herbal components into a fine powder with a mortar and pestle. Use a digital balance to correctly weigh each herbal powder required for the mix once it has been ground[13]. Next, add all of the fine powders in a mixer and blend thoroughly to produce a consistent consistency. To further refine the mixture, put it through a sieve (sieve no. 80) to eliminate any larger particles and get a smooth texture. After achieving a fine, homogeneous powder, transfer the mixture to a clean glass container. Choose one with a tight lid to keep the powder away from moisture and light. To maintain its efficacy, keep it cool and dry[14].

| SL.NO | INGREDIENTS | HM 1 | HM2 | HM3 |
|---|---|---|---|---|
| 1 | Strawberry Powder | 10gm | 10 gm | 10 gm |
| 2 | Amla powder | 15gm | 17 gm | 15 gm |
| 3 | Brahmi Leaves Powder | 25 gm | 27 gm | 15 gm |
| 4 | Calcium Bentonite | 10 gm | 10 gm | 10 gm |
| 5 | Fenugreek Seeds Powder | 15 gm | 15 gm | 15 gm |
| 6 | Neem leaves powder | 20 gm | 10 gm | 25 gm |
| 7 | Avocado Powder | 10 gm | 10 gm | 10 gm |

Table 3: Formulation of hair mask

**DIRECTION OF USE:**

**1. Preparation of the Hair Mask:**

- Take 1-2 tablespoons of the "Herbal Hair Mask" powder and put it into a clean bowl.
- Gradually add water to the powder, ensuring that the amount is just enough to make a smooth paste.
- Mix the powder and water thoroughly using a spoon or whisk to avoid forming any lumps.
- The resulting mixture should be of a moderately thin consistency, making it easy to apply.

**2. Application to Hair:**

- Section your hair into parts for easier application.
- Using your hands or a brush, apply the prepared paste evenly onto your hair, starting from the scalp and working your way down to the ends.
- Make sure all areas, including the roots and tips, are well-covered for maximum benefits.

**3. Waiting Period:**

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- Leave the mask on your hair for 30-40 minutes, allowing the natural ingredients to nourish and strengthen your hair.
- You can wrap your hair in a towel or use a shower cap during this time to avoid any mess.

**4. Rinsing and Washing:**

- Rinse off the mask thoroughly with water to remove all traces of the powder. o Use a mild, sulfate-free hair cleanser or shampoo to wash your hair gently.
- Avoid using hot water, as lukewarm or cool water helps to retain moisture and shine in your hair.

**5. Drying and Repeating:**

- After washing, allow your hair to air dry naturally instead of using heat-based drying tools.
- Repeat this process 1-2 times a week for best results, and experience the transformation to healthier, stronger, and more lustrous hair.

Regular use of this mask will help in revitalizing the hair and promoting better texture and shine.

**EVALUTION OF HERBL HAIR MASK**

**1. Organoleptic Evaluation:**

The formulation examination was conducted as part of the evaluation process, which involved macroscopic characteristics of the drug or product using sensory organs such as the eye and nose[15].

- · Color
- · Odour
- · Appearance

**2. Physiochemical Evaluation:**

**❖ pH**

The pH of a hair mask is crucial since hair has a slightly acidic pH, usually between 4.5 and 5.5. Maintaining a pH within this range protects the hair cuticle and promotes healthy appearance[16].

- · Dip the pH strip
- · Wait for the reading
- · Record the pH

**❖ Loss on Drying**

Measure 1.5 gm of the supercharged medication into a flat, thin porcelain plate. Dry in an oven at 100°C or 105°C until two successive weighing differ by no more than 0.5 gm. Cool in desiccators and weight. Moisture is commonly used to record weight loss.

Percentage loss on drying (%)=Initial Weight−Final Weight×100
Weight of sample used

**3. Rheological Evaluation**

**❖ Tapped Density**

Tapped density refers to the higher bulk density achieved by mechanically tapping a container containing powder samples. After noting the initial powder volume or mass, tap the measuring cylinder or vessel for 1 minute and take readings until little change is detected. The measurement was represented as grams per millilitre.

**Tapped Density = Mass / Tapped Volume**

**❖ Bulk Density**

Bulk density is the ratio between a powder's mass and bulk volume. The required amount of powder is dried and poured into a50 ml measuring cylinder up to the 50 ml mark. The cylinder is dropped onto a hard wood surface from a height of 1 inch at 2-second intervals. The volume of powder is measured. Finally, the powder is weighed. This is performed to obtain the average values.

**Bulk density = Mass / Bulk Volume**

**❖ Angle of repose:**

It is defined as the maximum anglepossible in between the surface of pile of powder tothe horizontal flow.

Place the needed amount of dried powder in a cylinder tube with open ends and place it on a flat surface. The funnel should be lifted to create a heap. The height and radius of the heap are measured and documented. To determine the angle of repose using the above method, use the following formula.

**θ = tan-1 (h/r)**

where, θ - angle of repose
h- height of the heap
r - radius of the base

**4. Phytochemical evaluation**

**1. Detection of carbohydrates:**

**❖ Molisch's Test:**

To 2-3 ml of aqueous extract, add a few drops of alpha-naphthol solution in alcohol, agitate, and concentrate. A violet ring forms when H2SO4 from the walls of the test tube combines with two liquids.

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❖ **Fehling's Test:**

Combine 1ml fehling A and 1ml fehling B solutions and boil for 1 minute. Add an equivalent volume of test solution. Heat in a boiling water bath for 5- 10 minutes. A yellow and then brick red is precipitate is observed.

**2. Detection of alkaloids:**

❖ **Hager's Test:**

A yellow precipitateis produced by combining 2-3 ml of filtrate with hagers reagent.

❖ **Mayer's Test:**

Creamy precipitate is produced by adding a few drops of Mayers reagent to 2- 3 ml of filtrate.

❖ **Detection of volatile Oil**: When 2 to 4 grams of hair mask are treated with an alcoholic sudan III solution, the hair mask turns red when volatile oils are present.

**3. Identification of Protein:**

- **Biuret Test:** Add 4% NaOH and a few drops of 1% $CuSO_4$ solution to 3 millilitres of T.S. The color turns pink or violet.
- **Foam test:**The cylinder shaking method was used to evaluate the hair mask's foaming capacity. A 250 mL graduated cylinder containing 50 mL of a 1% hair mask solution was shaken ten times while being held steady by a hand. The total volume of foam produced was calculated after a minute of shaking. Shaking and measuring the foam volume at one-minute intervals for a total of five minutes was how the foam volume was estimated[17].

**5. Solid Content (%)**

A clean, dry evaporating dish was weighed, and 4 grams of hair mask was added. Afterevaporating the liquid portion, the dish with the remaining solid content was dried, and the final weight of the solid content was measured precisely[18].

**Solid Content (%) = (Weight of Solid / Total Weight of Mixture) ×100**

**6. Dispersion of Dirt**

Half a test tube was filled with purified water and two drops of hair mask. One drop of India ink was added, then the tube was sealed with a stopper and shaken ten times. The presence of ink in the foam was then classified as None, Light, Moderate or Heavy[19].

**7.Spreadability**

The Spreadability of the hair mask was tested using a wooden block and glass slide setup. A 5 g sample of the hair mask was placed beneath the block, and a
movable slide was positioned on top. The time taken for the slide to move 5 cm was measured.

**S=m x l / t**

S=Spreadability.
m = is the weight attached to the upper slide.
l = is the distance travelled by the upper slide.
t = is the time it takes to separate the slides.

**8. Washability**

The washability of the formulated hair mask was evaluated by applying a small amount of the product onto the hair. After allowing the hair mask to sit for a few minutes, the hair was rinsed thoroughly with water. The assessment focused on how easily the mask could be removed without leaving behind any residue or sticky feeling. Observations included the amount of water needed for complete removal and the time taken to achieve a clean surface. A hair mask with good washability would rinse off easily, leaving the skin feeling clean without any oily or sticky residue[20].

**9. Stability Studies**

The optimized formulations&thermal stability was investigated by putting them in a glass container and keeping them in a humidity chamber at a temperature of 40±2°C and a relative humidity of 75±5%,for the period of 15 days. After storage, the parameter such as change in colour, odour, texture, appearance were checked[21].

**10. Microbial Assay**

1.**To prepare and sterilize nutrient broth:**

Materials:

- Beef extract: 2.5 g
- Peptone: 2.5 g
- Sodium chloride: 1.25 g
- Distilled water: 250 ml
- Nutrient agar (optional, for solid medium): 1-2 g

**2. Procedure:**

❖ Preparation of the Nutrient Broth:

- Measure 2.5 g of beef extract, 2.5 g of peptone, and 1.25 g of sodium chloride.
- Dissolve these ingredients in 250 ml of distilled water in a clean beaker orflask.
- Stir the solution thoroughly until all the components are completely dissolved.

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❖ Incorporating Agar (if a solid medium is required):

- If a solid medium is needed for plating, add 1-2 g of nutrient agar to thesolution.
- Mix well until the agar is evenly distributed.

❖ Adjusting pH:

- Check the pH of the mixture using a pH meter. The pH should be around 7.0.
- If necessary, adjust the pH by adding a few drops of 1 M HCl to lower it or 1M NaOH to raise it.

❖ Dispensing into Containers:

- Pour the nutrient broth solution into glass bottles or flasks, leaving some spaceat the top for expansion during sterilization.
- Seal the containers with cotton plugs or lids.

❖ Sterilization:

- Place the containers in an autoclave.
- Sterilize at 121°C (15 psi pressure) for 15-20 minutes to ensure allmicroorganisms are destroyed.
- After autoclaving, allow the broth to cool to room temperature.

❖ Using the Nutrient Broth:

- If the medium contains agar, pour it into sterile petri dishes while still warm(around 45-50°C) to create solid plates.
- If using as a liquid medium, use the sterilized nutrient broth directly forinoculating microorganisms.

❖ Storage:

- Store the prepared nutrient broth in a cool, dry place or refrigerate if not usingimmediately. Ensure the containers remain tightly sealed to preventcontamination.

**3. Aseptic Transfer of Liquid Culture Media to Petri Dish**

Materials Needed:

- Sterilized nutrient broth with agar (cooled to around 45-50°C)
- Sterile petri dishes
- Bunsen burner or spirit lamp
- Sterile gloves
- Alcohol (70% ethanol)
- Sterile pipette or pouring flask

Procedure:

❖ Preparation of Work Area

- Disinfect with 70% ethanol
- Work in a sterile environment
- Light Bunsen burner

❖ Transfer of Media

- Wear sterile gloves and sanitize
- Open petri dish carefully
- Pour 15-20 ml nutrient agar
- Close lid immediately

❖ Cooling and Solidification

- Let agar solidify (15-20 mins)
- Ensure smooth surface

❖ Storing Prepared Petri Dishes

- Store upside down
- Label with date and medium

**4. Preparation of bacterial colonies**

❖ Preparing the Work Area:

- Clean and disinfect the with 70% ethanol.
- Light a Bunsen burner.
- Wear sterile gloves and sanitize them.

❖ Inoculation:

- Flame the inoculating loop.
- Allow the loop to cool for a few seconds to prevent killing the bacteria.
- Dip the cooled loop into the bacterial culture or touch it to the sample beingtested.

❖ Streaking on Agar Plate:

- Carefully lift the lid of the petri dish.
- Gently streak the inoculating loop back and forth in a small section of the agarsurface.
- Rotate the plate slightly and continue streaking in a new area, ensuring you donot overlap too much with previous streaks.
- Repeat this process for 3-4 quadrants of the plate, flaming the loop betweeneach quadrant if necessary.

❖ Incubation:

- Close the lid of the petri dish securely.
- Place the plate upside down in an incubator set at an appropriate temperature(usually around 37°C for bacteria).
- Incubate for 18-24 hours or until visible colonies appear.

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❖ Observation and Identification:

- After incubation, examine the agar plate for the presence of distinct colonies.

## III. RESULT AND DISCUSSION:

**1. Organoleptic Evaluation of Formulation**

| SL.NO. | PARAMETER | HM 1 | HM 2 | HM 3 |
|---|---|---|---|---|
| 1 | Color | Light brown | Light Greenish | Greenish |
| 2 | Odour | Characteristics | Characteristics | Characteristics |
| 3 | Appearance | Powder | Powder | Powder |

Table 4: Organoleptic evaluation

**2. Physiochemical Evaluation:**

❖ **pH**

| SL.NO. | HM 1 (pH) | HM 2 (pH) | HM 3 (pH) |
|---|---|---|---|
| 1 | 5.4 | 5.3 | 5.5 |

Table 5: pH

❖ **Loss on Drying**

| SL.NO. | HM (LOD) | Initial weight | Final weight | Percentage (LOD) |
|---|---|---|---|---|
| 1 | HM 1 (LOD) | 94.65 | 94.55 | 6.6% |
| 2 | HM 2 (LOD) | 90.370 | 90.23 | 9.3% |
| 3 | HM 3 (LOD) | 101.60 | 101.49 | 7.3% |

Table 6: Loss on Drying

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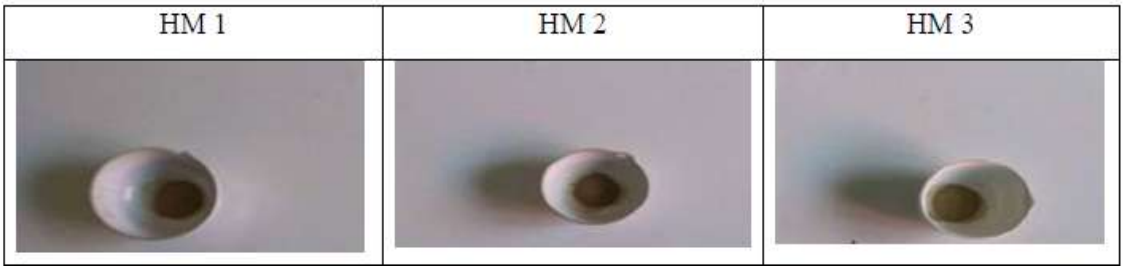


Figure 11: Loss on Drying

**3. Rheological Evaluation**

| SL.NO. | PARAMETERS | HM 1 | HM 2 | HM 3 |
|---|---|---|---|---|
| 1 | Tapped density | 0.54g/cc | 0.57g/cc | 0.58g/cc |
| 2 | Bulk density | 0.4 | 0.37 | 0.36 |
| 3 | Angle of Repose | 18.283 | 20.277 | 19.567 |

Table 7: Rheological Evaluation

**4. Phytochemical evaluation**

| SL.NO. | TEST | PURPOSE FOR DETECTION | RESULT |
|---|---|---|---|
| 1 | Molisch's Test | Presence of carbohydrate | Positive |
| 2 | Fehling's test | Presence ofcarbohydrate | 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 | Positive |
| 6 | Biuret test | Presence of Proteins | Positive |
| 7 | Foam test | Presence of Saponin | Negative |

Table 8: Phytochemical evaluation

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**5. Solid Content (%)**

| SL.NO. | BATCH NO. | Solid Content (%) |
|---|---|---|
| 1 | HM1 | 22.5% |
| 2 | HM2 | 26.5% |
| 3 | HM3 | 24.5% |

Table 9: Solid Content

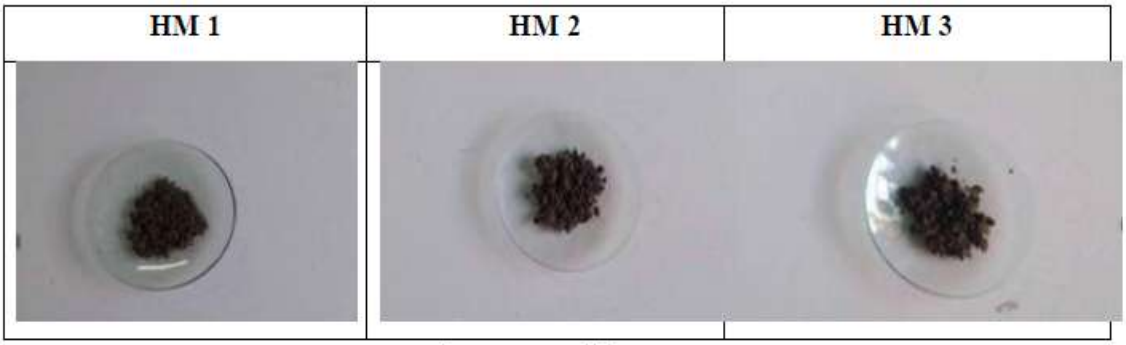


Figure 12: Solid Content

**6. Dispersion of Dirt**

The presence of ink in the foam was **None:** The hair mask has good cleansing properties and can effectively remove dirt and oil from the hair.

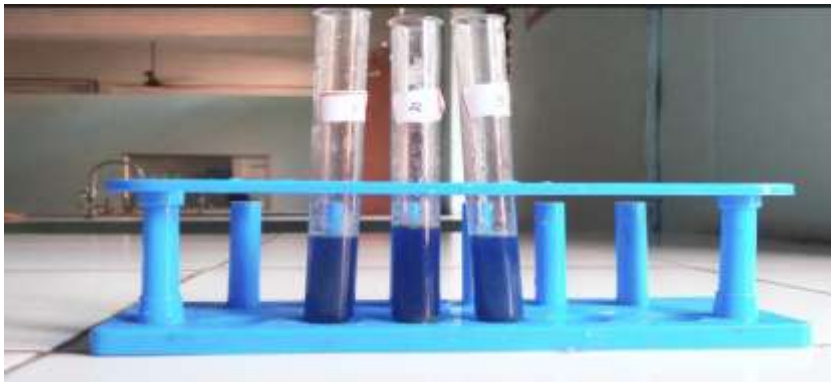

Figure 13: Dispersion of Dirt

**7. Spreadability**

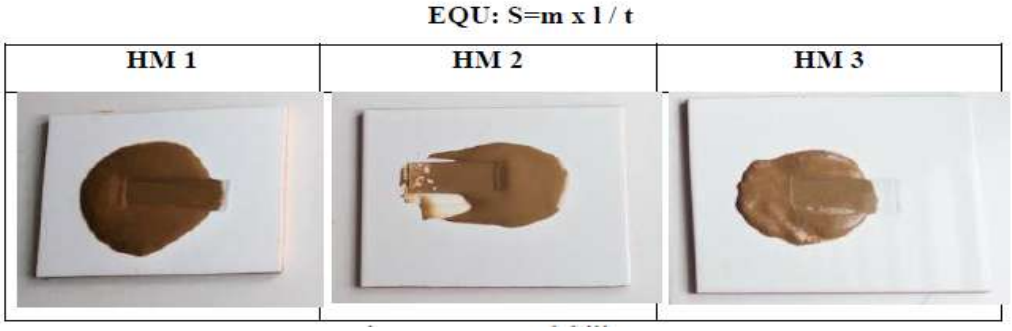


Figure 14: Spreadability

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| SL.NO. | BATCH NO. | SPREADABILITY |
|---|---|---|
| 1 | HM1 | 4.1% |
| 2 | HM2 | 3.12% |
| 3 | HM3 | 3.84% |

Table 10: Spreadability

**8. Washability**

| HM 1 | HM 2 | HM 3 |
|---|---|---|
| Normal Hair | Normal Hair | Normal Hair |

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Figure 15: Washability

**9. Stability Studies**

| SL.NO. | PARAMETERS | OBSERVATION |
|---|---|---|
| 1 | Change in colour | No change |
| 2 | Change in odour | No change |
| 3 | Change in texture | No change |
| 4 | Change in appearance | No change |

Table 11: Stability Studies

**10.Microbial Assay**

The microbial activity was not detected.

| HM 1 | HM 2 | HM 3 |
|---|---|---|

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Figure 16: Microbial Assay

## IV. CONCLUSION

The study on the herbal hair mask aimed to create a natural, non-toxic solution for hair care, utilizing plant-based ingredients such as strawberry, amla, fenugreek, and neem. These ingredients offer hydration, shine enhancement, and scalp health improvement. The formulation effectively targets common hair issues, including dryness, dandruff, and hair loss, leveraging the ingredients antioxidant, anti-inflammatory, and moisturizing properties. Evaluations demonstrated the mask's ability to improve scalp health, strengthen hair, and enhance shine without harmful side effects. This herbal hair mask is a promising, gentle, and effective alternative to chemical products, ideal for those seeking a healthier hair care option.

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