



FORMULATION AND DEVELOPMENT OF HERBAL PRODUCTS CONTAINING *HIBISCUS ROSA-SINENSIS*

Pratiksha vishnu kale
Aditya pharmacy college of beed

I. INTRODUCTION:

Hair is an epidermal derivative which is one of the vital parts increasing the overall elegance of the body. Hair fall, dandruff, lice, split ends, grey hair are few problems involved with hair faced by human^[1]. To overcome these, human takes many measures by applying many cosmetics for each. Hair oil is one among them used to solve almost all of these problems^[2].

Herbal cosmetics are in high demand due to the increasing interest of mankind towards them because they are more effective with nil or less side effects, easily available ingredients etc. Hair care cosmetics are now added with herbs and they are well recognised compared with synthetic ones^[3].

Herbal hair oil is more preferred and is used in many ailments of hair^[4]. They promote hair growth, improve elegance of hair and prevent hair fall^[5]. Hair oil not only promotes hair growth they also provide necessary moisture to the scalp rendering in beautiful hair.

The present work was aimed to prepare and evaluate a polyherbal hair oil containing herbs like curry leaves, bringaraj, hibiscus flower, hibiscus leaves, onion seed, fenugreek, cinnamon in coconut oil and orange oil. All these herbs have well known traditional potential in the treatment of hair care^[6].

Medicinal agents extracted from nature has been the main source in replacing many synthetic drugs that may cause side effects^[7, 8]. The most important bioactive compounds of plants are alkaloids, flavonoids, tannins and phenolic compounds^[9, 10]. There are still many on going studies done to discover plants that can act as medicine and use in cosmetic products. One such plant is *Hibiscus rosa-sinensis* Linn (HRS).

It is well accepted that the whole part of HRS such as stem, roots, flower, and leaves had been used as traditional and folklore medicine^[10,11]. The flowers usually used in herbal teas and food coloring and in some countries, they are eaten as salad or pickles proven. This shows that this plant is not harmful and safe to our bodies. The leaves have been used in healing processes due to their antioxidant, antityrosinase. and anti-bacterial activities^[12,13]. It's usage as traditional medicine is, however, still limited and warrants further studies. In addition, there are only a few articles on hair growth that uses HRS as an activating agent and the rest are about the anti-bacterial activity.

Drugs are an option to cure hair loss, but fear of side effects cannot be ignored. An option which is using an herbal remedy to cure this disease has yet to be incorporated into the mainstream of medical care due to limited scientific evidence. Hence, it is believed that HRS provides an alternative as a herbal

remedy that can be used to promote hair loss based on traditional practices. With that, in the present study, *Hibiscus rosa-sinensis* Linn (HRS) is used as an activating ingredient to promote hair growth. The extract from the leaves and flowers will be applied onto rats of Dawley Sprague and their hair growth will be monitored through histology study.

HUMAN HAIR:

Human hair has about 65-95% of its weight in proteins, more 32% of water, lipid pigments and other components. Chemically, about 80% of human hair is formed by a protein known as keratin, with a high grade of sulfur. Keratin is a laminated complex formed by different structures, which gives the hair strength, flexibility, durability, and functionality^[14]. The physicochemical properties and shape of the hair is the direct result of the organization of its various structural elements, proteins being the most significant. Hair shape is defined in the hair follicle: large hair follicles produce “terminal” hairs (scalp), small follicles produce fine “vellus” hairs (body hair), curved follicles produce curly hair in all ethnicities^[15].

STRUCTURE OF HAIR:

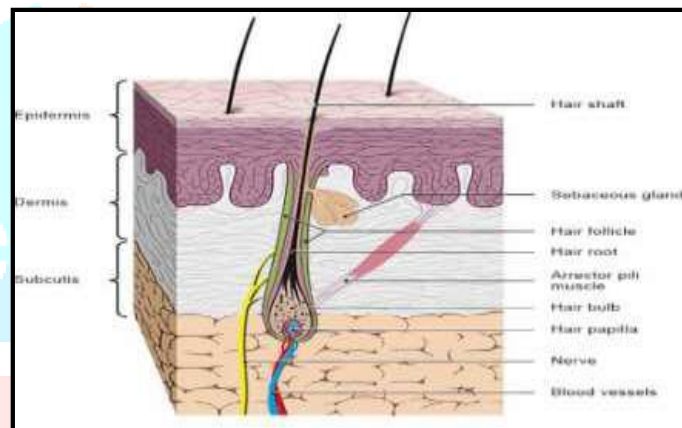


Figure 1: Structure of hair

- Each hair has a hair shaft and a hair root. The shaft is the visible part of hair that sticks out of the skin. The hair roots is in the skin and extends down to the deeper layers of skin. It is surrounded by the hair follicle (a sheath of skin and connective tissue), which is also connected to a sebaceous gland.
- Each hair follicle is attached to a tiny muscle (arrector pili) that can make the hair stand up. Many nerves sense hair movement and are sensitive to even the slightest draft.
- At the base of the hair, the hair root widens to a round hair bulb. The hair papilla, which supplies the hair root with blood, is found inside the bottom of the hair bulb. New hair cells are constantly being in the hair bulb, close to the papilla.
- New cells are constantly forming in the hair bulb. These cells stick together and harden. The full strand of hair develops from this group of hardened hair cells. Because new hardened cells keep on attaching to the hair from below, it is gradually pushed up out of the skin. In this way, a single hair on your head grows at a rate of about 1 cm per month.
- The color of the hair is determined by the amount of melanin in the hardened cells. This can vary a lot from person to person, and it changes over the course of a lifetime. The amount of melanin typically decreases as people get older, and more air gets trapped inside the hair – it then loses its color and turns white. Depending on someone’s original hair color and the number of white hairs that grow, the hair on their head then turns gray or white^[16].

HAIR GROWTH CYCLE:

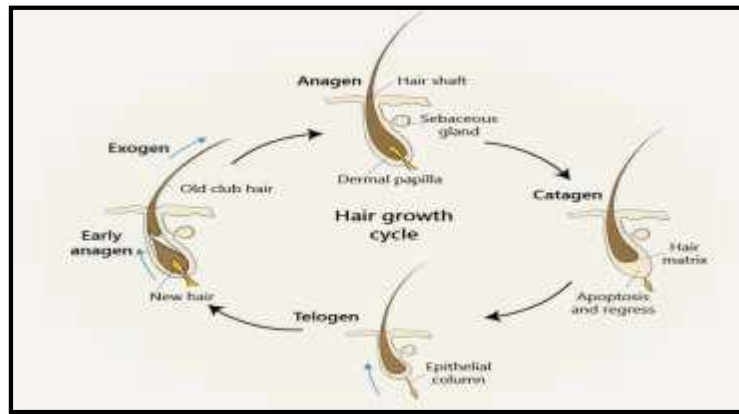


Figure 2: stages of growth cycle^[17]

Stage	Key feature
Anagen	Active growth phase Early anagen: hair matrix forms new hair Nourishment of HF from blood supply enables hair growth Lasts 2–6 years.
Catagen	Intermediate or “transition” phase Deeper portion of the HF starts to collapse, HF detaches from nourishing blood supply Lasts 1–2 weeks
Telogen	Resting phase Remains of the hair bulk are inactive, papillary cells completely separate from HF Lasts 5–6 weeks
Exogen	Shedding phase Hairs at the end of their life fall out Mainly coupled to early anagen but also occurs in telogen.

Table 1; The main phases of hair growth^[18]

HAIR FOLLOCLE CYCLING:

The HF of mammalian skin regularly cycles between involution and regeneration throughout postnatal life^[19].

There are four main phases of the HF cycle:

1. anagen (growth),
2. catagen (regression),
3. telogen (rest), &
4. exogen (shedding)^[18]. (Figure: 2 ; table:1)

The duration of each phase varies by anatomical location, nutritional and hormonal status, age, and species^[20]. In mice, for example, the first “test” hair shaft is generated relatively late at 17 days postpartum^[21] and is consequently often misinterpreted as “first anagen”. Scalp follicles undergo 10–30 cycles in a lifetime. The cycling of human HF is thought to be associated with the distribution of white adipose tissue which clusters around pi-losebaceous units in structures called “dermal cones”^[22]

1. ANAGEN(growth):

Anagen is the growth phase, and true anagen occurs 4 weeks after birth^[23]. The stem cells present within the bulge region begin to proliferate at the onset of anagen to produce a new lower HF. Human HF bulge cells are keratin 15 (K15) positive and express high levels of $\beta 1$ - integrin^[24]. The hair matrix transient amplifying cells, derived from epithelial HF stem cells in the bulge, also proliferate intensively and subsequently differentiate into distinct epithelial hair lineages^[25]. For the remainder of anagen, and for catagen and telogen growth phases, the HF stem cells are otherwise extremely slow-cycling^[24]. The anagen growth phase of human scalp hairs can last between 2 and 8 years^[26].

2. CATAGEN (regression):

Catagen marks the period of rapid HF involution, where the entire lower two thirds of the HF rapidly degenerate over 2–3 weeks leaving only club hair surrounded by an epithelial cap (fig:2). This occurs mainly by apoptosis of dermal matrix, inner root sheath (IRS), and outer root sheath (ORS)

keratinocytes. There is sparing of the bulge HF stem cells^[27]. The end result is formation of an epithelial strand, a remnant of the HF, which functions to approximate the dermal papilla with the bulge^[28]. In mice, the old hair shaft (club hair, now detached), normally remains in situ in the hair canal as the new hair emerges through the same orifice. In mice, the club hair may rest in the socket for several cycles and thus act to contribute to the density of the coat and leads to bulging of the ORS around the club^[29].

3. TELOGEN(rest):

Telogen follows catagen, marks the resting phase of HF cycling & involves the shedding or loss of hair^[30] (Fig: 2). Early in life, mice have highly coordinated HF cycling throughout the skin, but synchrony is lost with increasing age^[31]. Humans^[32], on the other hand, exhibit desynchronization of HF cycles shortly after birth^[31]. Furthermore, the duration of telogen increases throughout development; there is slower HF turnover in aged animals^[32] and in humans. Although classically thought of as a stage of relative quiescence, telogen is now recognized to be an extremely active stage that is critical in controlling HF cycling^[31]. The variety in hair length observed throughout the human body (e.g., eyelashes, torso, scalp) is due to the ratio between anagen and telogen phases. Scalp hair, for example, has a high anagen: telogen ratio resulting in long hair, but eyelashes and hair on the limbs spend less time in anagen and more time in telogen, resulting in shorter hair^[34].

4. EXOGEN(shedding):

While old hair shafts can be shed passively by mechanical forces, shedding in exogen is primarily an active process^[35]. Human HFs transition through the cycles at different rates. On average human HFs cycle every 2–8 years, meaning at any one point roughly 86% of hairs are in anagen, 1% are in catagen, and the remaining 13% are in telogen^[36].

NUTRIENTS IMPORTANT FOR HAIR HEALTH:

Beta carotene	Biotin	Vitamin B1	Vitamin B2
Vitamin B5 (pantothenic acid)	Vitamin B6	Vitamin B12	Vitamin D
Vitamin E	Inositol	Folic acid	Calcium
Zinc	Iron	L-Methionine	L – Cysteine
L Lysine	L-Taurine	Selenium	Polyunsaturated fatty acids (PUFAs)

Table 2: nutrients important for hair health^[37]

IMPORTANT FOOD AND HERBS USED IN MAINTENANCE OF HAIR HEALTH:

- **SALMON:** provide omega-3 fatty acids, protein, vitamin B-12 and iron. Supports scalp health.
- **DARK GREEN VEGETABLES:** Spinach, broccoli and Swiss chard, provide vitamins A & C used in sebum production (secreted by hair follicles). Dark green vegetables provide iron and calcium.
- **BEANS:** provide protein, iron, zinc, and biotin. Biotin deficiencies can result in brittle hair.
- **NUTS:** Brazil nuts are a natural source of selenium. Walnuts contain zinc and alpha-linoleic acid, an omega-3 fatty acid that may help hair condition. Pecans, cashews and almonds also contain zinc. Zinc deficiency can lead to hair shedding.
- **POULTRY:** provides the high-quality protein and iron. Deficiency of protein leads to weak and brittle hair.
- **EGGS:** Eggs are sources of protein, biotin and vitamin B-12 – important beauty nutrients.
- **WHOLE GRAINS:** Provides zinc, iron & vitamin B.
- **OYSTERS:** Provide zinc, a powerful antioxidant.
- **LOW FAT DAIRY PRODUCTS:** Calcium, Whey and Casein are important minerals for hair growth sourced from skimmed milk and yogurt.
- **CARROT:** excellent source of vitamin A. Balanced diet of lean proteins, fruits, and vegetables, whole grains, legumes, and fatty fish (salmon) and low- fat dairy products are potential aides to hair^[37].

TYPES OF HAIR LOSS :

- a) **Alopecia Areata (prime stage)** - Alopecia areata is a common autoimmune disease that results in the loss of hair on the scalp and else where. It usually starts with one or more small, round, non-scarring smooth patches. Mild Brief Alopecia Areata- Patient with repeated transient alopecia areata but never converts into alopecia totalis or universalis
- b) **Temporary Alopecia Areata** - Patient with Alopecia areata in advanced phase and some of them converts into Alopecia totalis/Alopecia universalis.
- c) **Ophiasis Alopecia Areata** - Ophiasis type of alopecia areata shows a band like hair loss. It occurs generally in the progressive or the occipital areas of the scalp, and therefore it is more difficult to treat, as most medicines have a delayed action on these areas.
- d) **Alopecia Totalis** - Loss of hair from whole Scalp.
- e) **Alopecia Universalis** - Loss of hair from entire body including eyebrows and eyelashes Scar ring Alopecia Any inflammatory process (burns, bacterial infections, ringworm, injury) necessary to cause permanent loss of follicles, affected area known as Scarring alopecia. Trichotillomania -This type of hair loss is known as compulsive pulling or dull self- pulling by a patient Himself or herself.
- f) **Traction Alopecia** - Hair elegance that tie hairs so tight can causes much traction at the root of hairs, and can develop adhesion alopecia
- g) **Chemotherapy and hair loss** - Chemotherapy is exclusive behavior for cancer patients but it marks normal cells and hair follicles too. This causes hair loss and known as anagen effluvium type of alopecia.
- h) **Diffuse Alopecia** - Unnecessary Loss of hair all over the scalp without creating a reinforcement. Hair loss due to side effect of the beauty treatments- Any beauty treatments like hair colors, dye, straightening, softening, rebounding, perming etc., which contains harsh chemicals can trigger hair loss for some individuals. Telogen effluvium (TE) and chronic telogen effluvium- (CTE) Dietary lacks, Crash dieting High grade fever, Anemia, Blood loss, Hormonal imbalance and pregnancy etc. can cause telogen effluvium type of hair loss telogen word is known for latent phase of the hair and fluvium means.

SYMPTOMS OF HAIR LOSS :

There are several factors for the hair loss; some of the main factors are given below -

1. Acute illness
2. Autoimmune disorders
3. Chemicals (hair dyes)
4. Chemotherapeutic agents/ drugs.
5. Diabetes
6. Hair loss following childbirth
7. Hair styling products
8. Hair styling techniques
9. High iron deficiency
10. Nutritional deficiencies
11. Other fungal infections
12. Physical trauma to the scalp
13. Poisons
14. Poor blood circulation
15. Poor diet or malnutrition
16. Prescription drugs
17. Psychological
18. Radiation exposure
19. Ringworm
20. Skin disease
21. Stress
22. Sudden weight loss
23. Surgery
24. Thyroid disease.

COMMON HERBS USED FOR HAIR CARE:

1) **Jatamansi:** -

- Improves the health of the hair follicles.
- Extends the growth (Anagen) phase of the hair.
- Reduces the time taken for hair to grow.
- Increases hair volume.
- Improves the strength of the hair.

2) **Amla:** -

- Strengthen the scalp and hair.
- Reduce premature pigment loss from hair or greying.
- Stimulate hair growth.
- reduce hair loss.
- Prevent or treat dandruff and dry scalp.

3) **Reetha:**

- Reetha increases the silkiness of hair.
- Prevents the scalp from lice.
- Prevents Dryness
- Good for hair growth
- Reetha reduces dandruff

4) **Neem:**

- Promote healthy hair growth.
- Temporarily seal hair follicles.
- Treats dandruff and itchy scalp.
- Hydrates dry ends of hair.

5) **Olives:**

- Improves softness and strength.
- Promotes the hair growth.
- Olives reduces the dandruff.
- Anti-bacterial and anti-fungal properties.

II. METHODOLOGY

1. **SELECTION:-**

• **Hibiscus Flower:**

You can use hibiscus for hair growth as it is rich in amino acids, a prime building block of keratin. Keratin is the protein that nourishes, strengthens, and binds the hair roots. Hibiscus is known to improve the build-up of keratin and boost the formation of new hair follicles, thereby stimulating hair growth.

• **Hibiscus Leaves:**

Hibiscus reduces the oil secretion by the glands that treat dandruff and itchy scalp. The leaves also reduce the growth of dandruff-causing fungi, reduce dandruff flakes and prevent its recurrence.

• **Cinnamon:**

When applied to the scalp, cinnamon may stimulate circulation. This could encourage hair growth and reduce hair loss. It also has antifungal properties, which might help treat dandruff caused by *Malassezia*, a type of fungus.

- **Fenugreek Seed:**

Fenugreek seeds are a rich source of iron and protein — two essential nutrients for hair growth. They also contain a unique composition of plant compounds, including flavonoids and saponins. These compounds are presumed to induce hair growth due to their anti-inflammatory and antifungal effects

- **Onion Seed:**

Onion oil is rich in sulfur which prevents breakage, split ends and thinning of hair. Other nutrients present in onion prevents oxidation of hair. It also maintains the regular pH of the hair, preventing premature greying.

- **Curry Leaves:**

They are rich in antioxidants and proteins, these antioxidants neutralize the free radicals and keep your hair healthy and strong.

- **Bhringraj:**

Bhringraj oil has antimicrobial and antifungal properties that can help reduce dandruff. The oil also has anti-inflammatory properties, which can help psoriasis or other skin irritations on the scalp. It is also said to improve circulation to the scalp.

- **Coconut oil:**

The lauric acid in coconut oil has nourishing properties that are especially prone to soak into the strands of your hair. Coconut oil absorbs into your hair quickly, providing moisture to tame frizz and heal breakage.

- **Orange oil:**

Orange essential oil moisturizes your hair shaft and prevents it from turning rough, dull and brittle. Using orange oil on your scalp and hair will improve the texture of your hair strands and encourage hair growth, leading to less hair fall.

2. COLLECTION:-

- Hibiscus flower – Hibiscus flower are easily available naturally and collected from plant .
- Leaves – Hibiscus leaves are easily available naturally and collected from plant.
- Cinnamon powder – Cinnamon is collected from market and it is cheap.
- Fenugreek seed – collected from market and it is cheap.
- Onion seed – collected from market.
- Curry leaves – collected from plant.
- Bhringraj - Purchased from the drug store.
- Coconut oil- Virgin coconut oil is purchased from the market.
- ORANGE OIL- PURCHASED FROM THE ONLINE STORE.

3. Extraction:

Extraction, as the term is used pharmaceutically, involves the separation of medicinally active portions of plant or animal tissues from the inactive or inert components by using selective solvents in standard extraction procedures. The products obtained from plants are relatively impure liquids, semisolids, or powders intended only for oral or external use. These include classes of preparations known as decoctions, infusions, fluidextracts, tinctures, pilular (semisolid) extracts, and powdered extracts. Such preparations popularly have been called galenicals, after Galen, the 2nd century Greek physician.

Extraction continues to be of considerable interest to obtain improved yields of drugs derived from plant and animal sources. For example, extraction of digitalis glycosides has been carried out using super critical carbon dioxide^[38]. Other techniques include ultrasonics, rotary-film evaporators, hydro-distillation, liquid chromatography, multiple-solvent extraction, counter current extraction, and gravitation dynamics.

This discussion is concerned primarily with basic extraction procedures for crude drugs to obtain the therapeutically desirable portion and eliminate the inert material by treatment with a selective solvent, known as the menstrum. Extraction differs from solution in that the presence of insoluble matter is implied in the former process. The principal methods of extraction are maceration, percolation, digestion, infusion, and decoction. The quality of the finished product can be enhanced by standardizing primary extracts and carrying out analytical assays during production on the raw materials, intermediate products, and manufacturing procedures.

The processes of particular importance, insofar as the USP is concerned, are those of maceration and percolation, as described specifically for Belladonna Extract, USP, and Cascara Sagrada Extract, USP. Most pharmacopeia's refer to such processes for extraction of active principles from crude drugs. The USP provides general directions for both maceration and percolation under the heading of Tinctures.

Techniques of extraction continue to be investigated and applied to obtain higher yields of the active substance from natural sources. Some of these methods include the use of different grinding and shearing processes of plants, use of specific membranes for extraction, and different extraction procedures, such as distillation, digestion, percolation, and microwaves.

A. MACERATION

In this process, the whole or coarsely powdered crude drug material, either leaves or stem bark or root bark, is placed inside a container; the menstrum is poured on top until completely covered the drug material. The container is then closed and kept for some days.

a. Hot maceration:

Maceration extraction of herbal oils. With the maceration extraction method, the flowers are soaked in hot oil to have their cell membranes ruptured and the hot oil then absorbs the essence. The oil is then cleared of the botanical and decanted.

This is a form of maceration in which gentle heat is used during the process of extraction. It is used when moderately elevated temperature is not objectionable and the solvent efficiency of the menstrum is increased thereby. This process is applied as reference process for hydrogen determination of all operational test units^[39].

b. Cold maceration:

In this process the solid ingredients are placed in a stoppered container with 750 mL of the prescribed solvent and allowed to stand for a period of at least 3 days in a warm place with frequent agitation, until soluble matter is dissolved. The mixture is filtered and, after most of the liquid has drained, the residue on the filter is washed with sufficient quantity of the prescribed solvent or solvent mixture; the filtrates are combined to produce 1000 mL

4. Acid Value:

Acid value (or **neutralization number** or **acid number** or **acidity**) is the mass of potassium hydroxide (KOH) in milligrams that is required to neutralize one gram of chemical substance. The acid number is a measure of the number of carboxylic acid groups in a chemical compound, such as a fatty acid, or in a mixture of compounds. In a typical procedure, a known amount of sample dissolved in an

organic solvent (often isopropanol) and titrated with a solution of alcoholic potassium hydroxide (KOH) of known concentration using phenolphthalein as a colour indicator.

The acid number is used to quantify the acidity of a substance e.g. biodiesel. It is the quantity of base, expressed in milligrams of potassium hydroxide, that is required to neutralize the acidic constituents in 1 g of sample.

$$AN = (V_{eq} - b_{eq})N \frac{56.1 \text{ g mol}^{-1}}{W_{oil}}$$

V_{eq} is the volume of titrant (ml) consumed by the crude oil sample and 1 ml of spiking solution at the equivalent point, b_{eq} is the volume of titrant (ml) consumed by 1 ml of spiking solution at the equivalent point, and 56.1 g/mol is the molecular weight of KOH. W_{oil} is the mass of the sample in grams.

The molar concentration of titrant (N) is calculated as such:

$$N = \frac{1000W_{KHP}}{204.23 \text{ g mol}^{-1} V_{eq}}$$

In which W_{KHP} is the mass (g) of KHP in 50 ml of KHP standard solution, V_{eq} is the volume of titrant (ml) consumed by 650 ml KHP standard solution at the equivalent point, and 204.23 g/mol is the molecular weight of KHP.

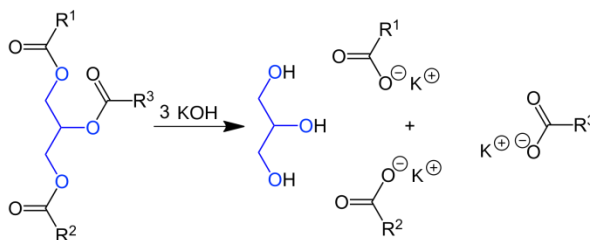
There are standard methods for determining the acid number, such as ASTM D 974 and DIN 51558 (for mineral oils, biodiesel), or specifically for biodiesel using the European Standard EN 14104 and ASTM D664 are both widely used worldwide. Acid number (mg KOH/g oil) for biodiesel should to be lower than 0.50 mg KOH/g in both EN 14214 and ASTM D6751 standard fuels. This is since the FFA produced may corrode automotive parts and these limits protect vehicle engines and fuel tanks.

As oil-fats rancidify, trig

lycerides are converted into fatty acids and glycerol, causing an increase in acid number. A similar observation is observed with biodiesel aging through analogous oxidation processes and when subjected to prolonged high temperatures (ester thermolysis) or through exposure to acids or bases (acid/base ester hydrolysis). Low Acid value indicates good cleansing by soap^[40].

5. SAPONIFICATION VALUE:

Saponification value or **saponification number** represents the number of milligrams of potassium hydroxide (KOH) or sodium hydroxide (NaOH) required to saponify one gram of fat under the conditions specified.^[42-44] It is a measure of the average molecular weight (or chain length) of all the fatty acids present in the sample as triglycerides. The higher the saponification value, the lower the fatty acids average length, the lighter the mean molecular weight of triglycerides and vice-versa. Practically, fats or oils with high saponification value (such as coconut and palm oil) are more suitable for soap making.



Determination:

To determine saponification value, the sample is hot-saponified with an excess of alkali (usually potassium hydroxide dissolved in ethanol), in standard conditions, generally for half an hour under reflux. Alkali is mainly consumed by glycerides : triglycerides, diglycerides, monoglycerides but also by free fatty acids, as well as by other ester-like components such as lactones.[45] At the end of the reaction the remaining quantity of alkali is titrated against standard solution of hydrochloric acid (HCl). Therefore, the SV (mg KOH/ g of sample) is calculated as following^[43]:

Where:

$$SV = \frac{(B - S) \times M \times 56.1}{W}$$

(B - S) is the difference between the volume of HCl solution used for the blank run and for the tested sample, in mL ;

M is the molarity of HCl solution, in mol · L⁻¹ ;

56.1 is the molecular weight of KOH , in g · mol⁻¹

W is the weight of sample, in g.

Standard methods for SV determination in vegetable and animal fats are for example: ISO 3657:2020, ASTM D5558 (fats and oils), ASTM D94 (petroleum products) and DIN 51559 (mineral oils).

The SV can also be calculated from the fatty acid composition as determined by gas chromatography (AOCS Cd 3a-94)^[46].

Handmade soap makers who aim for bar soap use sodium hydroxide (NaOH), commonly known as lye, rather than KOH (caustic potash) which produces soft paste, gel or liquid soaps. In order to calculate the lye amount needed to make bar soap, KOH values of SV can be converted to NaOH values by dividing KOH values by the ratio of the molecular weights of KOH and NaOH (1.403)^[47].

III. INTRODUCTION OF HERBS USED IN THE PRESENT PROJECT**A. HIBISCUS:**

Figure 3: Hibiscus ^[48]

1. DESCRIPTION:

The leaves are often lobed and may be smooth or covered in trichomes (plant hairs). The flowers can be borne singly or in clusters, and the flowers of many species last only a single day. An epicalyx (whorl of leaf like bracts that surrounds the sepals) is particularly common, and the stamens are typically fused into a tube. Members of the genus characteristically have spiny pollen, and their fruits are capsules^[49].

2. PLANT:

- Botanical name: Hibiscus rosa-sinensis
- Biological source: It is a species of tropical hibiscus, a flowering plant in the hibisceae tribe.
- Family: Malvaceae^[50].

3. SCIENTIFIC CLASSIFICATION:

- Kingdom: Plantae – plantes, Planta, Vegetal, plants
- Subkingdom: Viridiplantae – green plants
- Superdivision: Embryophyta
- Division: Tracheophyta – vascular plants, tracheophytes
- Subdivision: Spermatophytina – spermatophytes, seed plants, phanérogames
- Class: Magnoliopsida
- Family: Malvaceae – mallows, mauves
- Genus: Hibiscus L. – rosemallow, rose-mallow
- Species Hibiscus rosa-sinensis L. – Chinese hibiscus, shoe-black plant^[51].

4. CHEMICAL CONSTITUENT:

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^[52].

5. PHARMACOLOGICAL PROPERTIES:

- Antidiabetic, reproductive, fibrinolytic, hypolipidemic, antioxidant, anti-inflammatory, antipyretic, analgesic, immuno-modulatory, anticonvulsant, antidepressant
- Memory enhancement, cytotoxic, antimicrobial, antiparasitic, dermatological, anti haemolytic, urinary, hepatoprotective, neuroprotective, antitussive & many other effects.

6. IS HIBISCUS GOOD FOR HAIR?

Answer: **Yes**

According to Ayurveda, Panchmahabhutas influence your body's constitution in the form of energy. It is classified into three doshas, and each dosha exhibits different characteristics of your hair. The unique ratio of the three doshas reflects healthy hair.

Mostly an individual's hair shows a combination of the attributes of at least two doshas. Some people may likely recognize traits from all the three doshas. Rarely, someone may have only a specific dosha hair type.

Listed below are the hair characteristics of each dosha:

Dosha	Equilibrium State (Prakriti)	Excess State (Vikriti)
Vata (responsible for movement and motion)	Grows quickly, unruly hair condition, thin or coarse in density, a combination of curls and straight strands.	Stunted hair growth, falls out in clumps, dry, brittle, frizzy, lackluster, split ends
Pitta (responsible for metabolic activity)	Manageable hair, moderate thickness, very fine strands, soft and straight mane.	Damage hair roots by accumulating excess heat, premature thinning & greying,
Kapha (responsible for strength, structure, and lubrication)	Wavy, strong, thick and fuller volume, lustrous texture.	Oily scalp and sticky hair strands.

Hence, hibiscus is a fantastic herb to add to your hair care routine^[52]

7. BENEFITS OF HIBISCUS ON HAIR:

1. Hibiscus for Hair Growth:

Herbal hair oils are typically a combination of herbal extract such as hibiscus, mixed with a carrier oil base, such as: almond oil, coconut oil, mineral oil, jojoba oil, olive oil, walnut oil, wheat germ oil^[53]. Hibiscus is rich in vitamin C, flavonoids, amino acids, mucilage fiber, moisture content, and antioxidants. The goodness of hibiscus beautifies your hair by nourishing your locks, promoting the growth of luscious hair, and bringing out a naturally satin-soft texture to your mane.

2. Hibiscus Protects Scalp From External Damage:

Hibiscus plants are packed with resilient properties that keep your scalp protected from external stressors. Its impact on your scalp acts as a sunscreen to protect your hair from UVB rays. Cleansing properties of hibiscus also help balance the pH of your scalp, fight oiliness, build-up of dandruff, and activate your hair follicles.

3. Hibiscus for Hair Root Strength:

Hibiscus flowers and leaves are rich in invigorating ingredients - flavonoids & amino acids. Flavonoids enhance blood circulation to your hair follicles, retransform dormant follicles into hair follicles, stimulating new hair growth. Amino acids trigger keratin production in the cells of your hair follicles, encouraging healthy hair growth.

4. Hibiscus Delays Premature Greying of Hair:

Elevated Pitta dosha may cause premature greying of hair. Hibiscus is rich in natural pigments, antioxidants, and vitamins that can give a crimson tinge to your grey hair and bring out darker shine to your natural hair colour.

5. Hibiscus Prevents Dandruff:

Excess Kapha may cause oily dandruff flakes, and excess Vata may cause dry dandruff flakes. With antimicrobial properties, hibiscus curbs the growth of dandruff-causing yeast on your scalp, unclogs dandruff flakes from your hair follicles, and prevents dandruff recurrence.

6. Deeply Conditions Your Hair:

Elevated Vata dosha makes your hair dry and frizzy with split ends. Hibiscus acts as an ultra emollient that traps moisture in your hair shafts and restores elasticity in your hair strands. Its mucilage fiber prevents breakage and conditions your hair to make it silky and smooth.

7. Regulates Sebaceous Glands:

Sebaceous glands produce an oily substance called sebum to lubricate your hair. Elevated Kapha dosha triggers excess oil secretion, making your hair oily and sticky. Hibiscus balances the activity of these glands to maintain the natural moisturization of your hair.

8 METHODS TO USE HIBISCUS:

1. Hibiscus Oil for Hair Growth:

Applying hibiscus, combined with coconut oil, is the easiest way to grow long hair. Coconut oil pacifies Vata Dosha promotes hair growth by reducing protein loss, and moisturizes your hair.

- A. Take a bunch (depends upon the size of your hair) of hibiscus petals and leaves and blend them into a smooth paste. You can also use hibiscus powder.
- B. Heat up an adequate amount of coconut oil in a saucepan & add the hibiscus paste into it.
- C. Continue boiling it until you see powdery particles float to the bottom of the pan.
- D. Close the lid and put it aside until it cools down to normal temperature.
- E. Grind the flowers and petals to form powder. Follow the above process of boiling it in coconut oil.

2. Hibiscus Shampoo to Prevent Build up:

Excess Pitta dosha accumulates heat in your hair follicles, causing damage and hair loss. Hibiscus pacifies Pitta Dosha, soothes your scalp, and cools down your head. It removes build-up formed by pollutants and chemical residue without stripping away the natural moisture from your hair.

- A. Take hibiscus leaves double than hibiscus petals.
- B. Boil the leaves and petals in a bowl of water. See that the quantities are sufficient to make a shampoo for your hair.
- C. After it cools down, add 1-2 tablespoons of gram flour to it. Gram flour pacifies Pitta and Kapha.
- D. Replace your regular shampoo with this herbal blend and wash your hair thoroughly with the natural foam.

B. CURRY LEAVES:



Figure 4: Curry Leaves

1. DESCRIPTION:-

The curry tree, *Murraya koenigii* or *Bergera koenigii*, is a tropical to sub-tropical tree in the family Rutaceae (the rue family, which includes rue, citrus, and satinwood), and is native to Asia. ^[54] The plant is also sometimes called sweet neem, though *M. koenigii* is in a different family to neem, *Azadirachta indica*, which is in the related family Meliaceae. Its leaves, known as curry leaves, are used in many dishes in the Indian subcontinent.

2. PLANT:-

- Botanical name: *Murraya koenigii*
- Biological source: Dried leaves of *Murraya koenigii*
- Family: Rutaceae

3. SCIENTIFIC CLASSIFICATION:-

- Kingdom Plantae – Plants
- Subkingdom Tracheobionta – Vascular plants
- Superdivision Spermatophyta – Seed plants
- Division Magnoliophyta – Flowering plants
- Class Magnoliopsida – Dicotyledons
- Subclass Rosidae- Order Sapindales
- Family Rutaceae – Rue family
- Genus *Murraya* J. Koenig ex L. – murraya
- Species *Murrayakoenigii* (L.) Spreng.- curry leaf tree

4. CHEMICAL CONSTITUENT: -

Murraya koenigii is very rich source of organic compounds with different chemical composition such as alkaloids, flavonoids carbohydrates, and sterol is present in the plant extract prepared in solvents such as petroleum ether, ethyl acetate, chloroform, ethanol and water. ^[55,56]

5. BENEFITS OF CURRY LEAVES ON HAIR: -

A) Stimulates the Hair Growth:- Curry leaves are a rich source of protein which is **essential for hair growth** and maintaining overall health of your mane. Plus, it has beta-carotene and amino acids which also work at **reducing hair loss** and help strengthen hair follicles, regenerate dormant follicles and regrow new hair. **Curry leaves benefit** thin and falling hair and make it visibly fuller and better.

B) Prevents the Premature Greying:- Curry leaves are known to have darkening agents, antioxidants and **vitamin B complex** which can turn your **hair back to your natural colour**. It helps restore the natural pigment of your hair and turn your grey hair dark naturally. Plus, they have minerals like iodine, selenium, zinc, and iron which **prevent premature greying**. So if you are spotting your first greys or dealing with greying of hair, you need to get some of these beneficial curry leaves and use them to get your dark hair back.

C) Improves Scalp Health:- Curry leaves has antibacterial, antifungal and cleansing properties, **curry leaves benefits** the scalp and help **maintain good hair health**. It can be used to cleanse, exfoliate and moisturise the scalp. It **removes dead skin cells** off the scalp, **reduces dandruff** and alleviates itchiness and irritation. Not only does this ingredient leave your hair clean, but it also leaves it soft and nourished.

C. BHRINGRAJ: -



Figure 5: Bhringraj

1. DESCRIPTION :

Eclipta prostrata commonly known as false daisy, yerba de tago, Gunta kalagaraku/Gunta galagaraku, Karisalankanni, and bhringraj, is a species of plant in the sunflower family^[57,58]. It is widespread across much of the world. This plant has cylindrical, grayish roots. The solitary flower heads are 6–8 mm (0.24–0.31 in) in diameter, with white florets. The achenes are compressed and narrowly winged. This species grows commonly in moist places in warm temperate to tropical areas worldwide. It is widely distributed throughout India, Nepal, China, Thailand, and Brazil.

2. PLANT: -

- Botanical name: Eclipta prostrate
- Biological source: Eclipta alba family Composite
- Family: Asteraceae

3. SCIENTIFIC CLASSIFICATION: -

- Kingdom Plantae – Plants
- Subkingdom – Viridiaeplantae
- Superdivision – Spermatophytina
- Division – Tracheophyta
- Class – Magnoliopsida
- Family – Asteraceae
- Genus – Eclipta L.
- Species – Eclipta alba (L.) Hassk.

4. CHEMICAL CONSTITUENT: -

Eclipta alba (L.) contains wide range of active principles, which includes coumestans, alkaloids, flavonoids, glycosides, polyacetylenes, triterpenoids. The leaves contain stigmasterol, a-terthienylmethanol, wedelolactone, demethylwedelolactone and demethylwedelolactone-7-glucoside^[59]

5. BENEFITS OF BHRINGRAJ ON HAIR:-

A) Prevents Hair Loss:-

Bhringraj Powder is known for its effective action on hair and scalp. This herbal formulation nourishes the hair and prevents hair fall. It also stimulates the scalp cells to promote hair growth.

B) Fights the Dandruff:-

Bhringraj's medicinal composition helps fight infections like dandruff and lice. Owing to its anti-microbial properties, Bhringraj is said to hinder in the growth of microbes and other organisms in the hair and on the scalp.

C) Treats Baldness and Prevents Hair Greying:-

Bhringraj nourishes the hair by supplying vitamins and antioxidants to the hair. It prevents thinning of hair as well as dryness. The herb also restores the natural colour of hair. The application of Bhringraj powder mixed in yogurt prevents baldness.

D. CINNAMON:



Figure 6: Cinnamon

1. DESCRIPTION:

Cinnamon is a spice obtained from the inner bark of several tree species from the genus *Cinnamomum*. Cinnamon is used mainly as an aromatic condiment and flavouring additive in a wide variety of cuisines, sweet and savoury dishes, breakfast cereals, snack foods, teas, and traditional foods. The aroma and flavour of cinnamon derive from its essential oil and principal component, cinnamaldehyde, as well as numerous other constituents including eugenol.

2. PLANT:-

- Botanical name – *Cinnamomum verum*
- Biological source – Obtained from dried inner bark of the tree *Cinnamomum zeylancium*.
- Family – Lauraceae

3. SCIENTIFIC CLASSIFICATION: -

- Kingdom Plantae – Plants
- Division – Magnoliophyta
- Class – Magnoliophyta
- Order – Laurales
- Family – Lauraceae
- Genus – *Cinnamomum*
- Species – *C. verum*

4. CHEMICAL CONSTITUENT: -

Cinnamon consists of a variety of resinous compounds, including cinnamaldehyde, cinnamate, cinnamic acid, and numerous essential oils. ^[60] The spicy taste and fragrance are due to the presence of cinnamaldehyde. ^[61]

5. BENEFITS OF CINNAMON ON HAIR: -

A) Prevent hair loss and baldness:-

Cinnamon can help control hair loss and thus prevent baldness. It is also important to understand that the polyphenols contained in cinnamon act as natural antioxidants. It is also important to understand that cinnamon has antimicrobial properties that help prevent scalp infections.

B) Improve hair length, density and growth:-

The topical application of **cinnamon essential oil** acts on the length and density of hair. Cinnamon essential oil contains *cinnamaldehyde* which dilates blood vessels and stimulates blood flow to the scalp. This stimulates **hair growth**.

C) Prevent hair damage and increase the anagen phase:-

Cinnamon has anti-inflammatory, antioxidant and antifungal properties. They can help protect the scalp and hair from free radical damage, irritation and inflammation, and prevent dandruff.

D) Have anti-fungal Property: -

Cinnamon has antifungal properties. It will be a very good ally to add in your hair routine to fight against diseases causing seborrheic dermatitis or chronic dandruff for example.

E. Hibiscus leaf



Figure 7: Hibiscus Leaves

1. DESCRIPTION:

A hibiscus leaf will usually have two different shades of green on its lower and upper surfaces, with the upper surface usually a brighter green than the lower. Each leaf is around 2 to 7 inches long, with the axis of each leaf upholding a single flower. In addition, fresh growth tends to be a lighter shade of green as well. Hibiscus leaves are mostly made up of water, at a ratio of more than 85 percent. They also contain various chemical components that make them valuable for a variety of medicinal purposes^[62].

2. PLANT:

- Botanical name: *Hibiscus rosa-sinensis*
- Biological source: It is a species of tropical hibiscus, a flowering plant in the hibisceae tribe.
- Family: Malvaceae

3. SCIENTIFIC CLASSIFICATION:

- Kingdom: Plantae – plantes, Planta, Vegetal, plants
- Subkingdom: Viridiplantae – green plants
- Superdivision: Embryophyta
- Division: Tracheophyta – vascular plants, tracheophytes
- Subdivision: Spermatophytina – spermatophytes, seed plants, phanérogames
- Class: Magnoliopsida
- Family: Malvaceae – mallows, mauves
- Genus: *Hibiscus* L. – rosemallow, rose-mallow
- Species *Hibiscus rosa-sinensis* L. – Chinese hibiscus, shoe-black plant.

4. CHEMICAL CONCTITUENT:

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^[64].

5. Benefit of Onion seed on Hair:

- Stop hair loss.
- Make your hair look healthy and lustrous.
- Prevent premature graying.
- Thicken hair and add volume.
- Treat dandruff.
- Condition against frizz, dryness, and breakage.
- Prevent split ends^[65].

F. ONION SEEDS



Figure 8: Onion Seeds

1. DESCRIPTION:

Onion seeds, appropriately known as the "seeds of blessings" are considered to be one of the greatest healing herbs of all times. Kalonji, which may also be called nigella, refers to small black seeds grown on Kalonji bushes, which are grown widely through India. Kalonji is both flavouring, added to a variety of traditional foods, and an herbal remedy that has been touted as the magic bullet for a variety of ailments. Kalonji seeds are about the same size as sesame seeds, though they are a little more triangular instead of ovalshape^[66].

2. PLANT:

- Botanical name: *Allium cepa* L.
- Biological source: Onion produce balls covered with tiny flowers ready for pollination.
- Family: Alliaceae

3. SCIENTIFIC CLASSIFICATION:

- Kingdom: Plantae
- Subkingdom: *Allium cepa* L.
- Class: Magnoliopsida
- Family: Amaryllidaceae
- Genus: *Allium*
- Species: *A. cepa*

3. CHEMICAL CONSTITUENT:

It acts as antioxidant, mucolytic, anti-inflammatory and anti-diabetic. It is also known for its action on the stomach. It improves appetite and releases the intestinal gas. So, it acts as a digestive and carminative agent. its use in diabetes mellitus, hair growth, osteoarthritis, cancer, liver and kidney disease, asthma and several other conditions. In Ayurveda, it is used for bad breath, productive cough, asthma, skin diseases, hair fall and intermittent fever.

4. BENEFITS OF ONION SEED ON HAIR:

Onion seeds or kalonji make the hair healthy and shiny. It has anti-fungal properties that keep infections away, and also reduce the chances of scalp diseases which cause hair fall. Onion seeds are rich in essential oils which nourish the hair and help it grow^[67].

G. FENUGREEK (MEETHI) SEEDS:



Figure 9: Fenugreek Seeds

1. INTRODUCTION:

It is a spice, a flavoring agent and as a medicinal plant from ancient time. Fenugreek is a leguminous, herbaceous, rainfed crop included among the seed spices is about 30-60 cm tall, leaflets are about 2-2.5 cm long, flowers are 1-2 cm long, axillary, sessile and cultivated throughout the country^[68]. Among the spices, the Fenugreek is used as esoteric food adjacent to enhance the flavor and colour of the food and make it tasty and also used to modify the texture of food^[69].

2. PLANT:

- Botanical name: *Trigonella foenum-graecum*
- Biological source: Methi consists of dried ripe seeds of *Trigonella foenum-graecum*
- Family: Fabaceae

3. SCIENTIFIC CLASSIFICATION:

- Kingdom: Plantae
- Division: Magnoliophyta
- Class: Magnoliopsida
- Order: Fabales
- Family: Fabaceae
- Genus: *Trigonella*
- Species: *foenum-graecum*
- Binomial name: *Trigonella foenum-graecum*

4. CHEMICAL CONSTITUENT:

The main chemical components of *Trigonella foenum-graecum* are fibers, flavonoids, polysaccharides, saponins, fixed oils and some identified alkaloids (Mohammad et al.,2006, Amin et al.,2005)^[70]. Mature seeds mainly contain amino acid, fatty acid, vitamins, saponins and a large quantity of folic acid (84mg/100g)^[71]. It also contains disogenin, gitogenin, neogitogenin, homorientin saponaretin, neogigogenin, and trigogenin that are listed below (Kim su ji et al.,2006, Mohammad et al.,2006). The endosperm of the seed is rich with galactomannan. The young seeds mainly contain carbohydrates^[72].

5. BENEFITS OF FENUGREEK SEEDS FOR HAIR

- Prevents Hair Loss. Fenugreek contains lecithin, which acts as a natural emollient that conditions and moisturizes your scalp and hair deeply.
- Revives Damaged Hair.
- Fights Dandruff.
- Controls Scalp Inflammation.
- Adds Shine And Soft Texture.
- Prevents Premature Grey Hair.

H. COCONUT OIL



Figure 10: Coconut Oil

1. DESCRIPTION:

Coconut oil (or **coconut butter**) is an edible oil derived from the wick, meat, and milk of the coconut palm fruit.^[73] Coconut oil is a white solid fat, melting at warmer room temperatures of around 25 °C (78 °F), in warmer climates during the summer months it is a clear thin liquid oil. Unrefined varieties have a distinct coconut aroma.^[74] It is used as a food oil, and in industrial applications for cosmetics and detergent production.^[73,74] Due to its high levels of saturated fat, numerous health authorities recommend limiting its consumption as a food.^[74,75]

2. PLANT:

- Botanical Name: Cocos Nucifera
- Biological Source: Naturally occurring widespread fruit present on plant Cocos Nucifera
- Family: Arecaceae

3. SCIENTIFIC CLASSIFICATION:

- Botanical name: Cocos nucifera.
- Kingdom: Plantae
- Phylum: Angiospermae
- Class: Monocot
- Family: Arecaceae
- Genus: Cocos
- Species: nucifera

4. CHEMICAL CONSTITUENT:

Coconut oil contains only 6% monounsaturated and 2% polyunsaturated fatty acids. In the partial hydrogenation process, some of these are transformed into trans fatty acids.

5. BENEFIT OF COCONUT ON HAIR:

- High in lauric acid. Lauric acid is one of the main ingredients in coconut.
- High in protein.
- High in vitamins C, E, B-1, B-3, B-5, and B-6.
- Slows hair loss.
- Restores dry hair and scalp.
- Gets rid of dandruff.

I. Orange oil:



Figure 11: Orange Oil

1. DESCRIPTION:

Orange Oil, most commonly referred to as Sweet Orange Essential Oil, is derived from the fruits of the *Citrus sinensis* botanical. Conversely, Bitter Orange Essential Oil is derived from the fruits of the *Citrus aurantium* botanical. The exact origin of *Citrus sinensis* is unknown, as it does not grow wild anywhere in the world; however, botanists believe that it is a natural hybrid of the Pummelo (*C. maxima*) and the Mandarin (*C. reticulata*) botanicals and that it originated between the South-West of China and the Himalayas. For several years, the Sweet Orange tree was considered to be a form of the Bitter Orange tree (*C. aurantium amara*) and was thus referred to as *C. aurantium var. sinensis*.

2. PLANT:

- Botanical Name: CITRUS AURANTIUM
- Biological Source: The orange peel is the fresh or dried outer part of the pericarp of CITRUS AURANTIUM
- Family: Rutaceae

3. SCIENTIFIC CLASSIFICATION:

- Kingdom: Plantae
- Phylum: Magnoliophyta
- Class: Magnoliopsida
- Subclass: Rosidae
- Order: Sapindales
- Family: Rutaceae
- Genus: Citrus

4. CHEMICAL CONSTITUENT:

A mixture of complex hydrocarbons and oxygenated derivatives of terpenoid and nonterpenoid origin consisting of functional groups such as aldehydes, alcohols, ketones, and other complex molecules, like esters and organic acids^[76].

5. PHARMACOLOGICAL PROPERTIES:

Antioxidant, antimicrobial, anti-inflammatory, insecticidal properties. *Citrus* has also shown to be beneficial in reducing the chances of developing mental health diseases, like anxiolytic against anxiety and anticholinesterase against Alzheimer's, etc^[77]. *Citrus* fruits contain several important secondary metabolites, such as ascorbic acid, flavanones, phenolics, and pectin, which are recognized to have antioxidants properties beneficial for human health^[78]. In addition, *Citrus* flavonoids are used against free radicals and possess anti-inflammatory properties and are used to reduce the brain and degenerative diseases.

6. BENEFITS OF ORANGE IN HAIR:

Orange oil effectively treats dry, irritated scalp and eliminates dandruff. The essential vitamins in orange oil provide deep nourishment to your hair follicles, making them thick and strong. Orange essential oil moisturizes your hair shaft and prevents it from turning rough, dull and brittle.

IV. FORMULATIONS:

Formulations of Herbal Hair Oil

Formulation 1: Hot Maceration

Sr.No	Ingredients	Quantity
1	Hibiscus Flower	8flowers(fresh)
2	Hibiscus Leaf	8 leaves(fresh)
3	Onion seed	5gm
4	Fenugreek seed	5gm
5	Cinammon	2.5gm
6	Curry Leaves	2.5gm
7	Coconut Oil	100ml
8	Orange Oil	QS

Formulation 2: Cold Maceration

Sr.No	Ingredients	Quantity
1	Hibiscus Flower	10gm(dried)
2	Hibiscus Leaf	10gm(dried)
3	Onion seed	5gm
4	Fenugreek seed	5gm
5	Cinammon	2.5gm
6	Curry Leaves	2.5gm
7	Coconut Oil	100ml
8	Orange Oil	QS

Formulation 3: Hot Maceration

Sr.No	Ingredients	Quantity
1	Hibiscus Flower	8 flowers(fresh)
2	Hibiscus Leaf	8 leaves(fresh)
3	Onion seed	5gm
4	Fenugreek seed	5gm
5	Cinammon	2.5gm
6	Bhringraj Powder	2.5gm
7	Coconut Oil	100ml
8	Orange Oil	QS

Formulation 4: Cold Maceration

S.No	Ingredients	Quantity
1	Hibiscus Flower	10gm(dried)
2	Hibiscus Leaf	10gm(dried)
3	Onion seed	5gm
4	Fenugreek seed	5gm
5	Cinammon	2.5gm
6	Bhringraj Powder	2.5gm
7	Coconut Oil	100ml
8	Orange Oil	QS

V. EVALUATION:

The formulated herbal oil containing hibiscus rosa sineses and other ingredients was evaluated for parameters like acid value, saponification value, refractive index, viscosity and organoleptic parameters.

1. Organoleptic property: Colour, odour, skin irritation was determined manually.

2. Specific gravity: Specific gravity of the prepared oil was determined using picnometer or specific gravity bottle.

3. Viscosity: Viscosity was determined using brookfield viscometer. Using spindle no.63 at 100 rpm. For all four formulations.

4. pH: pH of the herbal oil was detected using pH meter.

5. Acid value: 4ml of oil was added with 10ml of ethanol and 10ml of ether. Phenolphthalein was added as indicator and titrated with 0.1M potassium hydroxide solution.

$$\text{Acid value} = 5.61n/w$$

Where,

n= Number of ml of 0.1M KOH

w= Weight of oil

5. Saponification value: 2g of oil was accurately weighed and transferred into a 250ml iodine flask. 25ml of 0.5M alcoholic potassium hydroxide was added and boiled under reflux on a water bath for 30mins.

Phenolphthalein was added as indicator and titrated against 0.1 N HCl ('a' ml).

Similarly, blank was performed ('b' ml) without the sample.

Saponification Value: $28.05(b-a)/w$

Where,

w= weight in grams of the solution.

6. Refractive index: It was determined using refractometer.

7. Sensitivity: The formulated herbal Oil was applied on hand and exposed to sunlight for 5mins to check for any irritation over skin.

VI. RESULT:

The formulated herbal hair oil containing hibiscus rosa sineses and the above mentioned ingredients was evaluated from the following parameters and the result is as followed.

Sr. no.	Parameters	Observation			
		F1	F2	F3	F4
1.	Colour	Yellowish green	Blackish green	Yellowish green	Blackish green
2.	Odour	Citrus	Citrus	Citrus	Citrus
3.	Specific gravity	0.912	0.901	0.916	0.904
4.	Viscosity	15.60cp	16.00cp	14.40cp	14.40cp
5.	pH	5	6	6	5
6.	Acid value	0.86mg KOH/g	2.98mg KOH/g	1.40mg KOH/g	2.6mg KOH/g
7.	Saponification value	250mg KOH/g	253mg KOH/g	260mg KOH/g	259mg KOH/g
8.	Refractive index	1.4509	1.4532	1.4509	1.4532
9.	Irritation test	No irritation	No irritation	No irritation	No irritation

VII. DISCUSSION:

The above result displays that the formulation no. 1 and formulation no. 3 is having low acid value which also indicates that the lower the acid value lower is the rate of rancidification which keeps the oil in its original form and no redox reaction takes place. The higher the saponification value, the lower the fatty acids average length, the lighter the mean molecular weight of triglycerides and vice-versa. Practically, fats or oils with high saponification value (such as coconut and palm oil) are more suitable for soap making.

VIII. CONCLUSION:

All the comparative parameters showed that they are within the limit and the formulation method followed i.e. hot maceration with curry leaves & Bhringraj(formulation no. 1 & 3) has the minimum acid value as well as higher saponification value concluded by the observation. As the less acid value indicates the amount of potassium hydroxide (KOH) in milligrams that is required to neutralize one gram of chemical substance i.e. the less amount of potassium hydroxide needed to neutralize so the presence of chemical substance is also less. So the hot maceration (formulation no. 1 & 3) will give better result regarding the hair growth and act on other hair problems.

IX. REFERENCES:

1. Ansari S.H. and Ali M. Hair care and herbal drug. Indian J Nat Prod. 13(1): 3-5, 1997.
2. Rathi V., Rathi J.C., Tamizharasi S. and Pathak A.K. Plants used for hair growth promotion: A review. Phcog Rev. 2(3): 165-167,2008
3. Dixit V.K., Adhirajan N. and Gowri C. Development and evaluation of herbal formulations for hair growth. Indian Drugs. 38(11): 559-563, 2001.
4. Patni P., Varghese D., Balekar N. and Jain D.K. Formulation and evaluation of herbal hair oil for alopecia management. Planta Indica. 2(3): 27-30, 2006
5. Adirajan N., Ravikumar T., Shanmugasundaram N. and Babu M. In vivo and in vitro evaluation of hair growth potential of Hibiscus rosasinensis Linn. J Ethanpharm. 88: 235-239, 2003
6. Purwal, L., Gupta, S. B. N. and Pande, M.S. Development and Evaluation of Herbal Formulations for hair growth, E- Journal of Chemisrty, Jan 2008, Vol-5, NO-1, 34-38.
7. Sargia B, Singh B, Gupta N, Gahlot L K, Gulati T, Hasija Y. MEDPDB: An online database of medicinal plants. J. Adv. Pharm. Edu. Res. 2018; 7(4): 204-207.
8. Kianitalaei A, Feyzabadi Z, Hamedi S, Qaraaty M. Althaea Officinalis in Traditional Medicine and modern phytotherapy. J. Adv. Pharm. Edu. Res. 2019; 9(S2): 154-161.
9. Ahmad M S, Shawky A, Ghobashy M O, Felifel R H A. Effect of Some medicinal plants on life cycle of Citrus Brown Mites (Eutetranychus orientalis). Int. J. Pharm. Res. Allied Sci. 2017; 6(1): 53-58.
10. Benzineb E, Kambouche N, Hamiani A, Bellahouel S, Zitouni H, Toumi H. Phenolics Compounds and Biological Activity of Leaves of Anabasis Articulata, an Algerian Medicinal Plant. Int.J. Pharm. Res. Allied Sci. 2019; 8(4): 1-5.
11. Adhirajan, N., Kumar, T.R., Shanmugansundaram, N., Babu, M. In vivo and in vitro evolution of hair growth potential of Hibiscus rosasinensis Linn. Journal of Ethnopharmacology 2003; 88: 235-239.
12. Anita Gnana Kumari, A.V., Palavesam, A., Anbu Jeba Sunilson, J, Anandarajagopal, K., Vignesh M., Parkavi, J. Preliminary phytochemical and antiulcer studies of Hibiscus rosa sinensis Linn. root extracts. International Journal Green Pharmacy 2010; 4:41-43.
13. [Nade, V.S., Kanhere, S.V., Kawale, L.A., Yadav, A.V. Cognitive enhancing and antioxidant activity of ethyl acetate soluble fraction of the methanol extract of Hibiscus rosa sinensis in scopolamine induced amnesia. Indian Journal of Pharmacology 2011; 43(2):137– 142.
14. Nivsarkar, M., Patel, M., Padh, H., Bapu, C., Shrivastava, N. Blastocyst implantation failure in mice due to “nonreceptive endometrium”: endometrial alterations by Hibiscus rosa-sinensis leaf extract. Contraception 2005; 71(3): 227-230.
15. Shen, H.M., Chen, C., Jiang, J.Y., Zheng, Y.L., Cai, W.F., Wang, B., Ling, Z., Tang, L., Wang, Y.H., Shi, G.G. The N-butyl alcohol extract from Hibiscus rosa-sinensis L. flowers enhances healing potential on rat excisional wounds. Journal of Ethnopharmacology 2017; 198: 291-301.
16. Hair fiber characteristics and methods to evaluate hair physical and. Maria Valéria Robles Velasco, Tania Cristina de Sá Dias, Anderson Zanardi de Freitas, Nilson Dias Vieira Júnior, Claudinéia Aparecida Sales de Oliveira Pinto, Telma Mary Kaneko, André Rolim Baby. january- march : s.n., 2009, Brazilian Journal of. Pharmaceutical Sciences , Vol. 45.
17. Human Hair and the Impact of Cosmetic Procedures: A Review on Cleansing and Shape-Modulating Cosmetics. By Célia F. Cruz, Cristiana Costa, Andreia C. Gomes ,Teresa Matamá ,and Artur Cavaco-Paulo. 3, 2016, Multidisciplinary Digital Publishing Institute(MDPI), Vol. 3.
18. What is the structure of hair and how does it grow? NCBI.

19. KERATIN RESEARCH.

20. Exogen, Shedding Phase of the Hair Growth Cycle: Characterization of a Mouse Model. Yoram Milner, Michael Kashgarian, James Sudnik, Mario Filippi, Menas Kizoulis, Kurt Stenn. 3, 2002, Journal of investigative dermatology, Vol. 119.
21. Complex hair cycle domain patterns and regenerative hair waves in living rodents. Plikus MV, Chuong CM. s.l. : PubMed.Gov, may 2008, journal of investigative dermatology.
22. ageing of hair follicle pigmentation system. DJ, Tobin. 2, s.l. : Int J Trichology, july 2009, Vol. 1, pp. 83-93.
23. hair follicle terminal differentiation is orchestrated by distinct early and late matrix progenitors. Mesler AL, Veniaminova NA, Lull MV, Wong SY. 4, s.l. : cell Report, april 2017, cell report, Vol. 19, pp. 809-821.
24. Dermal adipocytes and hair cycling: is spatial heterogeneity a characteristic features of dermal adipose tissue depot? Kruglikov IL, Schere PE. 4, s.l. : Experimental Dermatology, april 25, 2016, Vol. 25, pp. 258-62.
25. Resting no more: re-defining telogen, the maintenance stage of the hair growth cycle. Geyfman M, Plikus MV, Treffeisen E, Anderson B, Paus R. 4, november : Biol Rev Camb Philos Soc, 2015, Vol. 90, pp. 1176-1196.
26. Human hair follicle bulge cells are biochemically distinct and possess an epithelial stem cell phenotype. S Lyle, M Christofidou-Solomidou, y Liu, D E Elder, S Albedla, G cotsarelis. 3, december 1999, Journal of Investigating Dermatol Symposium Proceedings, Vol. 4.
27. hair follicle: a novel source of multipotent stem cells for tissue engineering and regenerative medicines. Panagiotis Mistryotis, stelios T Andreadis. 4, s.l. : tissue engineering part B review, august 2013, Vol. 19, pp. 265-278.
28. In vitro differences between keratinocyte stem cells and transit-amplifying cells of the human hair follicle. 6, s.l. : journal of investigative dermatology, december 2005, journal of investigative dermatology, Vol. 125, pp. 1099-1105.
29. Martel, Julianna L. and Julia H. Miao, Talel Badri. Anatomy, Hair Follicle. s.l. : StatPearls, 2018.
30. YC Hsu, Pasoli HA, Elaine Fuchs. Dynamics Between Stem Cells, Niche and Progeny in the Hair Follicle. January 2011, Vol. 144, 1, pp. 92-105.
31. New activators and inhibitors in the hair cycle clock: targeting stem cells' state of competence. Plicus, Maksim V. 5, journal of investigative dermatology, Vol. 132, pp. 1321-1234.
32. Promotion of anagen, increased hair density and reduction of hair fall in a clinical setting following identification of FGF5-inhibiting compounds via a novel 2-stage process. Dominic Berg, Masakumi Yamamoto, Masato Namekata, Joseph Haklani, Koichiro Koike, maria Halasz. s.l. : PubMed. Gov, february 27, 2017, Clinical, cosmetic and investigational dermatology, pp. 71-85.
33. Marlon R Schneider, Ruth Schmidt-Ullrich, Ralf Paus. The hair follicle as a dynamic miniorgan. PubMed.Gov. february 10, 2009, Vol. 19, 3.
34. From telogen to exogen: mechanisms underlying formation and subsequent loss of the hair club fiber. Claire a Higgins, Gillian E Westgate, Colin A B Jahoda. 9, september 2009, journal of investigational dermatology, Vol. 129.
35. Identifying Quiescent Stem Cells in Hair Follicles. Rodriguez, Christine N. 2018, method in molecular biology, pp. 137-147.
36. ANNOVAR: functional annotation of genetic variants from high-throughput sequencing data. Kai wang, Mingyao Li, Hakon Hakonarson. 16, september 2010, Nuclie acid research, Vol. 38.
37. Erdoğan, By Bilgen. Anatomy and Physiology of Hair. 2017.
38. Zizyphus jujube essential oil from seeds was investigated for its potential role on hair growth by in vivo method. Different concentration of essential oil was applied over the shaved skin of mice for 21 days. After 21 days mice treated with different concentration of essential oil of Zizyphus jujube showed a significant result for length of hair, hair thickness and hair follicles.
39. Moore WN, Taylor LT. Extraction and quantitation of digoxin and acetyldigoxin from the Digitalis lanata leaf via near-supercritical methanol-modified carbon dioxide. *J Nat Prod* 1996; 59(7): 690-693.
40. Horovitz B. *Stress-busting drinks take off.* USA Today 2011; May 16
41. "Saponification Value of Fats and Oils" <https://www.aocs.org/attainlabservices/methods/methods/search-results?method=111542>. Retrieved January 18, 2018.

42. "Saponification value of Fat and Oil" <http://www.kyoto-kem.com/en/pdf/industry/FatVegetableOil/ETIB-99307.pdf> (PDF). kyoto-kem.com. Retrieved July 8, 2016.
43. Klaus Schumann, Kurt Siekmann (2005). "Soaps". Ullmann's Encyclopedia of Industrial Chemistry. Weinheim: Wiley-VCH. doi:10.1002/14356007.a24_247 https://doi.org/10.1002/14356007.a24_247 . ISBN 3527306730.
44. Chakrabarty, M. M. (2003). Chemistry and Technology of Oils & Fats (<https://books.google.com/books?id=6ZOsAwAAQBAJ&pg=PA25>). New Delhi: Allied Publishers. pp. 89, 183. ISBN 978-81-7764-495-1.
45. Knothe, Gerhard (2002). "Structure indices in FA chemistry. How relevant is the iodine value?". Journal of the American Oil Chemists' Society. **79** (9): 847–854. doi:10.1007/s11746-002-0569-4 <https://doi.org/10.1007/s11746-002-0569-4> . ISSN 1558-9331 <https://www.worldcat.org/issn/1558-9331> . S2CID 53055746 <https://api.semanticscholar.org/CorpusID:53055746> .
46. "Saponification Chart" <https://www.fromnaturewithlove.com/resources/sapon.asp> . www.fromnaturewithlove.com. Retrieved 2020-09-13.
47. <https://en.wikipedia.org/w/index.php?>
48. Telogen effluvium. S Harrison, R Sinclair. 5, July 2002, clinical and experimental dermatology, Vol. 27.
49. Bent, Melissa. Nutrition and hair health. the trichological society.
50. Burgess, Lana. What does rice water do for your hair? NEWSLETTER. 2018.
51. Koganti, Sindhu. 15 Effective Ways To Use Hibiscus For Your Hair. *STYLECRAZE*. 16 February 2021.
52. Britannica, The Editors of Encyclopedia. Hibiscus. 43) Sathaye S, Bagul Y, Gupta S, et al. Experimental and toxicologic pathology: official journal of the gesellschaft fur toxikologische pathologie. *Experimental and Toxicologic Pathology*. 2011;63(6):587–591. *"Murraya koenigii"*. Missouri Botanical Garden, St. Louis, MO, USA. 2019. Retrieved 13 August 2019.
53. Pandey M.K., Singh G.N., Sharma R.K. and Lata S. Antibacterial activity of Eclipta alba (L.) Hassk Journal of Applied Pharmaceutical Science 2011; 01 (07);: 104-10.
54. Senanayake UM, Lee TH, Wills RBH. Volatile constituents of cinnamon (*Cinnamomum zeylanicum*) oils. *Journal of Agricultural and Food Chemistry*. 1978;26(4):822–824. Puri, H. S. 2003. *Rasayana: Ayurvedic Herbs for Longevity and Rejuvenation*. Taylor & Francis, London. pages 80–85.
55. Nantana Sittichai; Chayan Picheansothon, eds. (2014). *Herbal Medicines Used in Primary Health Care in ASEAN*. Department for Development of Thai Traditional and Alternative Medicine. pp. 148–149.
56. Singh G, Maurya S, deLampasona MP, Catalan CAN. A comparison of chemical, antioxidant and antimicrobial studies of cinnamon leaf and bark volatile oils, oleoresins and their constituents. *Food and Chemical Toxicology*. 2007;45(9):1650–1661
57. Senanayake UM, Lee TH, Wills RBH. Volatile constituents of cinnamon (*Cinnamomum zeylanicum*) oils. *Journal of Agricultural and Food Chemistry*. 1978;26(4):822–824.
58. Singh G, Maurya S, deLampasona MP, Catalan CAN. A comparison of chemical, antioxidant and antimicrobial studies of cinnamon leaf and bark volatile oils, oleoresins and their constituents. *Food and Chemical Toxicology*. 2007;45(9):1650–1661.
59. Sharma RD, Raghuram TC, Rao NS. Effect of fenugreek seeds on blood glucose and serum lipid in type 1 diabetes. *Eur J clin nutr*. 1990;44:301-306
60. Ajabnoor MA, Tilmisany AK. Effect of Trigonella foenum-graecum on blood glucose levels in normal and alloxan-diabetic mice. *J Ethnopharmacol*. 1998;22:45-49.
61. Belguith-Hadriche O, Bouaziz M, Jamoussi K, El Feki A, Sayadi S et al. Lipid-lowering and antioxidant effects of an ethyl acetate extract of fenugreek seeds in high-cholesterol-fed rats. *J Agric Food Che*. 2010;58(4):2116-2122.
62. Pandian RS, Anuradha CV, Viswanathan P. Gastroprotective effect of fenugreek seeds (*Trigonella foenum graecum*) on experimental gastric ulcer in rats. *J Ethnopharmacol*. 2002;81:393-397.
63. Max B. This and That: The essential pharmacology of herbs and spices *Trends. Pharma Sci*. 1992; 13:15-20.

64. Suresh P, Kavitha ChN, Babu SM, Reddy VP, Latha AK. Effect of ethanol extract of *Trigonella foenum graecum* (Fenugreek) seeds on Freund's adjuvant-induced arthritis in albino rats. *Inflamm.* 2012; 35(4):1314-1321.
65. "Coconut oil". Transport Information Service, German Insurance Association, Berlin. 2015.
66. ^ Jump up to:^{a b c} "Coconut Oil". The Nutrition Source, Harvard T.H. Chan School of Public Health, Boston. 2021.
67. ^ Jump up to:^{a b c d e} Sacks, Frank M.; Lichtenstein, Alice H.; Wu, Jason H.Y.; Appel, Lawrence J.; Creager, Mark A.; Kris-Etherton, Penny M.; Miller, Michael; Rimm, Eric B.; Rudel, Lawrence L.; Robinson, Jennifer G.; Stone, Neil J.; Van Horn, Linda V. (2017).
68. Ayaz M., Sadiq A., Junaid M., Ullah F., Subhan F., Ahmed J. Neuroprotective and anti aging potentials of essential oils from aromatic and medicinal plants. *Front. Aging Neurosci.* 2017;9:168. doi: 10.3389/fnagi.2017.00168.
69. Chhikara N., Kour R., Jaglan S., Gupta P., Gat Y., Panghal A. *Citrus medica*: Nutritional, phytochemical composition and health benefits—A review. *Food Funct.* 2018;9:1978–1992. doi: 10.1039/C7FO02035J.
70. Nagappan T, Segaran TC, Wahid MEA, et al. Efficacy of carbazole alkaloids, essential oil and extract of *Murraya koenigii* in enhancing subcutaneous wound healing in rats. *Molecules.* 2012;17(2):14449–14463
71. Pandey M.K., Singh G.N., Sharma R.K. and Lata S. Antibacterial activity of *Eclipta alba* (L.) Hassk *Journal of Applied Pharmaceutical Science* 2011; 01 (07);: 104-10.
72. Senanayake UM, Lee TH, Wills RBH. Volatile constituents of cinnamon (*Cinnamomum zeylanicum*) oils. *Journal of Agricultural and Food Chemistry.* 1978;26(4):822–824.
73. Singh G, Maurya S, deLampasona MP, Catalan CAN. A comparison of chemical, antioxidant and antimicrobial studies of cinnamon leaf and bark volatile oils, oleoresins and their constituents. *Food and Chemical Toxicology.* 2007;45(9):1650–1661

