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FORMULATION AND EVALUATION OF A HERBAL SHAMPOO

***Dr.Saurabh Dilip Bhandare, Mr. Shivam Yogesh Alai**

Nashik Gramin Shikshan Prasarak Mandal's, College of Pharmacy, Bramha Valley Educational Campus, Anjaneri, Trambak, Nashik-422213. Affiliated to SPPU; formerly known as University of Pune, ('Oxford of the East.').

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***Corresponding Author**
Dr. Saurabh Dilip Bhandare
Nashik Gramin Shikshan Prasarak Mandal's, College of Pharmacy, Bramha Valley Educational Campus, Anjaneri, Trambak, Nashik-422213. Affiliated to SPPU; formerly known as University of Pune, ('Oxford of the East.').

1. ABSTRACT

The main objective of this present study was to prepare and, evaluate a herbal shampoo and, determine physiochemical function that emphasises on: safety, efficacy and, quality of the product. Herbal shampoo is the natural haircare product which is use to remove grease, dirt, dandruff and, promote hair growth, it also strengthens hair and, gives darkness to the hair. It also provides softness, smoothness, and, shines for the hair. Various drugs are utilised for the preparation of cosmetics shampoo. Such drugs show various side effects such as: hair loss, increased scaling, scratching, discomfort, nausea and, headache. Therefore, an attempt is made to formulate herbal shampoo that is free from side effects. Hairs are the integral part of human beauty. People generally love using herbs for cleaning, beautifying and, managing hair since the ancient era as home or natural remedy for hair care. As the time has passed synthetic agents have taken a large share but mostly people are getting aware of their harmful effects on hairs, skin and eyes. These regions attracted to community towards the herbal products, which are less expensive and have negligible side effects. Hair cleansers or shampoos are used not only for cleansing purpose but also for imparting gloss to the hair and, to maintain their manageability and, oiliness for the hair. Shampoos are of various types, like: powder shampoo, clear liquid shampoo, liquid shampoo, lotion shampoo, solid gel shampoo, medicated shampoo, liquid herbal shampoo etc. As far as herbal shampoos are concerned in stability criteria. Depending upon the nature of the ingredients they may be simple or plain shampoo, antiseptic or antidandruff shampoo.

KEYWORDS: Herbal shampoo, natural hair cleanser, hair hygiene, hair care, natural quasi-drugs cosmetic preparation in pharmaceuticals, Indian quasi-herbal shampoo.

I. INTRODUCTION

Throughout history, hair has always been an important element of personal adornment. From the beautifully regular beard curls of the Assyrian kings to the elegant haircuts in the Middle East, to the carefully coiffured wigs of the European nobility, hair has been shown, admired, and envied. Hair care is for personal aesthetics, assisted by affordability of products.[37] Formulating cosmetics using completely natural raw materials is a difficult task than that of synthetic. The challenge lies in selecting materials that can be rationally justified as 'natural' and, formulating them into cosmetics whose functionality is comparable with their synthetic counterparts.[7] Shampoos are probably the most widely used cosmetic products for cleansing hairs and scalp in our daily life. Herbal shampoos are the cosmetic preparations that with the use of traditional Ayurvedic herbs are meant for cleansing the hair and scalp just like the regular shampoo. They are used for removal of oils, dandruff, dirt, environmental pollutions etc. Herbal shampoo is a type of cosmetic preparation that uses herbs from plants as an alternative to the synthetic shampoo available in the market. The herbal shampoo is important, as people nowadays prefer herbal products than chemical ones for they proved to enhance health. The awareness and, need for cosmetics with herbs are on the rise, primarily because it is believed that these products are safe and free from side effects. Especially over the spurious pharmaceutical market.

Shampoo's main purpose is to clean the hair, which is necessary owing to accumulated sebum, dust, and, scalp debris. Various shampoo compositions have been associated to hair care since ancient time then the cosmetics and, pharmaceuticals have been developed. Quality, hair-care habits, and, specific issues such as: baldness, as a dandruff cure and, for greasy hair androgenic alopecia is a kind of hair loss caused by androgens.[31]

Hair-care products may be defined as the preparation which is meant for cleansing, modifying the texture, changing of the colour, giving life to the stressed hair, providing nourishment to the hair and, giving the healthy look to the hair. The real technology of cleaning the hair and, scalp was developed in this century by the introduction of cake soap which was followed by the production of shampoo products.[31]

The pericarp of *Sapindus mukorossi*, commonly known as soapnut or reetha, fruits of *Phyllanthus emblica* commonly known as Amla, and**,** dried pods of *Acacia concinna* **(Sheekakai)** have traditionally been used in Indian folklore system for centuries for washing hair. Reetha and Sheekakai produce rich lather when shaken with water due to their high content of saponins. They are also known to produce beneficial effects on skin and**,** other organ system. Amla fruit is rich in vitamin C and**,** is employed in hair preparations as antidandruff agent, hair growth promoter and to strengthen hairs. Ziziphus spina-christi, known as the **Christ's thorn jujube**, is an evergreen tree or plant native to northern and, tropical Africa, Southern and, Western Asia. The Ziziphus spina-christi tree, known as **'**Side**,'** in Arabic, is indigenous to the Middle East including Oman, and its leaves are traditionally used by women to wash, darken and lengthen hairs. It is reported to contain four saponin glycosides that help in removing excess sebum without causing adverse reactions. Saponins also exhibit antibacterial and antifungal activities that make them important ingredients of cosmetic applications.

I.A. AIM AND OBJECTIVE

Aim: The aim of this study was to formulate and evaluate a herbal shampoo.

Objective

1. The objective of present research work was to develop an herbal shampoo for hair growing and strengthens without affecting or damaging hair. Reetha, Amla, Shikakai herbs have been selected on the basis of a traditional system and scientific justification with modern uses,
2. To formulate the herbal shampoo,
3. To evaluate the herbal shampoo,
4. To reduce the side effects of chemical formulation,
5. To improve hair texture, (with use of appropriate herbal ingredients.),
6. To reduce hair loss, (with use of appropriate herbal ingredients.),
7. To make hair stronger and shiny. (With use of appropriate herbal ingredients.).

II. Definition of herbal shampoo: shampooing.

A. Shampoos: Cleansing is clearly a dominant element of personal hygiene and, when reinforced by the aspect of attractive appearance, translates into a powerfull and, highly marketable stimulus. Shampooing has become this, a Sine qua non in maintaining the aesthetics of hair. The cleansing task is formidable. A mass of

100,000 to 150, 000 flexible fibres have to be cleansed of oily deposits of: Sebum, sweat, entrapped desquamated scalp cells, along with the residues of mousses, gels, and hair sprays. All this has to be done within the span of a few minutes, leaving the individual hair clean and free of tangles to which the ratched structure of hair cuticle makes it particularly vulnerable. Shampoo has other functions too other than cleansing.[37] Le shampoing cheveux naturels ou à base de plantes.

A.1. Definition: A shampoo is a preparation of a surfactant (i.e. surface active material) in a suitable form – liquid, solid or powder – which when used under the specified conditions will remove surface grease, dirt, and skin debris from the hair shaft and scalp without adversely affecting the user.

B. History: In the Indian subcontinent, a variety of herbs and their extracts have been used as shampoos since ancient times. A very effective early shampoo was made by boiling Sapindus with dried Indian gooseberry (amla) and, selection of other herbs, using the strained extract. Sapindus, also known as: **soapberries** or **soapnuts,** a tropical tree widespread in India, is called Ksuna. In ancient Indian texts and, its fruit pulp contains saponins which are a natural surfactant. The extract of soapberries creates a lather which Indian texts called phenaka. It leaves the hairsoft, shiny and manageable. Other products used for hair cleansing were shikakai *(Acacia concinna),* hibiscus flowers, ritha *(Sapindus mukorossi).* Guru Nanak, the founder and, the first Guru of Sikhism, made references to soapberry tree and soap in the 16th century. Shampoo with herbs.[3,4]

Herbal shampoos are cosmetic treatments made using herbs. Herbs from the daily cosmetic Ayurveda for cleaning hair are used to cleanse the hair on regular basis have been utilised to prepare herbal shampoos with many combinations. Just like conventional shampoo, it cleans the hair and scalp. They are used to get rid of oils, dandruff, and grime pollution of the environment, etc.[31]

C. Shampoo ingredients: Shampoos consists of an aqueous solutions of emulsion, or dispersion of one or more surfactants together with some additives to enhance performance and, aesthetics properties of the product. Additives are used to provide fragrance and colour, thickener, opacity and, convey specific tactile attributes.

These also includes: stabilisers, foam modifiers, preservatives, conditioning and, anti-dandruff agents. 1. Surfactants, 2. Anionic surfactants, 3. Non-ionic surfactants, 4. Amphoteric surfactants, 5. Shampoo additives.[37]

D. Specialty shampoos: Baby shampoos place stringent requirements for non-irritancy of the scalp and eyes. The majourity of products are based on amphoteric detergent systems. Thus, derivatives of imidazoline, betaine and, sulfobetaine are usually combined with non-ionic surfactants of the polyoxyethylated alcohol esters class to procure sting-free formulations.

E. Medicated dandruff shampoos: Medicated dandruff shampoos are designed to lessen and, alleviate the excessive desquamation of the scalp by inclusion of specific ingredients. These includes; anti-microbials such as: quaternary ammonium salts, keratolytic agents, e.g., Salicyclic acids and, sulfur, or anti-seborrheic agents or compounds like coal tar and other important medicinal substances like resorcinol. Last two decades, shampoos containing Selenium sulfide or zinc pyrithione were used as antidandruff actives that have greatly risen in popularity, reflecting both the efficacy of the products and, aesthetics of the formulations.

F. Product forms: The shampoos are generally formulations that are relatively simple aqueous systems and, as such: quite amenable to modulation of their physical forms.[37]

III. Action of shampoo on hair

The original prime function of the shampoo is to clean the hair. 'Champú de hierbas como limpieza del cabello.'

III.1. Hair soiling and, soil removal: During its residence on the scalp, hair is exposed to a variety of events that contribute to its soiling. Among them are the innate process of scalp desquamation, sweating and, sebum secretion, which are supplemented by deposition of extraneous substance arising either from environmental pollution (dust, and, other airborne contaminants) or from hair-grooming preparations, such as: hair oils, waxes, hair spray and, mousse residues. Of all these, sebum, because of its steady replenishment, greasy characteristics, high adhesiveness to hair and, ability to cement the other soil particulates together and, to the hair surface, appears most insidious and thus it is not surprising that its efficacious removal is key in hair cleaning.[37]

There are three types of hair soil to be dealt with. These are oily that soil or sebum, soluble soils, and insoluble particulate soils. All three types of soil require being wetted,

thus surface tension of the water is reduced by the shampoo surfactant allowing full contact with the soil's surface. Any soluble soil is then removed in the aqueous medium. A process known as roll-up, i.e., the displacement of the soil by the detergent solution, it removes oily soil or sebum. Insoluble particulate soils tend to be removed by electrostatic repulsion between the soil and, the hair fiber assisted by repulsion between the surfactant molecules adsorbed onto the hair fiber and, those dissolved onto the soil. In the process of soil removal, the detergent micelles make contact with the lipid surface for a finite time during which they take up an increment of lipid. This is assimilated to form lipid–detergent.

III.1.1. Other associated information of the hair: (hair development and, growth factors).

III.1.1.a. Hair and hormones: At puberty, when the tests begin secreting significant quantities of androgens, (masculinising sex hormones), males develop the typical pattern of hair growth. Sometimes there is loss of hair too. In females at puberty, the ovaries and, adrenal glands produce small quantities of androgens, which promotes hair growth. This hair growth can also be seen in axillae and, pubic regions.[37]

III.1.1.b. Skin gland: Sebaceous gland Sebace-greasy or oil glands are simply, branched acinar glands. With few exceptions, they are connected to hair follicles. The secreting portion of sebaceous glands lies in the dermis and, usually open into the neck of a hair follicle.[37]

III.1.1.c. Hair follicle: hair follicle develops between the ninth and twelfth weeks after fertilisation. The non-pigmented hair produced during the 5^{th} month of development of follicles are called as: lanugo that covers the body of fetus. Over the remainder of the body of an infant, a new growth of short, tiny hair occurs. These hairs are known as: Vellus hair, commonly called as "peach fuzz." In response to hormones (androgens) secreted at puberty, coarse pigmented and, frequently curly hair develops in axillae (armpits) and public regions. In males, this hair also occurs on the face and, other body parts.[38]

IV. Ideal properties of herbal shampoo

1. It should effectively and, completely remove dust or soil, excessive sebum or other fatty substances and, loose corneal cells from the hair.
2. It should produce a good amount of foam to satisfy the psychological aspect of good feeling and feeling of comptempt of hair cleaning.

3. Requirements of user: good lathering, aromatic, gentle, soothing and calming to head.
4. It should be easily removed on rinsing with water.
5. It should leave the hair non-dry, soft, lustrous with good manageability and, minimum fly away. Must leave hair shiny, silky in first few washes.
6. It should impart a pleasant fragrance to the hair.
7. It should not cause any side-effects / irritation to skin or eye.
8. It should not make the hand rough and, chapped.

V. Advantages

1. Pure and, natural ingredient.
2. Free from side effects as compared to chemical shampoo.
3. No chemical surfactants are used e.g.: - SLS. (In case of spurious chemical in market.).
4. No synthetic additives are used.
5. No animal testing required.
6. Earth and skin friendly. (Packaging is made from recyclable materials.).
7. No petroleum-based ingredients are used.

VI. Limitations of herbal shampoo

1. Natural products affect product uniformity, qualitycontrol.
2. Less stable as compared to chemical shampoo.
3. Herbal drugs have slower effect as compared to Allopathic dosage form. Also required long term therapy.
4. Difficult to mask odour.
5. Most of herbal drugs are not easily available and very costly.
6. Manufacturing process are time consuming and, difficult as compared to the use of synthetic shampoos.

VII. Typical hair shampoo formulation contains:[37]

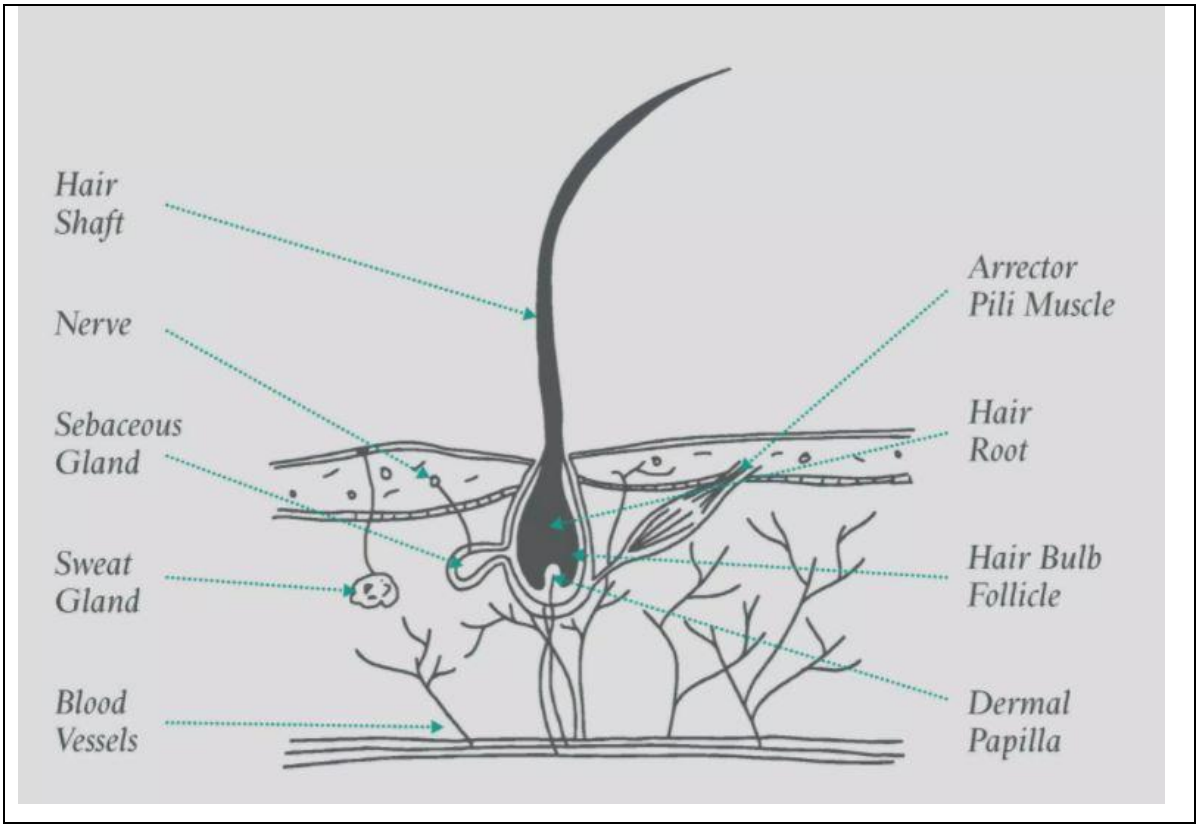
Table 1: Typical synthetic hair shampoo contents and, its content/ingredients.

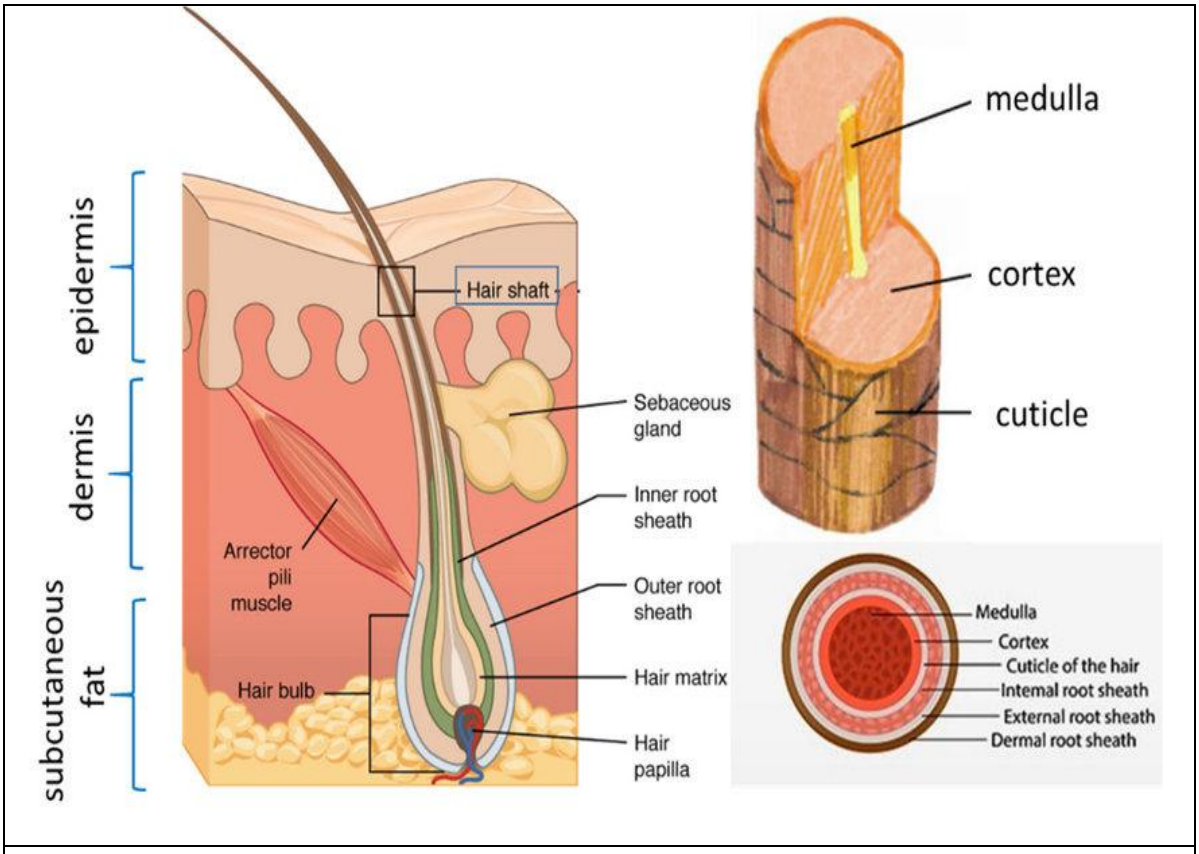
Sr.no.	Ingredients.	Function.
i.	Ammonium lauryl sulfate.	Primary cleanser.
ii.	Lauramide DEA.	Foam stabiliser.
iii.	Methyl paraben.	Required agent of pharmaceutical importance. (British pharmacopoeia, United States America of pharmacopoeia.).
iv.	Propyl paraben.	Required agent of pharmaceutical importance. (British pharmacopoeia, United States of America pharmacopoeia.).
v.	Sodium chloride.	Thickener.
vi.	Disidium EDTA.	Sequestering agent.
vii.	Fragrance.	For Aroma. *Pour l'aroma.*
viii.	FD and C yellow No.5.	Required agent of pharmaceutical importance. (British pharmacopoeia, United states of pharmacopoeia.).
ix.	D and C Orange No. 4.	Required agent of pharmaceutical importance. (British pharmacopoeia, United States of America pharmacopoeia.).
x.	Water.	Sterile water. # times-3. Diluent or mixing agent. (British pharmacopoeia, United States of America pharmacopoeia.). Potable water.

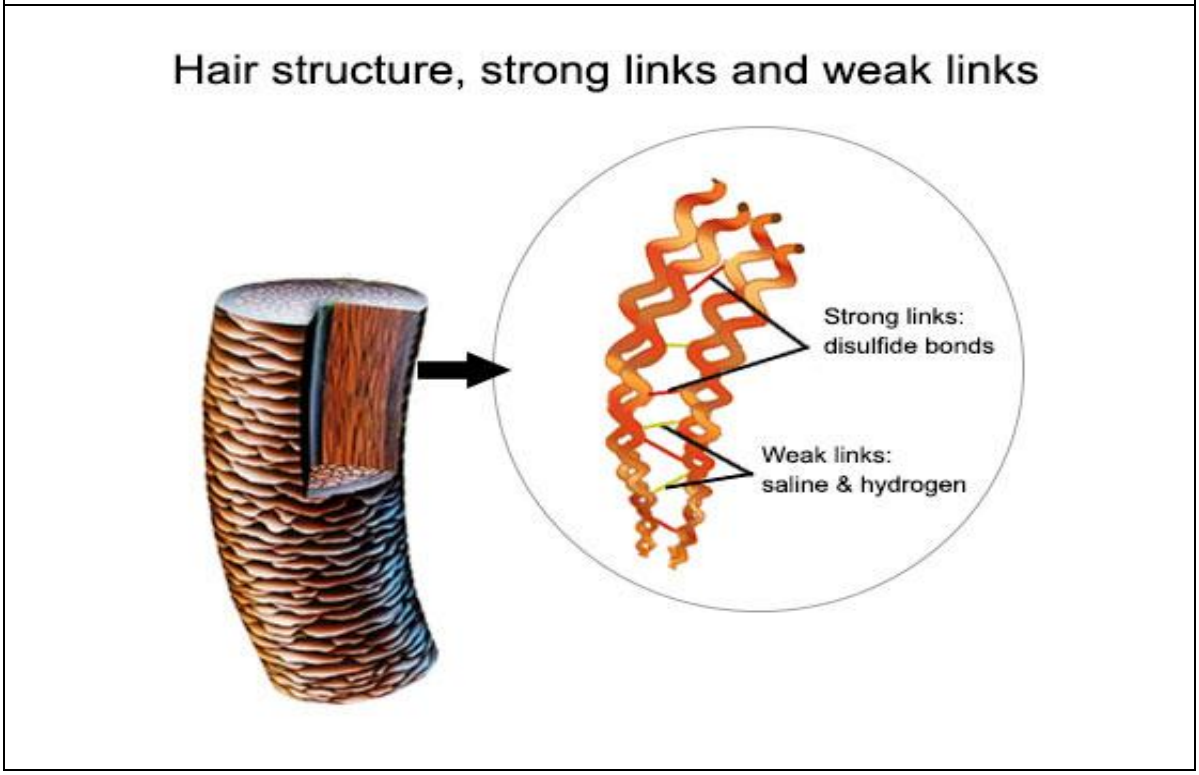
VIII. The structure and, hair properties

Hair follicles, which in tens of thousands are deeply invaginated in the scalp tissue, are the essential growth structures of hair. At the base of each follicle, the cells proliferate and, as they stream upwards, the complex and, intertwined processed of protein synthesis, structural alignment, and keratinisation transform the cytoplasm into the tough fibrous material known as hair. Hair is unique in that its structural and, growth characteristics are different between races, individuals of the same, races, areas, in the same individual, and even within the same follicle. The development of hair is a dynamic, cyclical process in which duration of the growth cycle depends not only on the body site, but also on such variables as the individual's age, nutritional habits, and hormonal factors. In the scalp, each hair grows steadily (about1 cm/month) and continuously for three to five years (anagen phase); growth then stops and is followed by a brief transient stage (catagen) and a 2 to 4 months resting stage. (telogen) during which the old hair is shed. With the onset of the anagen stage the new hair starts to

grow from the same follicle. The growth functions independently in each follicle, so hair are not shed simultaneously as they are in most animals. The cuticles are thin (0.5 µm), 50 to 60 µm square sheets, attached at their approximal ends to the underlying cortex. During the process of keratinisation, the cells plasma membranes are modified to establish a strongly adhesive layers between the adjacent cells, known as the cell membrane complex (CMC). Known as continuous phase. In the cortex are melanin dispersed throughout its structure. (Melanin pigment particles.) Its number, chemical characteristics and its distribution pattern determines the colour of hair. Hair, coarse hair in particular, vaculated medulla cells are present in the central region of the fiber. Although hair of different racial origin differs in shape, degree of curliness and, colour, there is little difference in the underlying chemical properties and fiber structure. (The hair colour is due primarily to the amount and type of melanin in its keratinised cells.).[37], [38]




epidermis
dermis
subcutaneous fat
Hair shaft
Sebaceous gland
Inner root sheath
Arrector pili muscle
Outer root sheath
Hair matrix
Hair bulb
Hair papilla
medulla
cortex
cuticle
Medulla
Cortex
Cuticle of the hair
Intemal root sheath
External root sheath
Dermal root sheath


Hair structure, strong links and weak links
Strong links:
disulfide bonds
Weak links:
saline & hydrogen

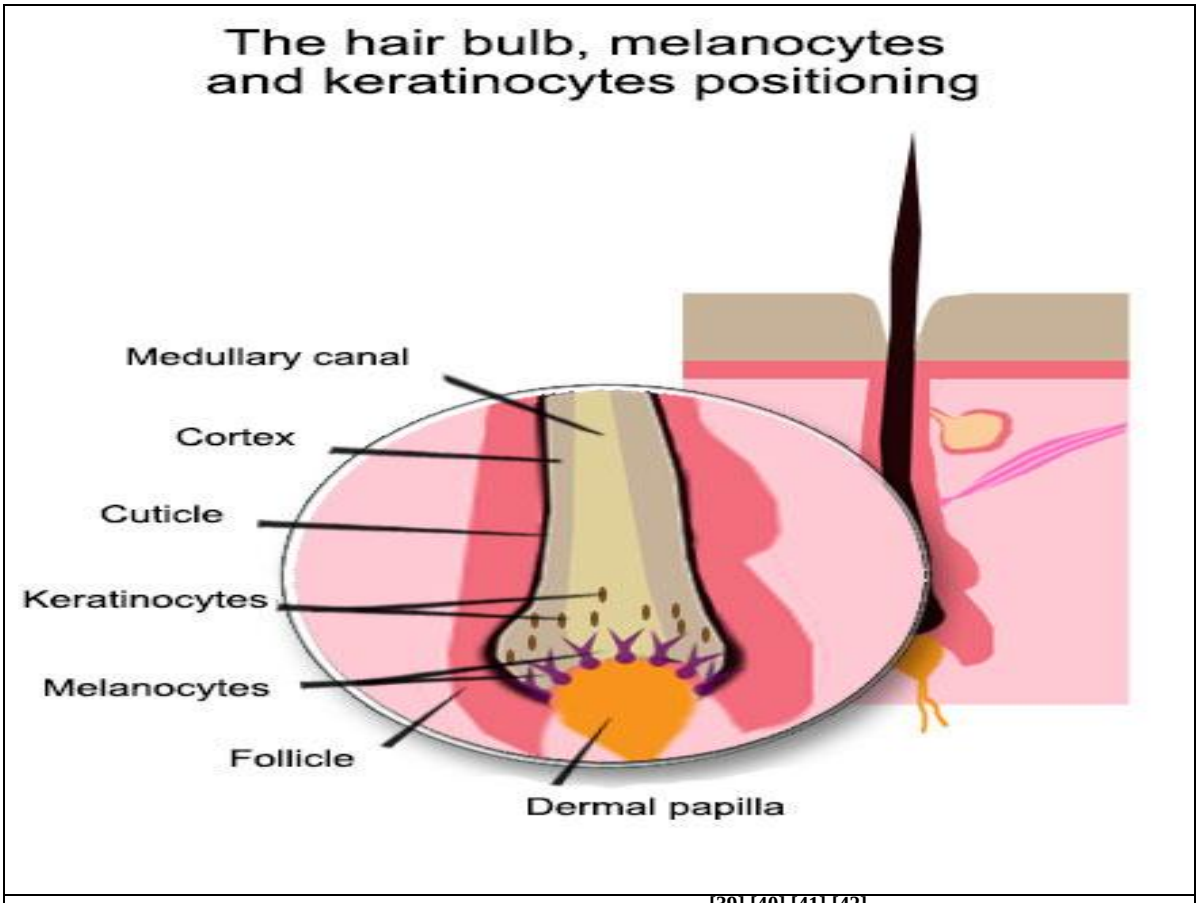


Figure 1. Structure of Hair.[39],[40],[41],[42]

IX. MATERIALS AND METHODS

IX.a. Procurement of material

IX.a.1.Collection of plant materials: *The dried and fresh plant components were gathered from local markets in Nashik. These plants are then transformed into appropriate forms such as: powder, crushed pieces, dried and stored in airtight containers until they are needed or used in the formulation. The following plants were chosen for the study because they have hair care properties: Amla fruit (Embelica officinalis), Shikakai fruit (Acacia concinna), and Ritha fruit (Sapindus Indica). The powdered Amla, Shikakai, and Ritha fruits were obtained from the local market. The raw materials collected were labelled with their biological source.*

IX.b. Preparation of herbal extracts

1. ***Reetha extract:*** *It is prepared by cold maceration method. 10 gm of Ritha powder in 70% ethyl alcohol (30mL) was added.*
2. ***Amla extract:*** *10 gm of Amla powder was weighed and added in 50 mL water and boil.*
3. ***Shikakai extract:*** *10 gm of Shikakhai powder was weighed and boiled in 50 mL water.*

4. ***Gelatin solution:*** *50 mL of water was boiled and then 1 gm of Gelatine powder was added into boiled water and again boil for 5 min. until desired solution was obtained.*

X. Formulation procedure

All the herbal extracts were triturate together using mortar and pestle. After triturating, the extract was filtered with the help of filter paper. Then to the filtered extract, added one drop of essential oil (Lavender oil/Rose oil) to improve aroma in the formulation and citric acid was added with constant stirring to balance the pH of formulation and made up the volume to 50 mL with gelatin solution.

Table 2: Formula of the herbal shampoo.

Sr. No.	Ingredients.	Quantity.
1.	Reetha extract,	10 gm,
2.	Amla extract,	10 gm,
3.	Shikakai extract,	10 gm,
4.	Gelatin solution,	q.s. B.P.,
5.	Citric acid,	q.s.,
6.	Lavender oil,	0.01mL/ q.s.,
7.	Methyl paraben, propyl paraben.	q.s. or as per formula, British pharmacopoeia, United States of America pharmacopoeia, Indian pharmacopoeia.

XI. Description of ingredients: Reetha.

a. **Common name:** Reetha. Reethey in Marathi. Soap-nut in British English, Washnut in Indian English. Rishtak and, Sanskrit synonyms: Kumbha beeja, Peeta Phenila, Phena, Garbhapati (abortifacient), Mangalya, Reetakaranja, Gucchapushpaka falam.

a.1. Botanical name: ***Sapindus Indica: Sapindus trifoliatus Linn,(S.Laurifolia Vahl)., Sapindus mukorossi,*** **a.k.a: soapberry.**

Used to wash the jewels, utensils of silver, utensils of copper and, bronze and, bronze metal god statues therefore called as Mangalya or mangala. It is also a versatile medicinal herb used to treat skin disease: pruritus, itching, toxic conditions, poisoning, in psychiatric disorders and is also used in respiratory disorders too. Traditionally also used in treatment of scorpion bite. **1.Family**-Sapindaceae, **2. Kingdom:** Plantae, **3. Subkingdom:** Tracheobionta (Vascular Plants), **4. Division:** Magnoliophyta (flowering plants), **5. Class:** Magnoliopsida (Dicotyledons), **6. Subclass:** Rosidae, **7. Order:** Sapindales, **8. Family:** Sapindaceae (Soapberry family), **9. Tribe:** Andropogoneae, **11. Genus:** Sapindus, (soapberry).

a.2. Habitat: Temperate to tropical and fruits/berries of soap-nut are collected during the summer in the India. Fruits in summer in Nashik. Soap-nut grows well in the areas with 150–200 cm of annual rainfall, soap-nut, a deciduous plant that reaches a height of 20 m, is common. Only clay soil may be used to grow this plant, some of the species have found to be sustained in sandy loam soil grown in the Bombay/Mumbai region but did not show fast growth, and bear poor fruits or soap-nuts as and when observed. (2000-2013); than that of the soap nuts grown in the black soil of the Deccan. Soap-nut is well suited and, grown in the Nashik region.

Reetha is completely odourless, hypoallergenic, and doesn't harm fabrics/hair in any way. Consequently, it is a common cleaning agent, a detergent or a shampoo ingredient. The versatility and sustainability of soap-nuts make them an essential component of every home.

Sapindus Species, Indian Soapberry, Washnut (Sapindus mukorossi).[32]

Figure 2: *Sapindus Indica.*

b. Amla

b.1. Common name: Amla.

b.2. Botanical name: ***Emblica officinalis.***

Emblica officinalis Gaertn. or ***Phyllanthus emblica Linn***, commonly known as Indian gooseberry or amla, is arguably the most important medicinal plant in the Indian traditional system of medicine, the Ayurveda. Various parts of the plant are used to treat a range of diseases, but the most important is the fruit. The fruit is used either alone or in combination with other plants to treat many ailments such as: common cold and fever; as a diuretic, laxative, liver tonic, refrigerant, stomachic, restorative, alterative, antipyretic, anti-inflammatory, hair tonic; to prevent peptic ulcer and dyspepsia, and as a digestive. Preclinical studies have shown that amla possesses antipyretic, analgesic, antitussive, antiatherogenic, adaptogenic, cardioprotective, gastroprotective, antianemia, antihypercholesterolemia, wound healing, antidiarrheal, antiatherosclerotic, hepatoprotective, nephroprotective, and neuroprotective properties. In addition, experimental studies have shown that amla and some of its phytochemicals/phytoconstitutents such as: gallic acid, ellagic acid, pyrogallol, some norsesquiterpenoids, corilagin, geraniin, elaeocarpusin, and prodelphinidins B1 and B2 also possess antineoplastic effects. Amla is also reported to possess radiomodulatory, chemomodulatory, chemopreventive effects, free radical scavenging, antioxidant, anti-inflammatory, antimutagenic and immunomodulatory activities, properties that are efficacious in the treatment and prevention of cancer. This review for the first time summarises the results related to these properties and also emphasises the aspects that warrant future research to establish its activity and utility as a cancer preventive and therapeutic drug in humans.[33]

Figure 3: *Emblica officinalis.*[34,35,36]

c. Shikakai

c.1.Common name: Shikakai.

c.2.Botanical name: *Acacia consinna.*

Acacia concinna in scientific terms, is a shrub-like tree native to Central India. *Acacia concinna (Leguminosae),* a climbing shrub with oblong-shaped dark brown pods, bipinnate leaves, and pink flowers. It is typically found in the Indian subcontinent's tropical woods.

Figure 4: *Acacia consinna.*

d. Citric acid

d.1. Common name: Lemon.

d.2. Botanical name: ***Citrus Lemon.***

Figure 5: Lemon juice.[37]

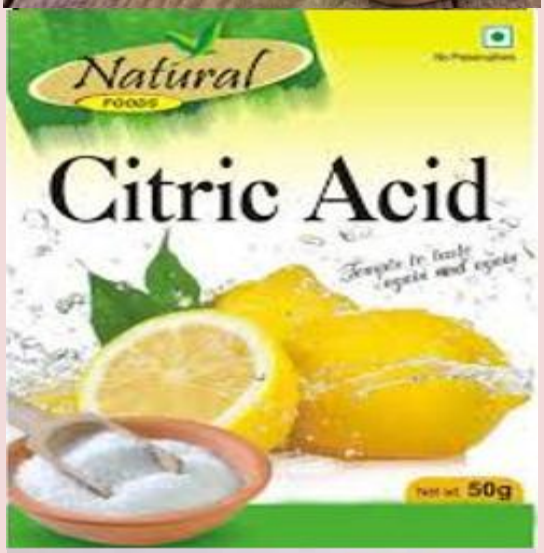
e. *Lavender* oil

e.1. Lavender oil is obtained from *Lavender* (*Lavandula angustifolia*), **Lavender oil** is an essential oil derived from the lavender plant. It can be taken orally, applied to the skin, and breathed in through aromatherapy.

Figure 6: *Lavender* oil.[38]

Table 3: List and, pictures of herbal ingredients.

Sr. no.	Common name, Latin name.	Picture.	Category.
1.	**Reetha.** *Sapindus mukorossi.*		Foaming agent. Cleansing agent for hair and, wool.
2.	**Amla, Indian Gooseberry.** ***Emblica officinalis.***		To provide nourishment to hairs. Also, a Quasi-agent. A herbal quasi-agent.
3.	**Shikakai.** ***Acacia consinna.***		Anti-dandruff. Hair tonic. Indian hair tonic.
4.	**Gelatin.** [British pharmacopoeia, United States of America pharmacopoeia. U.S.P. Laboratory and food grade. Gelatin: (Ph Eur monograph 0330). Pharmaceutical aid. Type-A, Type-B; as per British Pharmacopoeia. Bloom value: 80		Base, Hair growth promoter. (Absorbable gelatine: film, sponge.) USP. (44)

	to 120 percent of the labelled nominal value.] (43)		
5.	**Citric acid.** ***Citrus Lemon.***	  	Gives acidic tone to shampoo, heals wounded scalp. Natural healing agent, natural anti-dandruff, anti-microbial and cure fungal infections of scalp. Healing agent.

6.	**Aromatic oils**, such as: Rose oil, Mint oil, Lavender oil, Orange rind/peel oil, Sandalwood oil, Jasmile oil, Cypress oil, etc.		Perfume, aroma to the shampoos. **USP, IP, BP. (37)**

XII. Evaluation of herbal shampoo: With progress in the working on herbal or synthetic or medicated shampoos, the efficacy of developed shampoos prototypes is being evaluated in the laboratory using established testing procedures.

XIII. Result and discussion: All the point of discussion as per the laboratory results of evaluation of the herbal shampoos.

XIV. Evaluation and result

XIV.a. The prepared formulation was evaluated for product performance which includes organoleptic characters, pH, physicochemical characterisation, and for solid content.

1. Visual assessment/ Physical appearance, (Check for visual quality of the shampoo.).
2. pH determination, (Check with the pH of the herbal shampoo.).
3. % solid content, (percentage solid content.),
4. Dirt dispersion, (The visual estimation of ink in the foam is carried out to estimate the amount of ink as: nil, light, moderate or heavy.).
5. Skin irritancy, (skin irritation),
6. Foam determination.

XIV.1.a. Visual assessment: The formulation was assessed for colour, odour, appearance.

XIV.1.b. pH determination: The pH of prepared herbal shampoo was determined by using pH paper and neutral pH was obtained by adding a pH balancing agent, buffer to make it skin suitable.

The pH determination was checked using pH paper and, found that the shampoo is slightly acidic originally, due to presence of citric acid form lemon. The mild acidity of lemon is

tolerable to skin and benefits cure of irritation caused by dandruff, but make more skin suitable and for regular usage a mild pH change was introduced to making tonic to skin pH. Dandruff is a common condition that causes the skin on the scalp to flake; to cure this. Also cure the damage of skin.

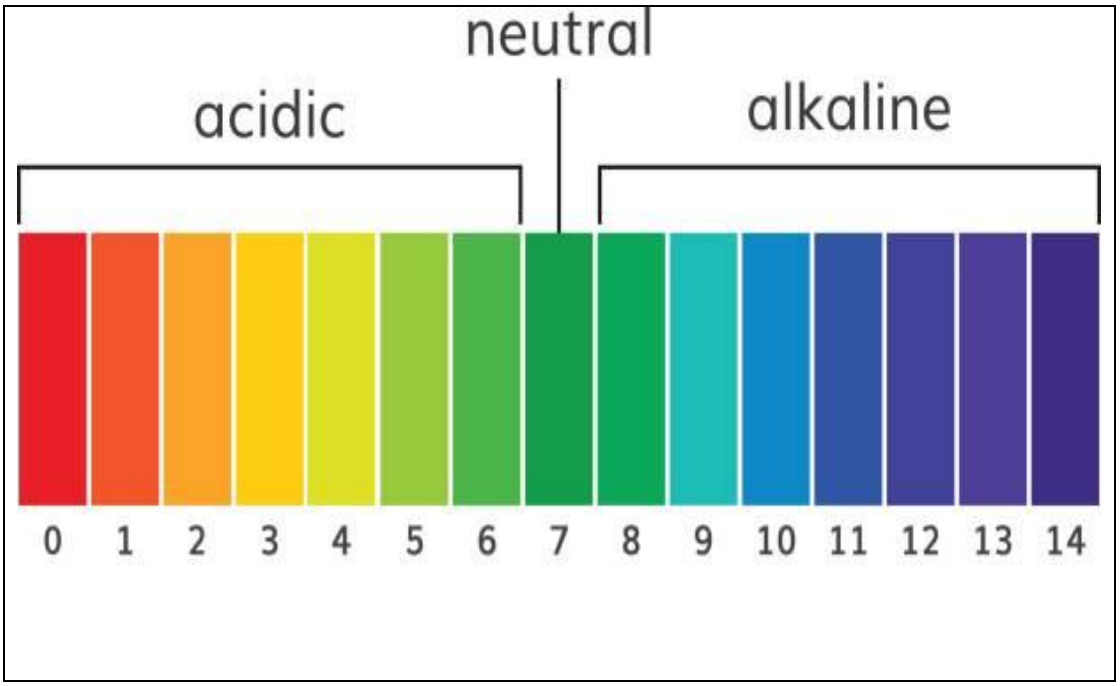
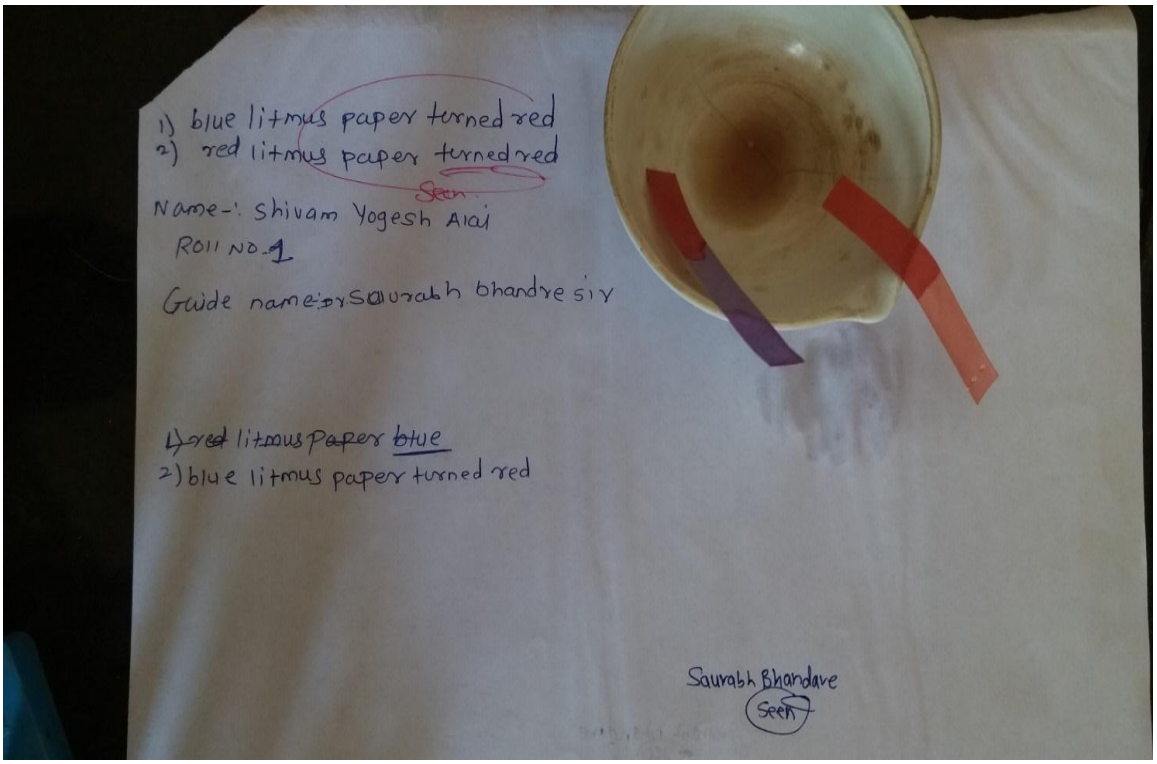


Figure 7: pH scale.



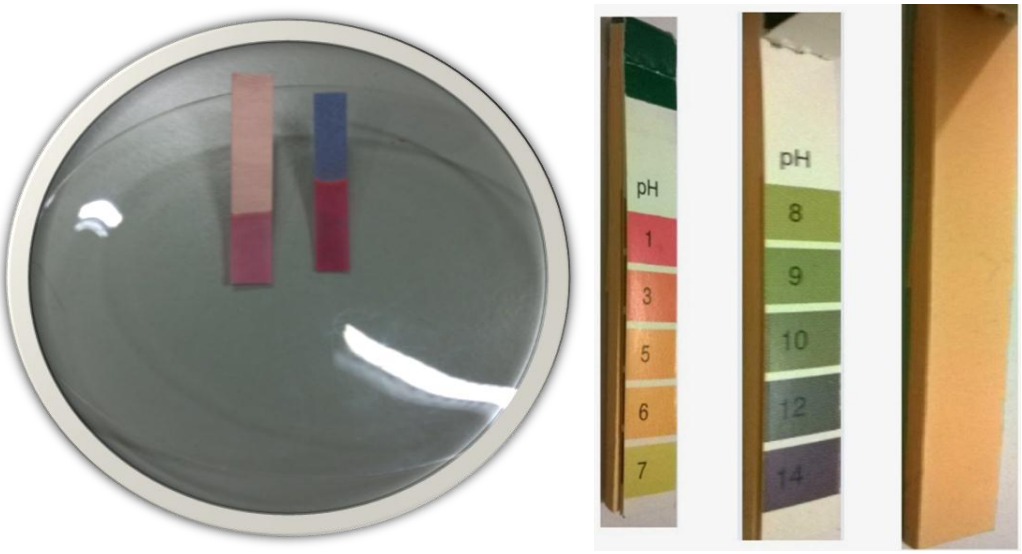


Figure 8: pH determination with litmus paper of original shampoo compared with standard reference. (The litmus paper indicated shampoo to be acidic initially before it was treated with buffer.). Other side is the pH paper with standard pH scale for reference of pH of next test.

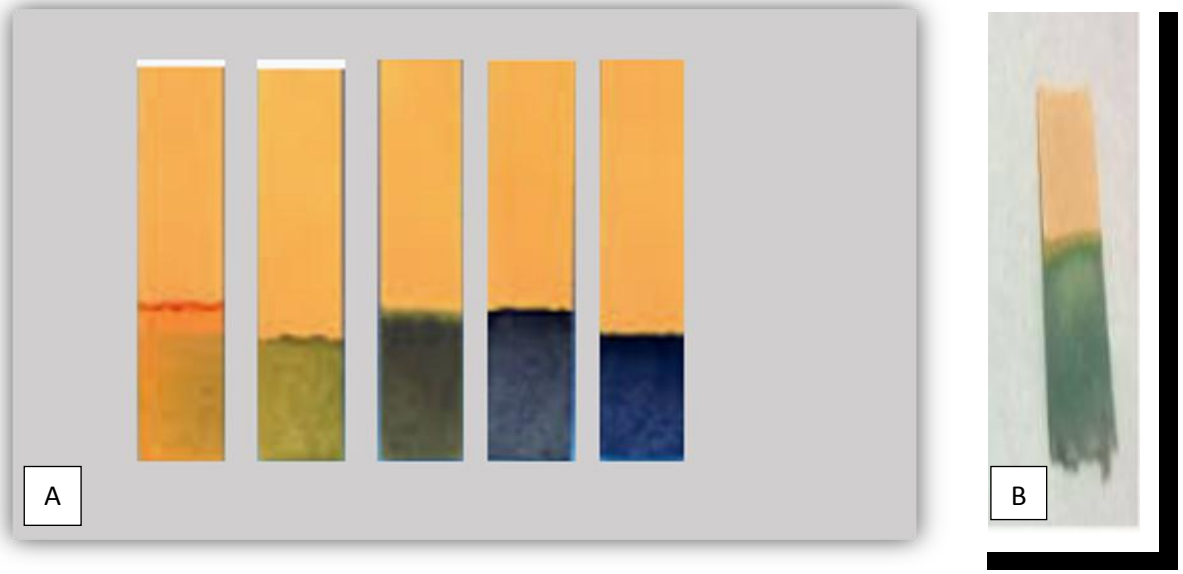


Figure 8.1. Determination of pH using pH paper strip and standard pH scale along with other standard reference materials.

A: pH of standard reference materials, **B:** pH of shampoo.

XIV.1.c. Dirt dispersion

Two drops of shampoo was added to 10 mL of water containing test tube and one drop of ink was added into test tube. Shake the test tube for 10 times. The amount of ink infoam was estimated as none, light, moderate or heavy.

Figure.8: Dirt dispersion test.

XIV.1.d. Percentage solid content

A clean and dry evaporating dish was weighed and 4 gm of shampoo added into dish. Then dish was allowed to evaporate the shampoo on hot plate. Weight of evaporating dish after evaporation of shampoo was noted.

XIV.1.d.a. % solid content = (B – A) /4 x 100.

Where, A= weight of empty evaporating dish. B= weight of evaporating dish after evaporation.

Figure 9: Percentage solid content.

XIV.1.e. Foam determination

Cylinder shake method was used for determining foaming ability.5 mL of shampoo was taken into measuring cylinder and volume was make upto 25 mL and shaken properly for ten times. Then 5 test tubes were taken and stock solution was measured as given in following observation table. And each test tube was adjusted for volume upto 10 mL by adding water. Than foam in each test was measured in cm and foaming index was calculated.

XIV.1.e.a. Foam index *=1000/A.*

Where, A= volume of decoction having exact 1cm of height.

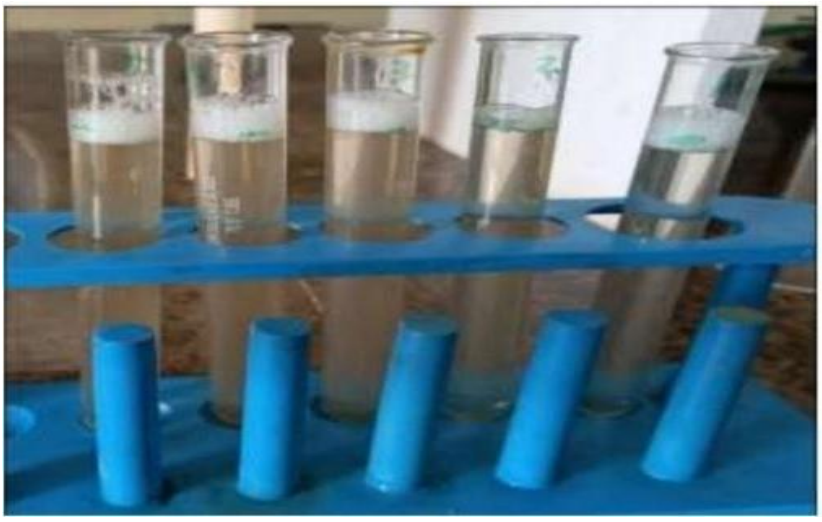


Figure.10: Foam determination test.

Table.4: Foam determination test.

Sr. no.	No. of test containing mL of solution.	Height of foam in cm.
1.	1 mL.	0.8
2.	2 mL.	1.1
3.	3 mL.	1.3
4.	4 mL.	1.8
5.	5 mL.	2

XIV.1.f. Skin irritancy/skin irritation study

Skin irritancy of shampoo can be checked by taking small amount of product on skin, after few minute to check whether local irritation or any inflammatory reaction are produce or not. As all-natural product of know scientific herbal origin are utilised, it is safe to utilise it on skin after appropriate processing, and pH balancing.

XIV.1.g. Physicochemical properties of herbal shampoo

Table 5: Evaluation test and observations.

Sr. no.	Evaluation test.	Observation.
1.	Colour,	Brownish.
2.	Odour,	Pleasant. (Aromatic in essence), (Pleasurable in sense.).
3.	Appearance,	Smooth, visually pleasing brown to coppery in colour.
4.	pH of shampoo + Buffer,	Range: 6.4-9.8.
5.	% Solid content,	8.25%.
6.	Dirt dispersion,	Heavy, to moderate.
7.	Skin irritancy,	No irritancy. Non-irritant.
8.	Foaming index,	500.

XV. DISCUSSION

The pure herbal shampoo was formulated by mixing the equal amount of the aqueous extracts of soapnut, Shikakai, and, Amla in definite amount as shown in **table 2.** The above plant extract contains phytoconstituents like: saponins from soap-berry; which is a natural surfactant having detergent property and, foaming property. An ideal shampoo must have adequate viscosity and, many natural substances that possess good viscosity which was also one of the parameter of this research carried out. Lemon juice is added to maintain the acidic pH in this formulation. The shampoo was formulated by admixing the equal amount of the aqueous extracts of all the ingredients with soapnut. The gelatin solution (10%) behaves as a pseudo plastic forming clear solutions. Lemon juice (1 mL) added to the shampoo serves as anti-dandruff agent, natural antioxidant, and chelating agent and,

maintains the acidic pH in formulation.

The gelatin also promotes hair growth and, also supports nature strength of hair fiber. The strength of the hair are maintained by introduction of gelation in the shampoo due to the usage of gelatin protein. The other required ingredients serve as natural herbs to support and, maintain healthy hair growth.

XVI. CONCLUSION

The present study was carried out with the aim of preparing the herbal shampoo that reduces hair loss during combing, safer than the spurious chemical conditioning agents, or shampoos sold in illegitimate shop or markets or unauthorised pharmacy. This shampoo is also developed with other conditioning properties; as well as to strengthen the hair growth. Herbal shampoo was formulated with the aqueous extract of medicinal plants that are commonly used for cleansing hair traditionally. Use of conditioning agents (synthetic, spurious) reduces the protein or causes hair loss. To provide the effective conditioning effects, the present study involves the use of shikakai, amla, and, soap-nut other plant extracts instead of synthetic cationic conditioners/shampoos. The main purpose behind this investigation was to develop a stable and, functionally effective shampoo by excluding all types of synthetic additives, which are normally incorporated in such formulations. To evaluate for good product performance of the prepared shampoo, many tests were performed as result of its formulation evaluation and, benefit as herbal shampoo. The results of the evaluation study of the developed shampoo revealed a comparable result for quality control test. Shampoo resulted good on hair and leaves them shiny and soft silky too. The herbal shampoo can be made using various other ingredient with similar approach of formulation along with some of the components or ingredient may be replaced as per the desire and requirement and fashion/current trends in formulation market.

The Reetha, *Sapindus mukorossi*, may be replaced by other synthetic detergents upon requirement like: SLS, /upon unavailability of *Sapindus mukorossi.* Similarly, gelatin with other similar substances, e.g., *Eclipta prostrata*, commonly known as **false daisy**, a.k.a., Bhringraj, from a species of plant family *Asteraceae*. It is wide spread across the world and, can be used in herbal preparations including the shampoos.

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XVIII. Conflict of interest: None.

XIX. REFERENCE

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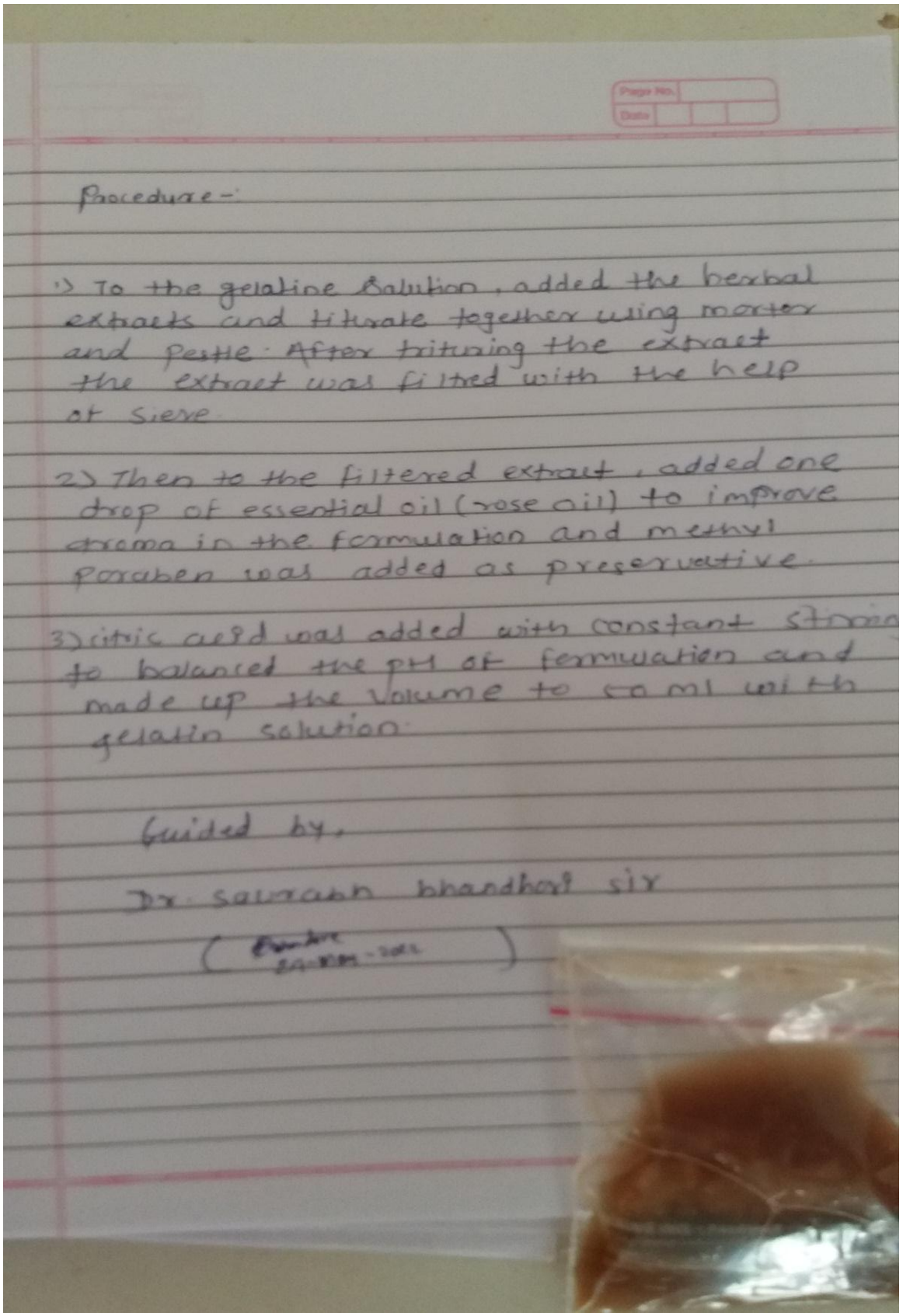
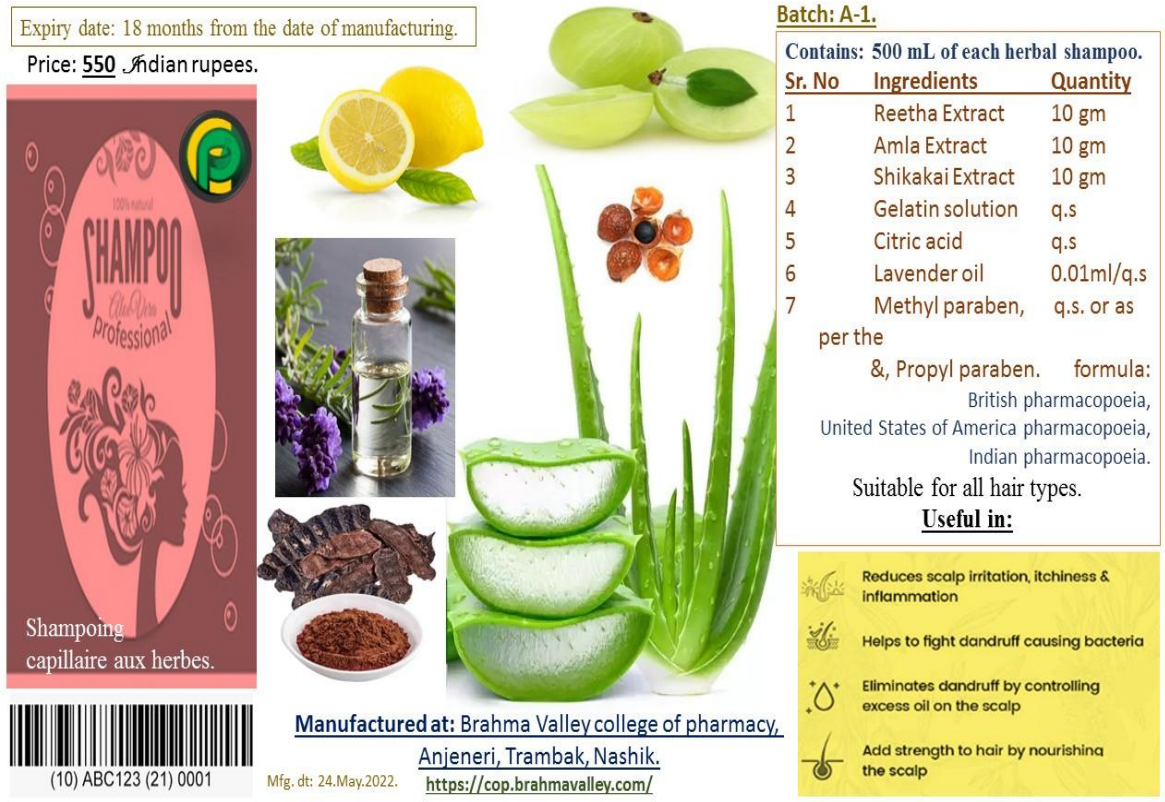
XX. Appendix: (Appendices)

XX.a. Laboratory work details: Shampoo in the shampoo self-sealable pouch/self-locking plastic zip bag.



XX.b. Label: Shampoing pour de beaux cheveux:



Indication: Wet hair. Gently massage onto the scalp. Lather; rinse thoroughly. Caution: Avoid contact with eyes; if contact occurs, rinse thoroughly with water.