



FORMULATION AND EVALUATIONS OF HERBAL ANTIDANDRUFF SHAMPOO

*Nitesh Dnyanba Bajad*¹, *Madhu shewale*²

¹ Student of Yashodeep Institute of Pharmacy, Chhatrapati Sambhaji Nagar, Maharashtra, India.

² Assistance Professor of Yashodeep Institute of Pharmacy, Chhatrapati Sambhaji Nagar, Maharashtra, India.

Email Id: - niteshbajad2001@gmail.com

Mobile No.: - 9370724442

ABSTRACT: -

The primary goal of this study is to make and assess a herbal shampoo and identify its physiochemical function, with an emphasis on the product's quality, safety, and efficacy. Herbal Shampoo is a natural hair care product that is used to support hair growth, strength, and darkness while also eliminating oil, grime, and dandruff. Additionally, it gives the hair gloss, smoothness, and tenderness. Cosmetic shampoo is made with a variety of medications. Many side effects, including hair loss, increased scaling and itching, pain, nausea, and headaches, are reported with these medications. As a result, an effort is made to create a herbal shampoo without any negative effects.

Keywords: herbal, cosmetics, shampoo, etc.

INTRODUCTION: -

The most popular hair treatment is shampoo. Shampoos are products that are mostly used to clean the scalp and hair. the current Even if herbal shampoo performs better and is safer than synthetic shampoo, it doesn't seem likely that consumers will embrace it. A more drastic strategy to make herbal shampoo more widely used would be to alter customer expectations by placing more of a focus on efficacy and safety in shampoos. This study's primary goal was to replace the hazardous synthetic ingredients in herbal shampoo composition with safe natural alternatives.

Hair Scalp Anatomy:

- Follicles in the intersection of the hypodermis and deep layers of the dermis are where hair originates. Another name for these follicles is "hair bulbs." Blood circulation is fed by a tiny tube that goes into the hair shaft, giving the hair all the nutrients it needs to stay healthy, including vitamins, mineral salts, and amino acids
- There are glands all around the hair shaft, the most significant of which is the sebaceous gland, which produces.
- Keratin, a fibrous helicoidal protein with a helix-shaped structure that makes up 95% of hair structure, is a component of the skin and all of its appendages, including body hair and nails.
- Keratin is produced by keratinocytes and is water insoluble, which gives hair protection and impermeability.
- Melanin is also present in the cortex of hair. The pigment that gives hair its colour is called melanin, and it is produced by specialised cells called melanocytes. The nascent hair shaft's keratinocytes receive pigment injections from the melanocytes. From the genesis to the end of the hair cycle, when the hair falls, the colour remains constant.

Anatomy of hair scalp

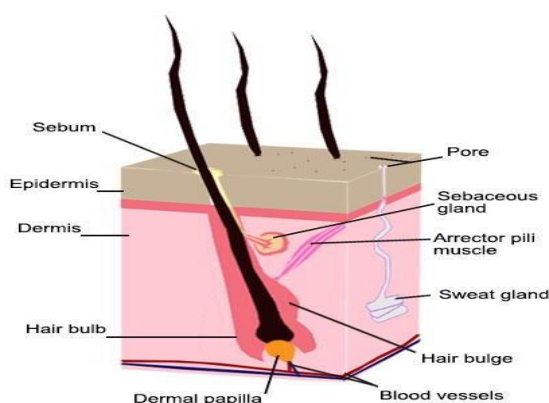


Figure 1: Anatomy of Hair Scalp

Hair Types:

Type 1: Of all the hair kinds, type 1 is the straightest, reflecting the greatest sheen and resilience. This type of hair is extremely tough to curl and difficult to damage. It is the most oily hair texture of all because sebum flows readily from the scalp to the ends without being interrupted by curls or kinks.

Type 2: hair that is wavy, with a shine and texture halfway between curly and straight. Additionally, wavy hair is more prone than straight hair to become frizzy. Type 3 and type 4 wavy hair is tough to styling, in contrast to type waves, which may switch between straight and curly styles with ease.

Type 3: hair that is curly and shaped like a 'S'. The wavy design could be interpreted as an uppercase "S," lowercase "s," uppercase "Z," or occasionally both. The hair type is typically thick, "climate dependent," and prone to damage. Less defined curls are the result of improper care.

Type 4 Kinky hair is characterised by a highly dense, frequently brittle curl pattern that is tightly coiled, or it may not have any curl pattern at all. This kind of hair is more prone to damage than other hair types because it has fewer cuticle layers and shrinks when wet.

Hair growth cycle: -

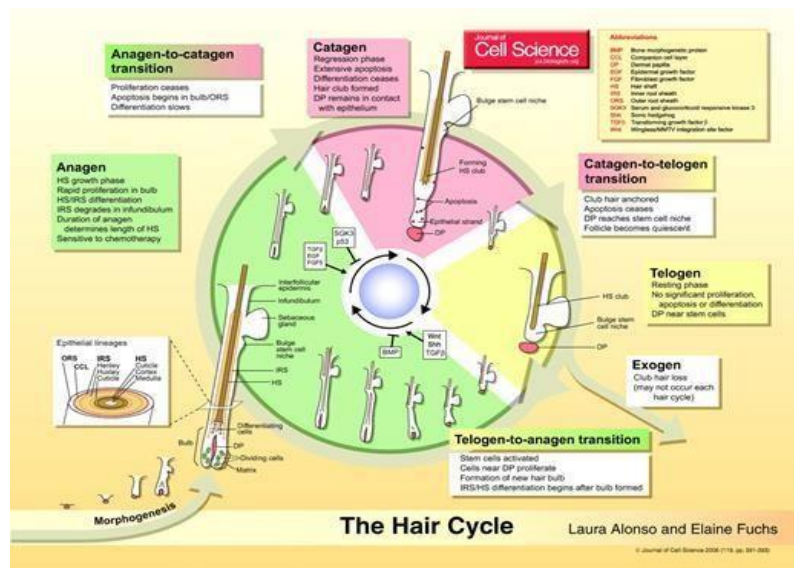


Figure 2: - Hair Growth Cycle

1. Anagen: Anagen is the stage of growth. Rapid cell division occurs, pushing the older, dead cells outside the hair bulb where they keratinize and allow the infant hair to begin growing. About three years pass during the anagen period. Every month, on average, each hair grows half an inch. 85% of hair follicles are in the growth phase at any given time.

2. Catagen: The resting or transitional phase is called catagen. When the hair reaches the catagen phase, it ceases to grow and remains in this phase for approximately one month. At this point, the growth begins to contract. The hair does not, however, come out and remains in place for a while. An average of 1% of hairs are in the catagen phase, or resting, at any given time.

3. Telogen: **Telogen**, which is often referred to as the shedding phase, is the last stage. This is the period of time when adult hair sheds. This stage lasted around three months. The hair follicle returns to either the growth phase or the anagen phase when the hair falls out. Ten percent or so of hairs are in the telogen phase at any given time.

It is significant to remember that, despite hair going through several phases, the overall amount of hairs often stays constant. The ideal A/T ratio, or the ratio between the anagen and telogen phases, is typically 80:20. This indicates that 20% of hair falls off and 80% of hair grows.

Common Causes of hair loss:

- Health insurance;
- Autoimmune conditions Stress on both a physical and emotional level; poor nutrition;
- hormonal fluctuations; and vitamin deficiencies

Ideal Properties of Shampoo:

1. Make a sufficient quantity of foam
2. Must not irritate the skin, scalp, or eyes
3. Must remove dirt entirely and efficiently
4. Give hair a pleasing scent

5. to give hair a glossy appearance.

Classification Of Shampoo:

1. Based on appearance
 - a] Powder shampoo
 - b] Gel shampoo or solid shampoo
 - c] Cream shampoo
 - d] Oil shampoo
 - e] Miscellaneous antidandruff shampoo or medicated shampoo
2. Based on Origin
 - a] Herbal shampoo
 - b] Egg shampoo
3. Based on Use or Function
 - a] Conditioning shampoo
 - b] Antidandruff shampoo
 - c] Therapeutic shampoo
 - d] Baby shampoo
 - e] Balancing shampoo
 - f] Clarifying shampoo

Ingredients used in herbal shampoo:

Sr No.	Ingredients	Parts used
1	Neem Leaves	Leaves
2	Fenugreek Seed	Seeds
3	Amla	Fruits
4	shikakai	Beans
5	Ritha or soap nuts	Fruits
6	Rose water	-
7	Distilled water	-

Table 1: Ingredients of herbal shampoo

Aim and Objectives

Aim: Preparation and evaluation of Herbal shampoo

Objective:

- To gather or buy extracts of herbal ingredients.
- To choose appropriate excipients
- To evaluate the organoleptic properties of herbal components.
- To create a herbal shampoo
- To assess herbal shampoo

Need of study

Herbal shampoos are regarded as the greatest hair care products because natural elements have been utilised by humans for aeons. Shampoos enriched with natural component extracts are known as herbal shampoos. The best and most durable effects are produced by these shampoos, which is their greatest quality. These shampoos don't harm hair and don't contain any harsh ingredients. Some of the advantages of herbal shampoos for hair development will be discussed in this blog.

1. Herbal shampoos for hair loss are composed of natural oils, minerals, and herbal extracts; they don't contain any harsh chemicals or pollutants. By hydrating your hair's roots and follicles, the substances help to increase the moisture content of your hair. Consequently, there is a decreased likelihood of hair loss as a result of breakage.

2. Using herbal shampoos on a regular basis will greatly improve your hair. For your scalp to produce thick, robust hair, the ideal ratio of oil to pH levels must be maintained. The shampoos' natural herbs aid to keep your scalp's ideal oil balance while eliminating extra oil.
3. Herbal shampoos for hair growth are designed to strengthen hair follicles by penetrating the roots and follicles with vital oils and nutrients.
4. Herbal shampoos work well for all hair types and don't have any serious adverse effects or allergies because they are manufactured from extracts of natural substances. The shampoos are made without synthetic additives using only organic and clean components. Thus, there's no reason to be concerned about allergies when using these shampoos.

PLANT PROFILE:

Neem leaves:



Figure 3: Neem leaves

Biological Source

Known by its popular name, curry leaf tree, *Murraya koenigii* (L.) Spreng is a tiny, strongly scented perennial shrub that is frequently found as undergrowth in woodlands.

Family ; -Rutaceae

Active Constituents:

It was discovered that much of what is added is present in the oils extracted from curry leaves. Curry leaves are rich in minerals, iron, magnesium, fibre, calcium, phosphorus, carbs, copper, and vitamins, including nicotinic acid, as well as antioxidants and vitamins A, B, C, and E. Curry leaves are an excellent source of folic acid and iron. Curry leaves are good for hair because they contain a lot of protein and beta-carotene, both of which help to stop hair thinning and loss. Since proteins are the building blocks of hair and are essential for hair development, proteins are required for hair growth.

Fenugreek seeds:



Figure 4: Fenugreek seeds

Biological name

The annual plant *Trigonella foenum graecum* is a member of the Leguminosae family. It is the well-known spice used in human cuisine. Fenugreek has long been employed in medicine and food preparation; its green leaves and seeds are used for both purposes.

Active Constituents:**Volatile oil**

Names **components of fenugreek chemically**

Alkaloids - Trimethylamine, Neurin, Trigonelline, Choline, G

Biological Source- entianine, Carpaine and Betain

Amino acids - Isoleucine, 4-Hydroxyisoleucine, Histidine, Leucine, lysine, l-tryptophan,

Saponins - Graecunins, fenugrin B, fenugreekine, trigofenosides A–G

Vitamins B1, B2, B6, and B9, as well as less than 2% of vitamin B3, and minerals iron, copper, manganese, magnesium, phosphorus, zinc, and potassium are all present in fenugreek seed.

calcium, less than 2% of selenium, and additional elements such as dietary fibre, proteins, carbs, and lipids

This common cooking ingredient increases blood flow to the scalp and is a long-standing treatment for hair loss.

Amla fruit:

Figure 5: Amla fruit

Biological Source: Amla, Emblica, Indian Goose Berry. This is made up of both fresh and dried fruits from the Euphorbiaceae family plant *Emblica officinalis* Gaerth (*Phyllanthus emblica* Linn.). It is a small to medium-sized tree that grows in all of India's deciduous forests.

Grown all throughout India and the surrounding nations, amla has become popular worldwide as a "superfruit." It should come as no surprise that 100 grammes of fresh amla berries provide the same amount of vitamin C as 20 oranges.

Amla, popularly called Indian gooseberries, is a flowering tree that bears the same name. The tiny berries have a vivid yellow-green colour and a spherical shape. Even though they have a strong sour taste by themselves, their flavour can improve recipes when incorporated.

Reetha and soap nuts:



Figure 6: Reetha or soap nuts

Biological Source:

Reetha, or *Sapindus mukorossi*, is a species of tree in the Sapindaceae family. The fruit, like other species in the genus *Sapindus*, is named soapberry and is often referred to as Indian soapberry or washnut.

Active Constituents

The fruit of *Sapindus mukorossi* is mostly composed of mucilage, sugars (10%), and saponins (10%–11.5%). Secondary plant metabolites known as saponins have a variety of biological functions.

Reetha is a powerfully cleansing herbal medicinal plant that is referenced in Ayurveda. Reetha trees are found in the Himalayan hills, and they yield about 35 kilogramme per tree. Reetha's bark and roots are often bitter and astringent, but they also have wonderful therapeutic qualities including anthelmintic and expectorant.

It is mentioned in Ayurvedic scripture that Reetha is an ideal remedy for treating mental and skin ailments. Reetha goes by a variety of names, including Soapberry, Wash Nut, and Soap Nut.

It is referred to as Arista in Ayurveda and is popularly called "soap nut tree" in India.

Shikakai bean:



Figure 7: shikakai beans

Biological Source:

Senegalia rugata, sometimes called Shikakai in India, is a prickly climbing shrub that is native to tropical Asia and China. It is widely found in the warm plains of central and southern India.

Family: Fabaceae**Active Constituents:**

This plant, one of the most widely used natural substances, has been utilised for ages in most parts of India as a hair cleaner. In addition to having other qualities that make it perfect for hair treatment, shikakai contains vitamins C and D.

Grown in Central India, shikakai, also scientifically known as *Acacia concinna*, is a shrub-like tree. It has been used for ages as a body and hair cleaner. When shaken with water, it produces a considerable amount of lather since the bark contains saponins. Along with vitamins A, D, E, and K, it is high in vitamin C.

Rose water; -

Figure 8: Rose oil

Biological Source

Rosa alba L. is a member of the Rosaceae family. Because of its smell, decorative qualities, and therapeutic benefits, this plant is extensively grown in Europe, Asia, North America, and Northwest Africa. It is also referred to as *sufaid gulab*, white rose, white rose of York, garden rose, and white oil-bearing rose.

Active Constituents

linalool, p-cymene, camphene, β -caryophyllene, farnesol, stearoptene, α -pinene, β -pinene, α -terpinene, limonene, citronellal acetate, geranyl acetate, neryl acetate, eugenol, methyl the most prevalent chemical components found in rose oil are rose oxide, geraniol, nerol, citronellol, and eugenol.

Rose essential oil is a very well-liked oil that has both therapeutic and aesthetic uses. It is quite beneficial to your skin and reduces the appearance of wrinkles and scars. It can assist in overcoming stress and despair. It helps keep your liver healthy and is excellent for your digestive system.

METHODS OF PREPARATION: -

Shampoos (a variety of brands were purchased from the local market) Quality control tests, such as visual inspection and physicochemical controls like pH and density, were carried out to analyse the formulations. Additionally, particular tests for shampoo formulations, such as the assessment of dry residue and wetting property, total surfactant activity, surface tension, and detergency tests, were conducted to guarantee the quality of the goods.

Weigh each ingredient precisely, then let it soak for the entire night. After soaking the ingredients overnight, the following morning (after the mixture has cooled and filtered), boil the ingredients in the same water over medium heat. All of the ingredients will be puffed and full of water. Rose oil, an adequate amount of essential oil, and methyl paraben were added for scent and preservation. The developed shampoo was put away in an appropriate container and used in additional tests.

Materials used

1. Butter paper
2. Spatula
3. Mixing vessel with stirrer
4. Measuring cylinder
5. Burner
6. Testing Instruments
7. Weighing machine
8. pH meter
9. Turbidity meter,

10. Conductivity Meter etc.

FORMULATION TABLE 2 : -

Sr No	Ingredient	Parts used	Quantity
1	Neem leaves	Leaves	5gm
2	Fenugreek seed	Seeds	10gm
3	Amla	Fruits	10gm
4	Shikakai	Beans	10gm
5	Ritha or soup nuts	Fruits	10gm
6	Rose water	-	Qs
7	Distilled water	-	Qs
8	Methyl paraben	-	Qs

Table 2: Formulation of herbal shampoo

EVALUATION TEST:

Evaluation of shampoo: -

1. Determination of pH
2. Dispersion of dirt
3. physical attributes and ocular examination
4. Calculating the percentage of solid content
5. Measurement of surface tension
6. A cleansing procedure
7. Wet period
8. Capacity to foam and stability of foam
9. dispersion capacity

Evaluation test: -

The resulting formulation's solid content, pH, physicochemical characterization, and organoleptic characteristics were all assessed in terms of product performance. Specific tests were carried out utilising standard protocol for surface tension, foam volume, foam stability, and wetting time in order to ensure the products' nature.

1. **Visual assessment** – We evaluated the colour, clarity, odour, and foam content of the manufactured product.
2. **PH determination** – Using a pH analyser, the produced herbal shampoo in 10% v/v distilled water was measured for pH at room temperature.
3. **Surface tension measurement** – A stalagmometer was used at room temperature to measure the surface tension of the shampoo that had been made in 10% w/v distilled water.
4. **Testing of wetting** - The time needed for the canvas paper to fully submerge was used to compute the wetting time [3]. One inch in diameter was cut from a 0.44 g piece of canvas paper. The canvas paper disc was placed over the shampoo (1% v/v) surface, and the timer was used to time how long it took for the paper to sink.
5. **Percent of Solids** -- weighed and noted the starting weight of an empty, dry evaporating dish. In the evaporating dish, 4 grammes of shampoo formulation—not the 1% solution—were added. The dish and shampoo were weighed, and the initial weights were noted. determined the precise weight of the shampoo alone and noted its initial weight. Once the liquid portion has evaporated, place the shampoo-filled evaporating dish on the hot plate. Weighing the dish and shampoo solids after drying, the outcomes were recorded.
6. **Foam Formation (Shake Test)** — Test D should be reviewed before beginning, as Test C and D are completed concurrently. Using a 250 ml graduated cylinder, take 50 ml of the 1% shampoo solution and note the volume. After that, cover the cylinder with your palm and give it ten shakes. Following sharing, the overall volume of the contents was recorded. determined the foam's volume and noted the bubbles' sizes.
7. **Viscosity**-- The Ostwald viscometer was used to measure viscosity.
8. **Surface Tension**-- made a 1% v/v shampoo solution by combining 200 ml of distilled water with 2 millilitres, or 40 drops, of shampoo. After taking the shampoo out of the beaker, distilled water was gradually added. A stalagmometer was used to measure the surface tension following a thorough mixing of shampoo and water.
9. **Foam stability test** - The cylinder shaking method was used to assess the foam's stability. A 250 ml graduated cylinder was filled with around 50 ml of the created shampoo solution (1%) and shaken violently ten times. The shake test's foam volume was recorded after one minute and four minutes, respectively, to determine the foam stability. After shaking the foam for one minute, the total volume was measured.

10. **Dirt dispersion test** : - Two drops of cleanser were added to 10 millilitres of refined water and placed in a test tube with a wide mouth. One drop of Indian ink was added to the shampoo mixture, and the test tube was sealed with a stopper before being shaken for ten minutes. The amount of ink in the foam was measured, and the outcome was categorised as light, medium, heavy, or none at all.
11. **Conditioning performance evaluation** – An Indian woman's synthetic hair was purchased from a salon and split into two swatches, each measuring roughly 10 cm in length and 5 grammes in weight. The test swatch that was washed with the specially designed shampoo was separated from the control sample, which had not been cleaned. Each hair was introduced for two minutes to a mixture of shampoo and water (10:15) in a conical flask, and then 50 millilitres of distilled water was used for washing. The process was carried out a maximum of ten times, allowing each tree to air dry at room temperature. A blind touch test was used to assess the conditioning impact of the produced shampoo in terms of softness and smoothness. Volunteers from student 20 numbers were chosen at random for the test.

RESULT AND DISCUSSION: -

A number of unique tests, including a physical test, PH, solid contents, surface tension, cleaning action, wetting time, foaming ability, and foam stability, were used to analyse this herbal shampoo.

Traditional knowledge was used in the formulation of the herbal shampoo preparation, with a focus on creating a stable and functionally useful product. In addition to being safer than chemical conditioning agents, the specially designed shampoos also significantly lessen hair loss when combing and promote hair development. Curry leaves, fenugreek, amla, shikakai, ritha, and rose oil are some of its constituents. which are secure to utilise.

Results of evaluation test:

Evaluation Test	Result
Colour	Brown
Transparency	Clear
Odor	Good
Ph of 10% sol.	7
Solid contents (%)	23.25
Foam volume (ml)	25
Foam type	Dense, small
Wetting time (s)	120s



Summary and conclusion:

In order to lower the risk of chemicals, this study intended to produce stable formulations shampoo rich in curry leaves extract and low in surfactants. According to the findings, every element that went into making the shampoo was deemed safe, and the physiochemical analysis produced excellent outcomes. The results of stability testing demonstrated a uniform and stable look after six months of storage at varying temperatures (4–8oC, 40oC, and room temperature). The recipe did, however, provide the best stability, particularly for the extracts of curry leaves, Retha, amla, and shikakai. To improve its quality, particularly with regard to conditioning performance, more research is needed.

Traditional knowledge was used in the formulation of the herbal shampoo preparation, with a focus on creating a stable and functionally useful product. In addition to being safer than chemical conditioning agents, the specially designed shampoos also significantly lessen hair loss when combing and promote hair development. To preserve the acidic mantle of the scalp, the shampoos' pH was modified to match that of the scalp. It was discovered to be safe, more efficient, and affordable.

REFERANCES :

1. Pawan M. shashikant M., Suraj M. , A review article on herbal shampoo, may 2021, volume8 issue 5
2. Ashwini P. and Sujata P. I, formulation and evaluation of herbal shampoo, world journal of pharmaceutical research, volume 9, issue 5, April 2020,901-911
3. Sandhyarani G., Ramesh A., review on shampoo 2014,1(2). page no 61-64
4. Vijayalakshmi A., Sangeetha S., Ranjith N., formulation and evaluation of herbal shampoo, Asian journal of pharmaceutical and clinical research, 11 dec 2018, vol.11, special issues
5. Ishii MK. Objective and instrumental methods for evaluation of hair care product efficacy and substantiation of claims. In: Hair and hair care. New York: Marcel Dekker, Inc; 1997. p.
6. Arora, P., Nanda, A., Karan, M. 2011. Shampoos based on synthetic ingredients vis-à-vis shampoos based on herbal ingredients: A review. Int. J. Pharma Sci. Rev. Res. 7, pp.41.
7. Sanskrit Lexicon, Monier-Williams Dictionary (1872).
8. Spoken Sanskrit, University of Koeln, Germany.
9. 9.Rahman, History of Indian Science, Technology and Culture at Google Books, Oxford University Press, ISBN 978-0195646528,
10. Tamil Nadu Medicinal plants board" (PDF). Archived from the original (PDF) on July 21, 2011.
11. Khushwant Singh, Hymns of Guru Nanak, Orient Longman, ISBN 978- 8125011613
12. "Forestry: Nursery Technologies". <http://agritech.tnau.ac.in>
13. Balsam, S.M., Gershon, S.D., Rieger, M.M., Sagarin, E., and Strianse, S.J.: Cosmetic Science and Technology, 2nd edition, Vol-2, John Wiley India, New Delhi, 2008.V
14. Barel, A.O., Paye, M., and Maibach, H.I.: Handbook of Cosmetic Science and Technology, 3rd Edition, Informa Healthcare, New York.
15. Badi KA, Khan SA. Formulation, evaluation and comparison of the herbal shampoo with the commercial shampoo. Beni-Suef Univ J Basic Appl Sci.
16. Gaud RS, Gupta GD. Practical Physical Pharmacy. 1st ed. New Delhi: C.B.S. Publisher and Distributer.
17. Mainkar AR, Jolly CI. Evaluation of commercial herbal shampoos. Int J Cosmet Sci 2000
18. Klein K. Evaluation of shampoo foam. Cosmet Toilet Mag.
19. . Ali HS, Kadhim RB. Formulation and evaluation of herbal shampoo from Ziziphus spina leaves extract. Int J Res Appl Pharm
20. Boonme P, Pakpayat N, Yotmanee K, Kunlawijitrungrsee S, Maneuan D. Evaluation of shampoos containing silicone quaternary microemulsion.
21. Reeve VE, Bosnic M, Rosinova E and Boehm-Wilcox C. A garlic extract protects from ultraviolet B (280–320 nm) induced suppression of contact hypersensitivity. Photochem Phytobiol.
22. Hahn G. In: Koch HP, Lawson LD, eds. Garlic: the science and therapeutic application of Allium sativum L and related species (2 nd edn). Baltimore Williams and Wilkins, 1996
23. Cavallito C, Bailey JH. Allicin, the antibacterial principal of Allium sativum. Isolation, physical properties and antibacterial action. J Am Chem Soc.
24. Aghel N., Moghimipour B. and Dana R.A., Formulation of an Herbal Shampoo Using Total Saponins of Acanthophyllum squarrosum, Iranian Journal of Pharmaceutical Research.
25. Mainkar, A. and Jolly, C. Formulation of natural shampoos. Int. J. Cosmet. Science
26. Aghel N, Moghimipour B, Dana RA. Formulation of an herbal shampoo using total saponins of Acanthophyllum squarrosum. Iran J Pharm Res
27. otluri A, Asma SS, Rallapally N, Durrivel S, Harish GA. Review on herbs used in anti-dandruff shampoo and its evaluation parameters. Indo Am J Pharm Res.
28. Shinde PR, Tatiya AU, Surana SJ. Formulation development and evaluation of herbal antidandruff shampoo. Int J Res Cosmet Sci.
29. Firthouse PU. Effects of Ocimum sanctum and Azadiracta indica on the formulation of antidandruff herbal shampoo powder. Der Pharm L
30. Pooja A, Arun N, Maninder K. Shampoos based on synthetic ingredients vis-à-vis shampoos based on herbal ingredients: A review. Int J Pharm Sci Rev Res
31. . Kapoor VP. Herbal cosmetics for skin and hair care. Nat Prod Radiance
32. Khushboo PS, Jadhav VM, Kadam VJ, Sathe NS. Psoralea corylifolia Linn. - "Kushtanashini". Pharmacogn Rev.
33. Srivasuki KP. Nutritional and health care benefits of amla. J Pharma
34. Roy RK, Thakur M, Dixit VK. Hair growth promoting activity of Eclipta alba in male albino rats. Arch Dermatol Re
35. arun J, Susan J, Suria J, Susan VJ, Criton S. Evaluation of pH of bathing soaps and shampoos for skin and hair care. Indian J Dermatol
36. Badi KA, Khan SA. Formulation, evaluation and comparison of the herbal shampoo with the commercial shampoo. Beni-Suef Univ J Basic Appl Sci.
37. Gaud RS, Gupta GD. Practical Physical Pharmacy. 1st ed. New Delhi: C.B.S. Publisher and Distributer.
38. Ali HS, Kadhim RB. Formulation and evaluation of herbal shampoo from Ziziphus spina leaves extract. Int J Res Appl Pharm.

39. Boonme P, Pakpayat N, Yotmanee K, Kunlawijitrunsee S, Maneenuan D. Evaluation of shampoos containing silicone quaternary microemulsion. *J App Pharm sci*.
40. Baran R, Maibah HI. Cosmetic dermatology in children. In: *Text Book of Cosmetic Dermatology*. 2nd ed. London: CRC Press; 1998. p.
41. Ireland S, Carlino K, Gould L, Frazier F, Haycock P, Ilton S, et al. Shampoo after craniotomy: A pilot study. *Can J Neurosci Nurs*
42. Sarath C, Vipin KV, Ann RA, Lindumol KV, Arun S. Development and evaluation of antidandruff shampoo based on natural sources. *J Pharm Phytother* .