

Formulation, Evaluation, and Comparison of Herbal Shampoo with Commercially Available Shampoo.

Naheed Waseem A. Sheikh*, Sanjay K. Bais, Manjunath B. Gadge

Fabtech College of Pharmacy Sangola-413307, Dist. Solapur, Maharashtra, India

Corresponding author details: -

Mr. Manjunath B. Gadge

B. Pharm Final Year, Fabtech College of Pharmacy, Gat no. 565/1, Pandharpur Road, Sangola-413307, Maharashtra, India.

ABSTRACT

Introduction: The natural herbal hair cleansing agent made was clear and appealing. Nowadays, customer choose natural components rather than the chemical or synthetic ones, the use of natural products is grown in market day by day. Because, it having less side effect and improves customer satisfaction. In addition to reflecting the general health of scalp, hair plays significant influence in one look. So, numerous modern advancements in hair science have been documented in literature, claiming novel approaches to hair treatment and cosmetics. **Aim:** The objective of this consider was to make herbal shampoo and check how it compares to a standard manufactured cleanser in terms of its physical and chemical highlights. Cleanser is utilized for cleaning hair and the scalp in a delicate way. In any case, for a long time, individuals have utilized shampoo not fair for cleaning, but too to keep hair delicate, glossy, and simple to oversee. It is moreover vital for keeping hair solid and wonderful, making it see glossy and less demanding to handle. compares with a standard manufactured cleanser in terms of its physical and chemical highlights. **Material and Methods:** The natural hair cleansing agent prepared by taking extract of *Acacia concinna* linn, *Trigonella foenum-graecum*, *Embllica officinalis*, *Citrus limonum*, and *Sapindus mukorossi* in different Proportion. Little amount of methyl paraben was included as preservative and citric acid was utilized to alter the pH and carried out tests such as visual check, Percentage solid content, Wetting time, Foam volume, Stability, Surface tension, Detergency, etc. Performed to determined different characteristics of prepared shampoo and marketed shampoo. The natural

hair cleansing agent had great cleaning control, small surface pressure, little bubbles, and great foam stability.

KEYWORDS: Herbal shampoo, commercial shampoo, physicochemical properties, formulation, cosmetic.

INTRODUCTION

In past, people use natural resources and plant for both beauty and medicinal purpose. Because natural ingredients are seen to be safer and more environment friendly, peoples are shifting to use natural cosmetic formulations. Compare to synthetic items natural products are more efficient are less expensive. A number of industries in industry are concentrating on development of hair care products, producing eco-friendly packaging and safety of products while keeping all maintenance [1]. Most of people use shampoo for cosmetic purpose. It is hair care product used every day for hair washing and scalp removal. Shampoos are viscous detergent solution with appropriate addition, preservatives and active ingredients that helps to retaining healthy hairs. Making shampoo softer and smother than the synthetic ones is really difficult task. Synthetic surfactant utilized in formulation of synthetic shampoo mainly for washing and foaming characteristics, many people can feel dryness, irritation, damage to their scalp when using synthetic surfactant frequently [2]. Shampoo is most common type for hair care treatment. Various medicinal plants or herbs with possible benefits on hair have utilize in natural hair cleansing agent around the world. The primary function hair cleansing agent is to remove oil, dirt, sweat, and other impurities accumulated on scalp and hair. Various shampoo formulations are related with hair quality, hair care habit and specific problems such as treatment of oily hairs, dandruff and for androgenic alopecia diseases. Mostly Indian women used shikakai and reetha as hair cleanser that clean hair and scalp without any harmful effect. In assentation with current drift, the corrective hair care for investigate has been centered on improvement of strong cleanser from common fixings, moreover as an elective and eco-friendly bundling way. In truth, among the different shampoos in comparison with conventional ones, it thought to be considered, for case a longer life time and the property of being helpful item, so simple to transport. These demonstrated too related costs, particularly those related to bundling, are brought down in agreement with showcased and users demands. Ayurveda the world's most antiquated however extraordinarily cutting-edge framework of recuperating and *Acacia concinna* linn (Leguminosae) is therapeutic plant that develops in rainy area of southern

Asia and natural products of this plant utilized for washing hairs, for advancing hair development, as an expectorant, emetic and laxative. In spite of the fact that the cases of these plants are known a few saponins based on acacia corrosive, past examination as it were brought about in the distinguishing proof of flavonoids¹. Distances across of hair between species can be change from 10 μ m to 250 μ m and are impacted by the metabolic and wholesome state of the creature. Chemical contrasts in strands such as pigmentation, protein, and lipid compositions moreover appear wide variety.

Individuals utilize diverse hair care items to alter how their hair looks, like shampoos, conditioners, hair colour, and straighteners. They need to discover beauty care products that work well and are simple to get. Testing how compelling these hair items are in a lab employment exceptionally exact apparatus. This audit looks at distinctive ways to test hair care items in a lab setting. These strategies can appear how the items influence hair strands. A few of the ways utilized are Checking Electron Microscopy, Transmission Electron Microscopy, Nuclear Drive Microscopy, Optical Coherence Tomography, Infrared Spectroscopy, Raman Spectroscopy, measuring protein misfortune, electrophoresis, checking colour and brightness, doing warm examination, and testing how effortlessly hair can be combed and how stretchy it is. The right testing strategy ought to be chosen based on what you need to discover out, like how the hair feels, how shinning it is, how solid it is, how stretchy it is, and how well the external layer and internal portion of the hair hold up.

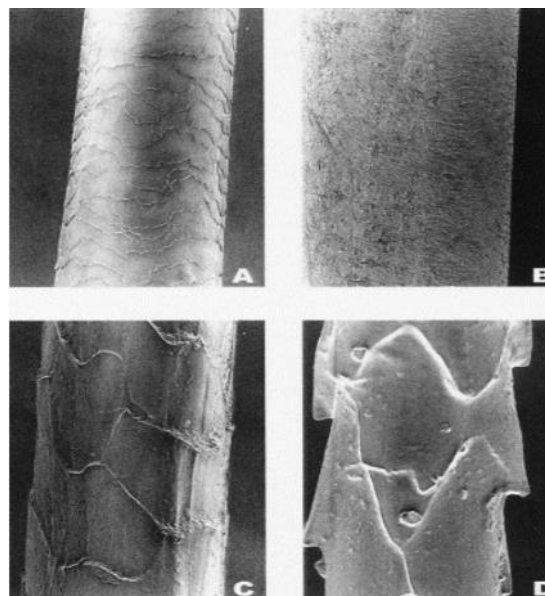


Fig no 1: Degree of variation between hairs [3].

Herbs used in formulation of shampoo

Emblia officinalis (Amala)

Amala is essential herb which can be utilize in traditional system for hair care and overall health benefits. It is first tree grown in world, according to Indian mythology. The other names of this tree are Amla, Indian Glasberry, or *Phyllanthus emblica*. Amala comes under Euphorbiaceae family. In later a long time, numerous logical sorts of writing have recorded diverse Phyto-constituents of *E. officinalis*. The amla natural product incorporates various bioactive components counting isotretinoin, ellagic corrosive, apigenin, chebulinic corrosive, quercetin, gallic corrosive, chebulagic corrosive. The tannins too found in the natural product extricate of amala are pedunculagin, emlicanin A, phyllaemblicin B, emblicanin B. Traditional ayurvedic literature describes amala as beneficial for strengthening hair and improving scalp condition. amala acts both internally as rasayana (nourishes dhatus) and externally as hair tonic. Traditional formulation describe that Amalaki is categorized as keshya, indicating its role in promoting hair protection and also preventing hair disorders. Amala can improve lifespan, digestion, and relieve constipation. As mentioned in Ayurvedic Medicine System amala significantly decreases fever, inflammation, blood purifying.



Fig no.2: *Emblia officinalis* (Amala) [4]

Sapindus mukorossi (Reetha)

Reetha also called as soapnut, many peoples can utilize this as natural cleansing agent because it contains saponin. Reetha deciduous tree generally filled in upper ranges of Indo-Gangetic field. The pharmacological studies presented in this review confirm this plant's therapeutic value. Although classical ayurvedic study mentioned reetha properties such as kaphahara (oil removing), kandughna (anti-itching), also mentioned in Bhavaprakasha Nighantu support its traditional use in scalp cleansing, dandruff control and maintenance of hair hygiene. It can be

utilized on a day-by-day premise to the hair scalp and advance hair regrowth. Reetha powder can be blended with warm water to frame a glue which can be utilized to knead the scalp to offer assistance oversee dandruff and to evacuate lice from the scalp due to its insecticidal property.

As per Ayurveda, it moreover makes a difference oversee skin contaminations such as dermatitis, psoriasis and pimples due to its Tridosha property (Vatta Pitta Kaph adjusting property). Reetha decoction (Kadha) might to act as a wound cleanser as it quickens wound recuperating and stops auxiliary contaminations. It is prudent to maintain a strategic distance from the utilize of Reetha water on delicate parts such as eyes as it may cause redness and swelling of the eyelids. Previous studies have mentioned that the plant's potential as spermicidal, hepatoprotective, anti-inflammatory, anti-protozoal, and other properties.



Fig no.3: *Sapindus mukorossi* (Reetha) [5]

***Trigonella foenum-graecum* (Methi)**

The methi contain wellbeing benefits and hair properties of cleanser. *Trigonella foenum-graecum* (methi) belonging to family Fabaceae, a seed can also use to enhance flavour, colour and is also used as medicinal purpose. According to ayurveda methi do not directly described as hair care agent, its properties such as Snigdha (unctuous), Balya (strength promoting) and Vatahara (reducing dryness). Fenugreek seeds are rich with vitamin E. New Fenugreek clears out are useful for heartburn, tooting and in drowsy liver treatment. Normal utilize of new Fenugreek takes off glue makes a difference hair develop, jam natural colour, keeps hair smooth and moreover cures dandruff. Fenugreek Seeds increase the stream of drain and to diminish the sum of calcium oxalate in the kidney which causes kidney stones. In creature considers, Fenugreek showed up to bringing down the chance of creating colon cancer by blocking the

activity of certain chemicals. Fenugreek is a herbaceous, rainfed trim included among the seed Flavors is approximately 30-60 cm tall, flyers are around 2-2.5 cm long, blossoms are 1-2 cm long, axillary, sessile and developed all through the nation. Among the Flavors, the Fenugreek is utilized as esoteric nourishment adjoining to improve the flavour and colour of the nourishment and make it delicious and moreover utilized to modify the surface of nourishment. It's traditional use in conditioning hair, reducing hair-fall and improving hair strength.



Fig no.4: *Trigonella foenum-graecum* (Methi) [6]

***Citrus limonum* (lemon)**

Citrus limon (commonly known as lemon) which comes under Rutaceae family, cultivated in different hot and rainy, humid region of the world and mostly in northern region of India. It contains many medicinal properties and used in cosmetic and pharmaceutical industries. Apart from plant the extracted peel contain essential oil of *C. limon* has many medicinal properties for various diseases. The lemon peels essential oil (EOs) rich in monoterpene compounds such as D-limonene, γ -terpinene, and β -pinene demonstrated remarkable antioxidant, antidiabetic, anti-inflammatory, and dermato-protective activities. Lemon develops on little, prickly trees which comes to a tallness of 10 to 20 feet. The clears out of the lemon are dull green in colour and they are organized on the other hand on the stem. The lemon has a white, fragrant bloom with five petals. This specific blossom comes from a lemon cultivar called 'Pink Lemonade'. The takes off of this cultivar are variegated and the natural product is striped. Lemons are oval citrus natural products with smooth permeable skin. A few natural products have a pointed tip on the foot of the natural product whereas other lemons are adjusted at the base. A few sorts of

lemons are very bigger than other lemon assortments and take after prolonged grapefruits. Lemon has numerous assortments few of which incorporates Bush lemon, Eureka, Lisbon,



Ponderosa, Variegated Pink, Verna, Villafranca, Yen Ben and Yuzu. The colour run of lemon natural product is from greenish yellow to shining yellow. Lemons see exceptionally comparable to limes, but lemons tend to be a small bigger and are yellow when ready, where limes are green.

Fig no.5: *Citrus limonum* (lemon) [7]

***Acacia concinna* linn (shikakai)**

Acacia concinna Linn. Which is commonly known as shikakai, belonging to family Leguminosae that cultivated in rainy forest of southern Asia. It contains saponin. Shikakai traditionally been used in herbal hair care preparation for cleansing and maintaining healthy hairs. These properties support its traditional use in promoting hair growth, maintaining scalp health and cleansing hair without causing excessive dryness. The fruits of this plant are utilized for washing hair in regard to the genuineness and test of Shikakai natural product. Display paper reports on pharmacognosy, physio-chemical parameters counting the lean Layer Chromatography of natural product. The result appears the nearness of saponin depth in mesocarp, stone cells in pericarp locale, set vessels were watched. The phytochemical examination of the arranged test by executing organoleptic, tiny, physicochemical, preparatory phytochemical screening and quantitative estimation appears 8.04 % at that point after Chromatographic ponder to guarantee reasonable parameters for its quality control. *A concinna* Linn. (Leguminosae) is a restorative plant that develops in tropical rainforests of southern Asia and the natural products of this plant are utilized for washing hair an endeavour has been carried

out in regard to the realness and test of Shikakai (*Acacia Concinna* Linn.) natural products. The plant, *Acacia Concinna* is useful in traditional medicinal system of some ailments, it is important to standardize it for use as a drug.



Fig no.6: *Acacia concinna* linn (shikakai) [8]

MATERIAL AND METHODS

Plant material

All are required herbs are obtained from local market of Solapur, Maharashtra, India. The obtained herbs are cleaned, make dry powder and keep a side in airtight container for later research.

Extraction procedure

Powder forms of *Acacia concinna* linn, *Trigonella foenum-graecum*, *Emblica officinalis*, *Citrus limonum*, and *Sapindus mukorossi* (100 g) were weighed accurately and aqueous extraction had been done, 1:10 ratio (10 times weight of drug i.e. 5g in 50ml of water, on water bath at 80-100°C). As solution concentrated up to 20ml, filtration was done. Residue had taken and volume makeup to 40 ml, again was boiled. After remaining 20ml was filtered to determine the yield value, the extract was concentrated and weighed at reduced pressure.

Formulation of herbal shampoo

The extract was mixed in different proportion to obtain shampoo whose formula is shown in table no.1. Herbal extract was added to 10% gelatine solution and were mixed by shaking for 20 min. Lemon juice and methyl paraben also added with continuous stirring finally the PH of solution was adjusted by adding sufficient quantity of 1% citric acid solution [9].

Table no.1: Composition of formulated herbal shampoo (100 ml).

Ingredients	Quantity
Shikakai powder	2.5 g
Reetha powder	2.5 g
Amala powder	2.5 g
Lemon juice	10 mL
Fenugreek powder	2.5 g
Citric acid	1 g
Glycerin	3 mL
Preservative	q.s.
Distilled water	q.s.

Evaluation of formulated herbal and commercially available shampoo

A well to ensure the products, specific physicochemical test for shampoo formulation including: Determination of PH, visual inspection, surface tension, foam volume and foam stability, detergency, preliminary stability study, viscosity, wetting test and conditioning performing study [10].

pH Determination

The electronic PH meter is used to determine acidic and basic nature of shampoo. Normal PH meter consists special electronic probe which is connected to a PH meter which measures and display PH [11]. The PH of 10% v/v of shampoo solution in distilled water was measured with help of PH meter at room temperature. PH identified in temperature of 27°C +20°C. in case of liquid shampoo, PH was read directly in sample in PH meter.

Determination of % solid content

The clean dish weighed and added appropriate amount of shampoo to dish. Both can be weighed and calculate the weight and put the evaporating dish with shampoo and placed until solid residue remains [12]. After that only solid after drying calculated by following formula.

$$\text{Percentage of shampoo} = \frac{\text{dried weight of shampoo}}{\text{Initial weight of shampoo}} \times 100$$

Visual inspection

The performed natural hair cleansing agent was evaluated for clarity, colour, Odor, and froth stability.

Determination of foam formation

The cylinder shake method used to assess foaming capacity [13]. By taking 20 ml of shampoo in, dry measuring cylinder, the initial amount of foam created by herbal shampoo was measured. The measuring cylinder was shaken 10-15 times to get final volume, and foam formation can be calculated by following formula [14].

$$\text{Foam formation} = \text{final volume of shampoo} - \text{initial volume}$$

Determination of viscosity

The rheological properties like viscosity of hair cleanser were identified by using Oswald's viscometer [15]. Throughout the investigation, and size of container remain unchanged.

Dirt dispersion

Take a shampoo and add two or three droplets of shampoo into the measuring cylinder to create volume of 10 ml. The measuring cylinder is then filled with water, add little amount of ink, and shake it for one minute. The result was written in form of ink dispersed such as light or moderate [16].

Surface tension

Surface pressure estimation carried out with 10% cleanser weakening in refined water at room temperature. Clean the stalagmometer utilizing unremitting corrosive and filtered water. Since surface pressure is profoundly influenced with oil or other oils [17]. The data calculated by following equation:

$$R2 = (W3-W1) n1 \times R1 (W1-W2) n2$$

where,

W1 is weight of empty beaker.

W2 is weight of distilled water with beaker.

W3 is weight of beaker with shampoo solution.

n1 is no. of drops of distilled water.

n2 is no. of drops of shampoo solution.

R1 is surface tension of distilled water.

R2 is surface tension of shampoo solution.

Table 2: Herbs and its extraction methods [18].

Herbs	Extraction
<i>Emblica officinalis</i> (Amala)	Distilled water was used to extract the amala. 20 g of amala powder blended with 200 ml of boiling water in container, heat for 30 minutes, cool and filter.
<i>Sapindus mukorossi</i> (Reetha)	Decoction was used to extract Reetha. 20 gm of Reetha powder added to 200 ml of purified water in beaker. The mixture was heated until distilled water was reduced to one third of initial volume, then strained and filtered.
<i>Trigonella foenum-graecum</i> (Methi)	The 20g of Methi powder added to 200 ml of distilled water and soaked for 10 hours overnight, covered and heat for 20-30 minutes, filter and obtain viscous extract.
<i>Citrus limonum</i> (lemon)	The extraction of lemon juice using boiled ethyl acetate with straightforward mechanical procedure.
<i>Acacia concinna</i> linn (shikakai)	The 20g of shikakai powder was added to 200 ml of distilled water. Heat 60-70°C for 40 minutes with continuous stirring, cool and filter.

Wetting time test

The canvas was cut into 1-inch diameter discs which having an average weight of 0.44g. The disc was floated on prepared herbal shampoo solution 1 % w/v and started stopwatch. The time necessary for disc to begin to sink was measured accurately and noted as wetting time [19].

RESULTS AND DISCUSSION

Natural herbal shampoo preparation

Natural hair cleansing agent prepared by mixing extracts of *A. concinna linn*, *T. foenum-graecum*, *E. officinalis*, *C. Limonum*, and *S. mukorossi* in definite amounts [Table1]. This plant contains variety of phytochemicals like saponin, which having surfactant property. It also has good detergent and foaming property. An ideal shampoo should possess but have enough viscosity to remove from container easy. So many natural ingredients may be used suitable viscosity for easy application and effective cleansing. Citric acid was added to adjust the PH to desired level. Our formulated shampoo contain lemon which having natural antioxidant, chelating and anti-dandruff properties, which also maintain acidic PH of shampoo. Shampoo also preserved by adding small amount of methylparaben.

Evaluation of formulated herbal and commercial shampoo

The comparative effectiveness of both formulated herbal shampoo and commercial shampoo was evaluated and the results are discussed below.

Physical appearance

A shampoo looks attractive and should be apply on outside, just like any other shampoo. The physical qualities of formulated herbal and commercial shampoo colour, Odor, clarity, etc. are shown in [Table 3]. Freshly prepared hair cleanser smell good. Only with the differential of colour, there is no difference in Odor, transparency or foaming properties of formulated herbal shampoo and commercial shampoo. The colour of shampoo can be determined by visual inspection of formulation [20].

Percentage solid content

Unlike earlier findings shampoo with large solid content are harder to remove from hair, whereas shampoo with lower solid content will remain fluid and remove easily and rapidly after use. For balanced cleaning action, an optimal shampoo should include 20-30% of solid, the Commercial Dabar vatika shampoo shows 27% solid content and our prepared natural hair cleanser shows 30% solid content. The higher content of prepared cleanser due to presence of concentrated herbal extracts and natural constituents present in formulation and the obtained value indicates acceptance consistency according to table 3.

pH

pH is essential factor which cause irritation to eyes and skin it shampoos it also required for healthy hairs and scalp tightness. Alkaline shampoo basically helps scalp to expand and open up, where commercial manufactured shampoo having a broad PH which opposes to fixed PH. However, by consumer rating the mildly acidic shampoo are well liked. During study, the formulated herbal shampoo having PH Fig. no 7: PH 5.27(F1), Fig. no 8: PH 5.78(F2), Fig. no 9: PH 6.59(F3) which is slightly acidic and nearby skin PH and other commercial shampoo.

Foam formation and foam stability

From the people side, froth formation and froth stability is very essential part of cleanser. Important parameter that was consider in shampoo evaluation for determination of foam stability. The froth volume produced by prepared cleanser is more than 50ml. We measured foam by shaking cylinder manually and the prepared herbal cleanser showed foam volume 1 and Dabar Vatika showed 15 ± 5 ml and Dabar Vatika shows 98 ± 3.33 ml foam volume. effective foaming agents and natural saponin contain herbal ingredients. The prepared formulations showed stable foam throughout the observation period, indicating good foaming stability and contain higher foam property due to presence of shikakai. The result indicates that the formulated shampoo possesses good foaming ability and cleansing performance.

Viscosity

The viscosity of liquid can be increases with its thickness. The viscosity of formulated shampoo can be identified by the proportion of particles present. In this study suggest that, viscosities of different samples changes or vary as per the rpm increases, which exhibit pseudoplastic activity and all the sample contain pseudoplastic properties, which is good for shampoo viscosity. During evaluation study, the Dabar vatika shampoo shows viscosity 42 seconds and our prepared herbal cleanser shows 48 seconds, it means formulated herbal shampoo shows more time to flow as compared to marketed Dabar vatika indicating slightly higher viscosity due to presence of natural herbal extracts and natural thickening constituents in formulation, the result suggest that the formulated shampoo possess good consistency, stability and ease for application.

Table No3. Physicochemical evaluation of formulated herbal and commercial.

Specification	Commercial shampoo	Prepared herbal shampoo	p-value
Colour	Greenish black	Dark brown	
Transparency	Transparent	Transparent	
Odor	Pleasant	Pleasant	
pH	6.50-7.20	5.20-6.80	< 0.06
% solid content	27	30	
Foam volume	98±3.33	115±5	<0.001
Foam type	Small bubble size	Small bubble size	
Viscosity (sec)	42	48	
Dirt dispersion	Light	Medium	
Wetting time (sec)	155±2.26	168±1.50	<0.001
Surface tension	31.23	45.12	<0.06

Dirt dispersion

Dirt dispersion test was done by dispersing ink into shampoo formulation. It is suggested that ink or dirt saturation in foam is difficult for rinsing and get deposited again on hairs. If ink or dust stay in water portion, it proves better cleansing activity. All the formulation showed moderate dispersion of ink in water portion which shows that actual effectiveness. To get better washing action, the dirt should remain in water component. We measured dirt dispersion test in which the ink was concentrated in the water portion of every shampoo, ensuring their adequate cleansing capacity and practical usefulness. It was observed that amala contain good cleansing property than other due to higher content of flavonoids [21].

Wetting time

The wetting ability of surfactant is depended on its concentration and is commonly used to test its efficacy. We measured the wetting time of commercial Dabar shampoo and herbal shampoo was found to be $155 \pm 2.26 < 168 \pm 1.50$ seconds which is good. For result it was concluded that Dabar Vatika shampoo contain maximum detergents so it having least wetting time as compare to our formulated herbal shampoo show maximum wetting time [Table3] so, it means our formulated herbal shampoo contain minimum concentration of detergents [22].

Table 4: The mean score of volunteer opinion on conditioning of tresses after treatment with shampoo (n=20).

Score	Commercial shampoo	Formulated herbal shampoo	No washing
1	0	1	18
2	1	3	3
3	10	13	0
4	9	6	0
Average	3.3	3.5	2.2

Surface tension

Early study mentioned that, the ideal shampoo should reduce the surface tension of distilled water 72 dynes/cm to nearly to nearly 40dyne/cm as shown in table 3. The formulated herbal shampoo demonstrated good cleansing and detergent properties by decreasing surface tension of water to 45.12 dyne/cm and $p < 0.06$.

Conditioning performance

The shampoo conditioning performance was based on the mean score of volunteers refers was tabulated in table 4. On conditioning performance evaluation done by using F₁, F₂, F₃ formulations, F₃ formulation was concluded to have a better conditioning effect and shinning as compared to F₁ and F₂ [23]. The basic property of shampoo is to clean. A shampoo should contain good detergency power can range from 18-33%. The result indicated that the formulated herbal shampoo has having good conditioning performance level.

CONCLUSION

The study was carried out to prepare and test a hair care formulation made from a natural herb. The formulated shampoos were checked for distinctive things like pH, how much froth it makes, how long the froth keeps going, and how thick the cleanser is. The study comes about were at the point formulated herbal shampoo was compared with well-known brand Dabur Vatika shampoo. Indeed, in spite of fact that formulated herbal shampoo didn't clean as well as the commercial one, it has great surface and carried out so also to the store-bought form. This is likely since commercial synthetic shampoo used additional harmful chemicals like thickening (viscosity) operators and surfactants that play vital role in cleansing. The formulated herbal shampoo had great physical and chemical properties like PH, foam stability, viscosity, % solid content, dirt dispersion test, wetting time, surface tension. When the study comes about appear that utilizing herbal shampoo can work well, advertising great cleaning with good hair care properties. The PH of formulated herbal shampoo was secure and safe for utilize on hair and scalp which don't damage the hair. The overall conclusion appears that the formulated herbal shampoo worked well and, in few cases, way better than the commercially available shampoo. So, the study says that herbal shampoo is secure, safe, works well, and is great for cleansing with positive consumer acceptance.

FUTURE PROSPECTS OF HERBAL SHAMPOO

The formulated herbal shampoo can be progressed advanced by adjusting amount and combination of herbal ingredients to get superior cleansing activity, froth quality, and conditioning impact. Future work may moreover incorporate the expansion of other therapeutic herbs that shows anti-dandruff activity and scalp protection. Further assessment can be carried out by conducting long-term steadiness thinks about beneath diverse natural conditions to decide the storage stability and shelf-life of the formulation. Safety can be considered on different hair and scalp types may also help to confirm the suitability of the product for regular use. The formulation may be tried on large number of volunteers to study customer satisfaction and overall performance after regular use. In future there is increasing demand towards the herbal formulation rather than the synthetic ones. Because, herbal formulations are mainly synthetic free or free from harmful chemicals so, the consumers also moving towards natural cosmetics. of Future research can be focused toward to prepare completely natural formulation without using any synthetic chemicals. The Formulated herbal shampoo has more scope for commercial production after proper standardization, quality control studies, and packaging

development. The study may also help in promoting the use of herbal-based cosmetic products as safer alternatives for daily hair care.

REFERENCES

1. Preethi JP, Padmini K, Srikanth J, *et al.* A review on herbal shampoo and its evaluation. Asian J Pharm Anal. 2013;3(4):1536.
2. Gubitosa J, Rizzi V, Fini P, *et al.* Hair care cosmetics: From traditional shampoo to solid clay and herbal shampoo, a review. Cosmetics. 2019;6(1):13.
3. Jones LN. Hair structure anatomy and comparative anatomy. Clin Dermatol. 2001;19(2):95–103.
4. Ikram A, Khalid W, Aziz M, *et al.* Nutritional and bio-chemical composition of amla (*E. officinalis*) and its therapeutic impact: A review. Acta Sci Nutr Health. 2021; 5(2): 153–160.
5. Bisen NM, Anande HA, Dhote MG, *et al.* *S. mukorossi* (reetha) – The natural foaming agent: An overview. World J Pharm Res. 2023;12(22):678–689.
6. Yadav UCS, Baquer NZ. Pharmacological effects of *T. foenum-graecum* L. in health and disease. Pharm Biol. 2014;52(2):243–254.
7. Paw M, Begum T, Gogoi R, *et al.* Chemical composition of *Citrus limon* L. Burmf peel essential oil from North East India. J Essent Oil-Bear Plants. 2020;23(2):337–344.
8. Khanpara K, Renuka V, Harisha C. A detailed investigation on shikakai (*A. concinna* Linn.) fruit. J Curr Pharm Res. 2012;9(1):06–10.
9. Al Badi K, Khan SA. Formulation, evaluation and comparison of the herbal shampoo with the commercial shampoos. Beni-Suef Univ J Basic Appl Sci. 2014;3(4):301–305.
10. Patel S, Gupta A, Gupta M. Formulation and evaluation of polyherbal anti-dandruff shampoo and its marketed comparison. J Res Appl Sci Biotechnol. 2022; 1: 1–9.
11. Namita N. Formulation and evaluation of herbal shampoo having antimicrobial potential. Int J Pharm Pharm Sci. 2013; 5:708–712.
12. Nayak M, Panda S, Pani S. Preparation and evaluation of herbal powdered shampoo. World J Pharm Res. 2018;7(9):230.
13. Sharma RM, Shah K, Patel J. Evaluation of prepared herbal shampoo formulations and to compare formulated shampoo with marketed shampoos. Int J Pharm Pharm Sci. 2011;3(4):402–405.

14. Singh A, Saxena A. Formulation and evaluation of herbal anti-dandruff shampoo from bhringraj leaves. Pharm Pract Res. 2018; 1:5–11.
15. Patel I, Talathi A. Use of traditional Indian herbs for the formulation of shampoo and their comparative analysis. Int J Pharm Pharm Sci. 2016;8(3):28–32.
16. Telrandhe UB, Tapse AR, Madia DK, *et al.* Formulation, evaluation, and comparison of herbal shampoo with commercially available shampoos. Asian J Pharm. 2023;17(3).
17. Gahlawat J, Sharma D, Thakur GS, *et al.* Formulation and evaluation of polyherbal liquid shampoo. Eur J Biomed Pharm Sci. 2019;6(7):149–154.
18. Zambare KK, Gonge SB, Shewale GB, *et al.* Preparation and evaluation of polyherbal shampoo. Res J Top Cosmet Sci. 2019;10(2):41–44.
19. Shukla R, Pandey V, Golhani D. Herbal shampoo of *Zizyphus oenoplia* (L.) Mill from ethanol extract of leaves. Invent Rapid Cosmeceut. 2015; 4:256.
20. Kumar A, Mali RR. Evaluation of prepared shampoo formulations and to compare formulated shampoo with marketed shampoos. Int J Pharm Sci Rev Res. 2010;3(1):025.
21. Reddy KV, Yachawad AV, Landge S. Formulation and evaluation of herbal shampoo: *Bryophyllum pinnatum*. Asian J Pharm Res. 2020;10(2):86–88.
22. Monagas M, Brendler T, Brinckmann J, *et al.* Understanding plant to extract ratios in botanical extracts. Front Pharmacol. 2022; 13:981978.
23. Ihoeghian NA, Akwara E. Formulation, evaluation, and comparison of herbal shampoo with marketed synthetic shampoos. NIPES J Sci Technol Res. 2021;3(4).