

Formulation and Evaluation of Hair Nourishing Shampoo Containing Guava Leaves

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ABSTRACT

Shampoos are a kind of formulation that are used for the removal of oils, dirt, dandruff, environmental pollutants and any other particles that gradually build up in the hair. Shampoo is a cleansing aid for the hair and is counted among the foremost beauty products. Shampoo is considered not only as cosmetics product, but is also responsible for maintaining the health and the beauty of hair. As the scalp is one of the most absorbent parts of the body, product applied to the scalp go directly to the blood, without being filtered in any way so it is very important to know and understand the effects of ingredients used in shampoo formulations. The main objective of formulation of herbal shampoo is to emphasize the safety and efficacy of natural products in shampoo preparation. The formulated herbal shampoo contains Guava leaves, Aloe vera, Rosemary oil, Tulsi. Formulation of three herbal shampoo was prepared containing different amount of Guava leaves extract and tulsi oil. The following evaluation parameters were carried out – pH test, foaming capacity, surface tension, viscosity, solid content test, skin irritation test, wetting time and surface characterization analysis using scanning electron microscope. The formulation of F3 shows best result of evaluation parameters as compare to F1& F2. The optimized batch formulation of F3 shows good microbial activity. The advantage of this herbal shampoo is better nutrients and nourishment to hair follicles and to overcome on dryness problem. The guava leaves used in this herbal shampoo formulation nourish the scalp and promotes hair growth and the tulsi oil is used for antimicrobial activity for the preparation.

Key Words: Shampoos, beauty products, Guava leaves, hair growth.

INTRODUCTION

Shampoo are products which remove surface grease and dirt from the hair shaft and scalp. A liquid or cream preparation of soap or detergent to wash the hair is called shampoo. The cleansing or detergent action of a shampoo is primary function. However, the foaming qualities of a wash has main act in acceptability¹. Shampoo is of various types, like powder shampoo, liquid shampoo, lotion shampoo, solid gel shampoo, medicated shampoo, etc. Shampoo is individual of best widely used for hair products current, based on their synthetic elements in addition to herbaceous elements. Depending upon the nature of the ingredients they may be simple or plain shampoo, antiseptic or antidandruff shampoo and nutritional shampoo containing vitamin, amino acids, proteins². The main aim of wash is to remove the undesired particles such as soil, lubricate, skin mites, dandruff, tangible toxins and other contamination particles from hair without falling much of sebum (oily secretion)³. Now-a-days many synthetic, herbaceous, medicated and non-medicated shampoos are available marketing but recognition of herbaceous shampoo between customers is on rise by way of being natural origin and are safe and free from after effects⁴. The pH of the shampoo is kept slightly below 7(acidic) to

prevent the breaking of the disulphide bonds in the hair keratin, the questions accompanying synthetic shampoo are their extreme artificial synthetic character, weak degradability, non-flexibility for everyday custom and by all means the high price. shampoo available in the markets generally contain a chemicals like surfactants, most often Sodium lauryl sulphate and Sodium laureth sulphate, for the foaming and cleansing action but continuous use of these shampoo makes hair brittle and causes dryness to the scalp, leads to hair loss, dryness of hair after prolong used and leaves the hair too dry to handle with comb, produce irritations to the eyes and scalp, formation of dandruff which is one of the most common embarrassing scalp disorder⁵.

Herbal formulation is studied as alternative to artificial shampoo, efficient are large quantity, of curative plants that are proclaimed to have advantageous effect on haircut and are usually used for the formulation of shampoo, it holds all the natural ingredients accompanying herb extract. There are best numbers of plants that are stated to have advantageous belongings on hair and usually used in shampoos. Herbal shampoo helps hairs to devise their characteristic of dampness, shine, progress, thickening, strength of hair roots, anti-dandruff characteristic. The main advantages of herbal shampoo are that it

has no side effects⁶. These herbal shampoos are generally used to remove the dandruff, to add the natural colour to hair, to remove the extra oil content of the hair, for the healthy growth of the hair, to remove the dust, dirt, scales of the scalp, to prevent hair falling, to remove lice and nits, to impart softness and smoothness to the hair shaft, etc. it is assumed that they can penetrate to the hair shafts, stimulate the sebaceous glands and enhance the blood circulation and impart greater strength to the hair root and the shaft⁷. A wide range of active principles of various plants including vitamins, hormones, phyto-hormones, amino acid, essential oil and enzymes are being considered useful in cosmetic formulations⁸. A good shampoo should almost immediately form abundant foam irrespective of the type of water used or the nature of soil or fat to be removed from hair. Though foam formation is not released to the cleansing effect, but people psychologically always prefer a high foam product⁹.

Classification of shampoo Based on Appearance are Powder shampoo, Liquid shampoo, Gel shampoo, Oil shampoo. Based on the used or function are Conditioning shampoo, Antidandruff shampoo, and Clarifying shampoo¹⁰

Ideal properties of shampoo

It should effectively and completely remove dust or soil, excessive sebum or other fatty substances and loose corneal cells from the hair. It should produce a good amount of foam to satisfy the psychological requirements of the user. It should be easily removed on rinsing with water. It should leave the hair non -dry, soft, lustrous with good manageability and minimum fly away. It should impart a pleasant fragrance to the hair. It should not cause any side-effects / irritation to skin or eye. It should not make the hand rough and chapped.¹¹

Function of hair

It should effectively and completely remove dirt or soil. It should effectively wash the hair. It produces a good amount of foam to satisfy the user. It should be readily removed by rinsing with water. It should impart a pleasant fragrance to the hair. It should not have any side effect or causes irritation to the skin and eye.¹²

MATERIALS AND METHODS

Materials

The advantages of herbal shampoo are reduced side effect as well as easily available ingredients which cost very less and produce effective cleaning and nourishing effect on hair.¹³

The shampoo has been prepared in three different formulations which is mentioned as F1, F2, F3 and the ingredients used in this protocol with its quantity is mentioned in table 1.

Use of ingredients

Aloe vera Calms an itchy scalp, Deep cleans oily hairs, Strengths the hair. Aloe vera contains proteolytic enzyme which repair dead skin cell on scalp, promote hair growth, Reduce fizziness, Moistening agent and Healing property.¹⁴ Rosemary oil used to prevent premature greying, Anti-dandruff property, thinning agent.¹⁵ *Albizia amara* is having cleansing property. It Nourishes and improves strength of hair and it is having anti-fungal property, promotes the hair growth. It gives soft and lustrous to hair Prevents dandruff.¹⁶ Guava leaves strengthen the hair follicles, promotes thicker hair, Stronger, shinier and healthier hair growth and it is a Scalp reducing agent.¹⁷ Tulsi oil has Anti-microbial property and prevents the hair loss by strengthen the hair follicles. It is also used to treat dandruff and itching Prevents premature greying of hair.¹⁸ Acacia is an Emulsifying agent which is rich in vitamins and antioxidants. It nourishes and rejuvenates hair and promotes shiny hair Prevents dandruff and lice.¹⁹ Lemon is a natural cleanser rich in vitamin C. It promotes hair growth. The fresh fruit or dried fruit can be used to prevent dandruff and maintains scalp healthy. It does not dry out the hair. It is a pH modifier.²⁰ Rose water improves growth of hairs, reduces dandruff and has anti-inflammatory properties. It softens the hair Oiliness and helps with scalp issue.²¹

Formulation of Herbal Shampoo

Guava leaves is extracted by taking 100gms of freshly leaves of guava, crushed the content of guava leaves, this extract is then passes through the muslin cloth to take the pure extract in filtrate, the extract is then used for the formulation of herbal shampoo. Aloe vera juice and Rosemary oil was incorporated with stirring followed by

mixing of Guava extract and Tulsi oil. Then add ethyl alcohol and methyl paraben which is used as preservatives and lemon juice used for masking the smell of the formulation. Then add the perfume and water to the formulation.

Evaluation of Prepared Herbal Liquid Shampoo

To evaluate the prepared formulations, quality control tests including visual assessment and physiochemical controls such as pH, viscosity, and density were performed. Also, to ensure the quality of products, specified tests for shampoo formulations including the determination of dry residue and moisture content, salt content, surface tension, thermal and mechanical stability and detergency test is carried out.

Physical appearance/visual inspection: The attractiveness of shampoo for consumers tends to be judged visually thus having good physical appearance is important. The formulation prepared was evaluated in terms of their clarity, foam producing ability and fluidity.²²

Determination of pH: The pH of 10% shampoo solution in distilled water was determined at room temperature 25°C with the help of pH meter.²³

Determine % of solid content: A clean dry evaporating dish was weight and added 1gm of herbal shampoo for evaporation, the dish and herbal shampoo was weighed.

The extract weight of the herbal shampoo was calculated only; the evaporating dish with herbal shampoo was placed on the hot plate until the liquid portion was evaporated. The weight of the herbal shampoo only (solid) after drying was calculated.²⁴

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

Rheological or viscosity evaluations: The viscosity of herbal shampoo was determined by Ostwald's viscometer. The viscosity of the herbal shampoo was measured by counting drops of herbal shampoo from the mark A (top) to B (bottom).²⁵

$$ny = nw \frac{dyty}{dwtw}$$

Where, nw: viscosity of water, ny: viscosity of tested liquid, dw: density of water, dy: density of tested liquid, tw: timing of runoff of water, ty: timing of runoff of tested liquid

Dirt dispersion: For this test, 10ml of distilled water was placed into a large tube. Two drops of shampoo were added into the test tube followed by one drop of Indian ink. Test tube was shaken for ten times. The amount of ink stained in the foam was recorded as none, light, moderate or heavy.²⁶

Skin irritation test: Apply the solution of prepared herbal shampoo on the skin and kept for 5 minute and observed for irritation and redness of skin.²⁷

Foam ability and foam stability: Cylinder shake method was used for determining foaming ability. 20ml of the 1% shampoo solution was put into a 250ml graduated cylinder and covered the cylinder with hand and shaken for 10 times. The total volumes of the foam contents after 1minute shaking were recorded. The foam volume was calculated only. Immediately after shaking the volume of foam at 1 minute interval for 4 minutes were recorded.²⁸

Surface tension: surface tension is carried out by the Ostwald Stalagmometer. Mount the stalagmometer in a vertical position on any suitable stand to avoid unnatural of drop. Fill the preparation in a dry stalagmometer up to a level

higher than mark A and count the total number of drops formed as the formulation meniscus travel

$$R2 = \frac{(W3-W1) N1 \times R1}{(W2-W1) N2}$$

from mark A to a mark B. Repeat the steps for F2 and F3.⁸⁷

Where, W1- Weight of empty specific gravity bottle, W2- Weight of specific gravity bottle + distilled water, W3- Weight of specific gravity bottle + liquid sample, R1- Density of water, R2- Density of sample.

Compound Electron Microscopy: Surface morphology of the hairs was examined by compound electron microscope. Hair sample were mounted directly on the CEM hair sample

slide using double side stitching tape and hair on treatment with herbal shampoo. The photomicrographs of suitable 10X magnification were obtained for surface characterization; the following two samples were characterized by CEM.²⁹

Stability study: The stability study was carried out of the prepared herbal shampoo at standard temperature of 25- 30°, and the storage period of 2 months indicated that they are chemically and physically stable or it can be performed by keeping the prepared shampoo in a closed container at cool and dry place for 3days. The changes like color, texture of shampoo was observed at particular time period.³⁰

RESULTS AND DISCUSSION

All plant materials like Rosemary oil, *Albizia amara*, Tulsi oil, Lemon juice and Rosewater were collected from Ayurvedic store and remaining like *Aloe vera* and Guava leaves were collected in and round Bangalore. The purpose of use in the herbal shampoo and its details are mentioned below table no.02.

A shampoo like any other cosmetic preparation should have good appealing physical appearance.

The formulated shampoos were evaluated for physical characteristics such as colour, odour and transparency. The results of visual inspection of series of formulation are listed in table no.3.

Most shampoos are formulated as either neutral or slightly alkaline to minimize the damage to hair. The pH of shampoos has been shown to be important for improving and enhancing the qualities of hair, minimizing irritation to the eyes and stabilizing the ecological balance of the scalp. Mild acidity prevents swelling and promotes tightening of the scales thereby inducing shine. As seen from table no.4, all the shampoos were acid balanced and were ranged 6.0-6.50, which is near to the skin pH.

Good shampoos usually have 20% to 30% solid content as it is easy to be applied and rinse out from the hair. If it does not have enough solid it will be too watery and wash away quickly, similarly too many solids will be hard to work into the hair or too hard to wash out. If the shampoo has too many solids it will be hard to work into the hair or too hard to wash out. The result of per cent of solids contents is tabulated in table no.5 and was found between 1.13 to 1.36%. As a result, they were easy to wash out.

Sl.NO.	Composition	F1	F2	F3
1	Aloe vera	3.6ml	3.6ml	3.6ml
2	Rosemary oil	0.8ml	0.8ml	0.8ml
3	Potassium hydroxide	1.06gm	1.06gm	1.06gm
4	Glycerol	0.8ml	0.8ml	0.8ml
5	<i>Albizia amara</i> extract (chigare)	0.04gm	0.04gm	0.04gm
6	Acacia	0.04gm	0.04gm	0.04gm
7	Guava leaves	1ml	2ml	3ml
8	Tulsi oil	1ml	2ml	3ml
9	Sodium bicarbonate	0.12gm	0.12gm	0.12gm
10	Lemon juice	1ml	1ml	1ml
11	Methyl paraben	0.06gm	0.06gm	0.06gm
12	Rose water	q.s	q.s	q.s
13	Distilled water	20ml	20ml	20ml

Table no. 1: Composition of herbal shampoo formulation (20 ml)

SL.NO	COMPOSITION	USES	F1	F2	F3
1	<i>Aloe vera</i>	Moistening agent	10ml	10ml	10ml
2	Rosemary oil	Thinning agent	0.8ml	0.8ml	0.8ml
3	Potassium hydroxide	Disinfectant	1.06gm	1.06gm	1.06gm
4	Glycerol	Surfactant	0.8ml	0.8ml	0.8ml
5	<i>Albizia amara</i>	Cleansing agent	0.04gm	0.04gm	0.04gm
6	Acacia	Emulsifying agent	0.04gm	0.04gm	0.04gm
7	Guava leaves	Scalp reduce agent	1ml	2ml	3ml
8	Tulsi oil	Anti-microbial agent	1ml	2ml	3ml
9	Sodium bicarbonate	Cleanser	0.12gm	0.12gm	0.12gm
10	Lemon juice	Anti-dandruff agent	2ml	2ml	2ml
11	Methyl paraben	Preservatives	0.06gm	0.06gm	0.06gm
12	Rosewater	Fragrance	q.s	q.s	q.s
13	Distilled water	Aqueous medium	2ml	2ml	2ml
14	Ethyl alcohol	Preservatives	1ml	1ml	1ml

Table no. 2: Composition of herbal shampoo formulation (20 ml)



Fig.1: Extract of guava leaves and herbal shampoo formulation (F1, F2 and F3).

FORMULATION	PHYSICAL APPEARANCE
F1	Yellowish brown, Tulsi like smell
F2	Yellowish brown, Tulsi like smell
F3	Yellowish brown, Tulsi like smell

Table no.3: Evaluation of Formulation for Physical Appearance.

FORMULATION	pH
F1	6.16
F2	6.41
F3	6.45

Table no.4: Determination of pH

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Fig. 2: pH of F1, F2 and F3

FORMULATION	SOLID CONTENT
F1	1.13
F2	1.45
F3	1.36



Fig. 3: Determination of percentage solid content

Table no.5: Determine per cent of solid content

SI. NO.	FORMULATION	VISCOSITY
1	F1	1.069
2	F2	0.9422
3	F3	0.9399

Table no.6: Viscosity of herbal shampoo



Fig.4: Viscometer

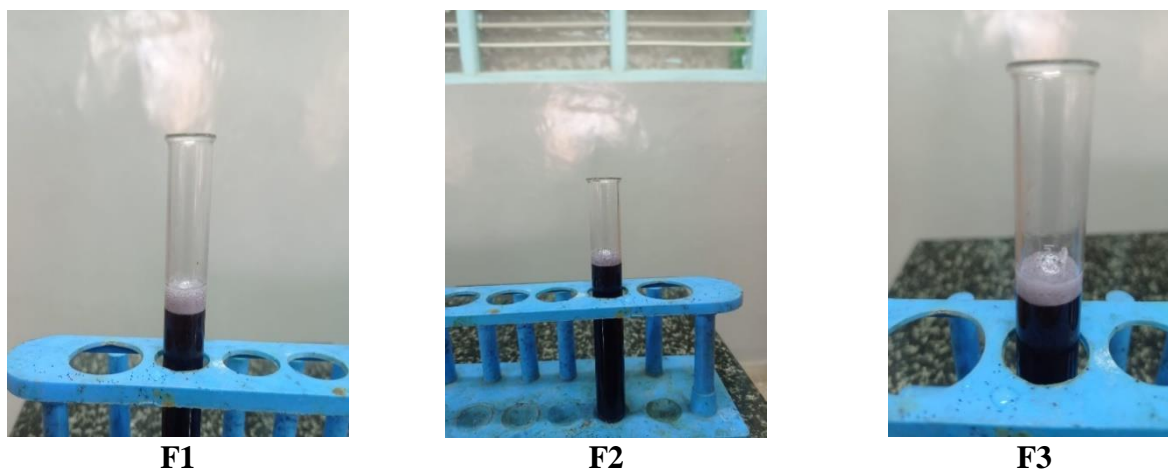


Fig. 5: Dirt dispersion test



Fig. 6: Skin irritation test

SI. NO	FORMULATION	HEIGHT OF FOAM IN cm
1	F1	0.5
2	F2	0.6
3	F3	0.8

Table no.7: Foam ability of herbal shampoo

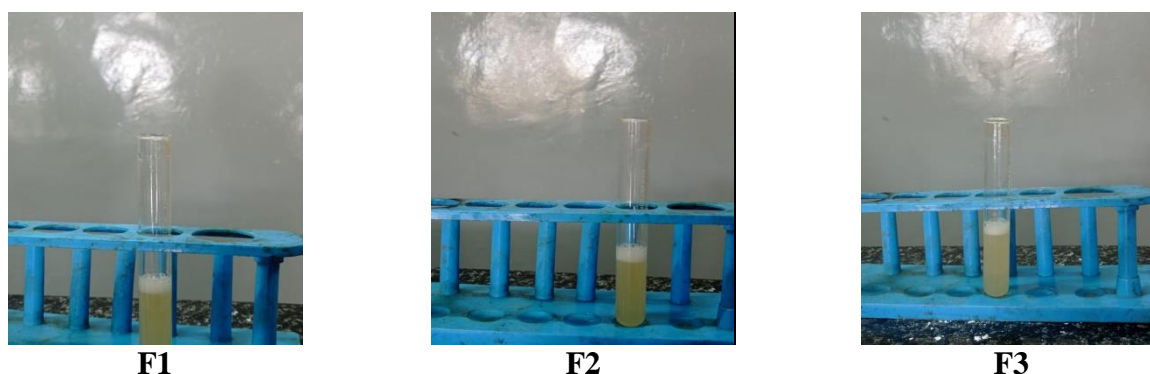
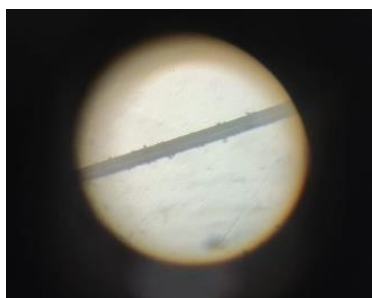


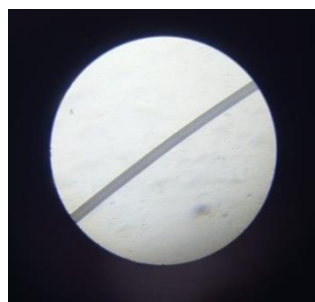
Fig.7: Foam determination

SI. NO	FORMULATION	SURFACE TENSION
1	F1	56.123
2	F2	46.051
3	F3	45.51

Table no.8: Surface tension



Sample-1: Hair



Sample-2: Hair with herbal shampoo

Fig. 8: SEM images

The results of rheological evaluation showed that the viscosity of the samples changes gradually with the increase in rpm, therefore the shampoo formulations were time dependent. The results obtained from the rheological studies were fitted into different flow behaviours, using the linear or non-linear regression. The results of viscosity evaluation are showed in table no.6.

Dirt dispersion is an important criterion for evaluation of cleansing action of shampoo. Shampoos that cause the ink to concentrate in the foam are considered of poor quality because ink or dirt that stays in foam is difficult to rinse away and gets re-deposited on the hair. Shampoo that causes the ink to concentrate in the foam is considered poor quality, the dirt should stay in water. Dirt that stays in the foam will be difficult to rinse away, it will redeposit on the hair. The results indicate that no dirt would stay in the foam; so prepared formulations are satisfactory. The amount of ink stained in the foam was recorded as light and shown in the figure 5.

The skin irritation test was done as per mentioned procedure. The observations showed no reddening or swelling of the skin. Also there were no itching sensations. No skin irritation was observed.

Foam production has little to do with cleansing activity of shampoos, it is importance to the consumer and is therefore an important criterion in evaluating shampoo. The shampoo showed good foaming property. The volume of foam formation in the shampoo was shown in table no.7.

The term indicates the amount of surfactant present in shampoo to reduce the surface tension. Lesser the surface tension stronger is the cleaning ability of the shampoo. The reduction in surface tension is an indication of their good detergent action. A proper shampoo should be able to decrease the surface tension of pure water to about 40dynes/cm. it is one of the main mechanisms of detergency. The reduction in surface tension of water from 72.8dynes/cm to 34dynes/cm by the herbal shampoos in an indication of their good detergent action.

By using compound microscope, the results shows that the hair which is washed with herbal shampoo is removing all dirt and produce clean and smooth appearance as shown in the figure no.14.

Stability and acceptability of organoleptic properties of formulations during the storage period indicated that they are chemically and physically stable. The shampoo was observed for physicochemical changes for 3 days and observed at interval of time period. No changes were observed. The shampoo was found to be stable.

Three formulations F1, F2, F3 of herbal shampoo were prepared using Aloe vera, Rosemary oil, *Albizia amara* extract (chigare), Acacia, Guava leaves, Tulsi oil, Lemon juice, Rose water in different composition (Table 1). All the required quality control parameters were checked carefully. A thorough quality control check was performed on all the necessary parameters which showed positive and

acceptable results in all three formulations. Though F3 formulation was found to be excellent. When these useful herbal ingredients are incorporated into shampoo, more stable and effective products are produced with good appearance and patient compliance. The pH of the shampoo is good which helps in improving and enhancing the qualities of hair, minimizing the irritation to the eyes and stabilizing the ecological balance of the scalp. *Albizia amara* provides efficient foam to the formulation in contact with water which helps in decreasing of surface tension and proper application of the shampoo on the scalp. All the evaluation parameters like Organoleptic evaluation, Cleaning action, foaming, Dirt dispersion, Wetting agent, Nature of hair after wash was carried out under standard guidelines and was found to be within the standard range. Skin irritation tests yielded successful results.

CONCLUSION

The objective of the study is to develop a stable and functionally effective herbal shampoo by excluding synthetic chemicals, which are normally incorporated in such formulation to larger extent. The formulated herbal shampoo is not only safe, but also improves and strengthens the hair which prevent dryness and dandruff from it. The formulated shampoo of f3 batch is optimized having good hair nourishing property. The pH of the shampoo was adjusted to 6.45, to retain the acidic pH of scalp. All the ingredients used for the preparation of herbal shampoo are safer than marketed commercial shampoo.

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