Formulations and Evaluation of Herbal Shampoos

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Abstract:

A shampoo is one of the primary beauty products with an ever-increasing market share. It is a cleaning aid for human hair. The shampoo is used for various purposes. There wide range applications of formulations of shampoo. These are hair cleaning, anti-dandruff, anti-lice, anti-dirt, hair conditioning, and smoothing of hair surface. The demand for herbal shampoo has increased due to its compatibility with the human hairs and skin. This shampoo is safe to human skin over synthetic shampoo. Though the lather formation is good in synthetic shampoos, these contain a chemical preservative that has harmful effects on human skin. In the present investigation, three herbal shampoo formulations and one market sample have been evaluated. The herbal formulation, with self-preserving property, has been given preference over chemical preservatives. Eight herbal powders have been used in the preparation of three different herbal formulations. The evaluation of the shampoo formulations has been done using parameters such as lather formation, pH, solids, viscosity, cleaning percentage, surface tension, and detergency. It is found that the shampoo that foams well does not clean well. In market samples, preservatives are the main cause of skin reactions besides fragrances. All the three formulations did not show redness, edema, dryness, and scaling. All the physical and chemical properties of formulations during the storage period evaluated, and it shown significant stability of products.

Index Terms: anti-dandruff, anti-lice, formulations, herbal shampoos, self-preserving property, and synthetic shampoos

I. INTRODUCTION

Hairs have vital importance in human beauty. Since ancient times people are using herbs for cleaning, beautifying, and managing hair. Hair shampoo is a cosmetic preparation used for cleansing of hair and the scalp. Hair shampoos are used for cleaning, imparting gloss to hair, maintaining optimal oiliness, lubrication, medication, and conditioning for hairs [1]. The main role of shampoo is to remove accumulated sebum, scalp debris, and residues of the hair. The use of shampoo has increased over the years; however, synthetic shampoo has harmful effects on the human body [2]. The herbal shampoo is becoming popular due to compatibly, safety, and negligible side effects. The safety is the most important parameter for long term usage of shampoo. Based on nature and utility shampoos have been categorized as powder shampoo, liquid shampoo, lotion shampoo, a medicated shampoo, liquid herbal shampoo, etc. Especially based on formulation shampoos have been classified as simple or plain shampoo, antiseptic, antidandruff shampoo, nutritional shampoo, etc. [3]. The quality evaluation of shampoo is carried out based on visual assessment and physicochemical parameters. The major physicochemical parameters, such as pH, density, viscosity, and surface tension, are evaluated for quality control of herbal shampoo.

Nowadays, trust in herbal shampoos has increased, and many multinationals have entered the production of herbal shampoo. In view of safety, increased demand in local and global market export potential, three plant-based shampoo formulations have been prepared and evaluated on the physicochemical parameters.

II. MATERIALS AND METHODS:

Materials and Methods: **Medicinal plants viz.** Maka (*Eclipta alba*), Aloe (*Aloe barbadensis*), Neem (*Azaradicta indica*), Shikakai (*Acacia concinna*), Ritha (*Sapindus trifolatus*), Amla *(Emblica officinalis)*, Brahmi (*Centella asiatica*) and Nettle leaf (*Urtica dioica)* were procured from the authentic sources. A decoction of Maka, Aloe, Neem, Shikakai, Ritha, Amla, Brahmi, and nettle leaf were prepared. The appropriate proportion of Sodium lauryl sulphate was mixed, and the homogenous solution was made with constant stirring. A desirable amount of essential oil from Chamomile and flower and lemongrass leaf was extracted by steam distillation method. Sodium lauryl sulfate used as a surfactant.

Evaluation parameters of Herbal Shampoos: To evaluate three formulations, quality control tests such as visual assessment and physicochemical controls are carried out. The quality tests such as pH, density, viscosity, determination of dry residue, moisture content, total surfactant activity, solid contents, surface tension, thermal stability, mechanical stability, and detergency tests were carried out. The results were compared with marketed formulations.

Physical appearance/visual inspection: The formulations were evaluated in terms of their clarity, foam producing ability, and fluidity.

1. **Determination of pH:** 10% shampoo solution was prepared in distilled water, and pH at 25°C was recorded.
2. **Determine % of solids contents:** A clean and dry evaporating dish was weighed, and in it, 4 g of shampoo added, and it was weighed. An evaporating dish with shampoo was placed on a hot plate till the liquid portion was evaporated and then weighed. Difference between the initial weight and final weight was calculated, and the total % of solids was calculated.
3. **Rheological evaluations:** Viscosity of shampoos was determined with Viscometer. The viscosity of the shampoos was measured at 25°C.
4. **Dirt dispersion:** A test tube containing 10 ml of distilled water was taken and in it two drops of Shampoo. One drop of ink was added, the test tube was shaken for ten times, and the amount of ink in the foam was recorded as none, light, moderate and heavy.
5. **Cleaning action:** 5 g of wool yarn was put in grease, and then was placed in a flask that contains 200 ml. of distilled water and 1 g shampoo in a flask. The temperature of the flask was kept 350C. The flask was shaken for 4 min. At the rate of 50 shakes/min. The solution was removed, and the sample dried and weighed. The amount of grease removed was calculated using formulae DP= 100(1-T/C) in where DP is % of detergency power, C is the weight of sebum (in control sample), and T is the weight of sebum (in test sample).

6. **Surface tension measurement:** It was calculated by the stalagmometric method using 10% shampoo dilution in distilled water at room temperature. It is calculated using the equation of $R_2 = (W_3-W_1) N_1 \times R_1 (W_2 - W_1) N_2$, Where W_1 = weight of empty beaker; W_2 = weight of beaker with distilled water; W_3 = Weight of beaker with shampoo solution; N_1 = Number of drops of distilled water; N_2 = Number of drops of shampoo solution; R_1 = surface tension of distilled water (at room temperature); R_2 = surface tension of shampoo solution (at room temperature).

7. **Detergency ability:** It was determined by The Thompson method. A crumple of hair was washed in 5% sodium lauryl sulfate (SLS) solution, dried, and then divided into 3g weight groups. The samples were suspended in an n-hexane solution containing 10% artificial sebum, vigorously shaken and solvent was evaporated (at room temperature), and sebum content was calculated. In further steps, each sample was divided into two equal parts. One was washed with 0.1 ml of the 10% test shampoo, and the other sample was treated as control. Then the sample was dried and resided sebum on the samples was extracted with 20 ml n-hexane, re-weighed and finally, the % percentage of detergency power was calculated by using DP= 100(1-T/C) formulae.

8. **Foaming ability and foam stability:** 'Cylinder shake method' was employed for calculating the foaming ability of herbal shampoo formulation. In this method, 50ml of the 1% shampoo solution was put into a 250 ml graduated cylinder, it was covered, the cylinder was hand-shaken for 1 minute, and total foam volume was calculated.

9. **Stability study:** The stability and acceptability of herbal shampoo were mainly done based on color, foaming ability, and foam stability and detergency ability percentage.

III. Results and Discussion:

Table 1. Formulations of Herbal shampoo

Sr.no.	Particulars	Uses	F1	F2	F3
1	Maka (*Elipta alba*)	Hair growth	2g	1g	0.5g
2	Aloe (*Aloe barbadensis*) leaf	Conditioning, Hair lustring	2g	1g	0.5g
3	Neem (*Azaradicta indica*) leaf	Antiseptic and antibacterial	2g	1g	0.5g
4	Shikakai (*Acacia concinna*) fruit	Foam base	2g	1g	0.5g
5	Ritha (*Sapindus trifolatus*) fruit	Saponins	2g	1g	0.5g
6	Amla (*Emblica officinalis*) fruit	Hair growth promoter	2g	1g	0.5g
7	Brahmi (*Centella asiatica*) leaf	Support health of hair	2g	1g	0.5g
8	*Urtica dioica* leaf	Hair growth promoter	2g	1g	0.5g
9	*Martica Chamomile* flower	Volatile oil	q.s.	q.s.	q.s.
10	*Cymbopogon citratus* leaf	Volatile oil	q.s.	q.s.	q.s.
11	Sodium Lauryl sullphate	Surfactant	15g	10g	5g
			100ml	100ml	100ml

Table 2 Physical parameters evaluation of Formulations

SN	Formulation	Colour	Lather	P^H	Solids%	Viscosity (ps)	Cleaning action%	Surface tension (dyne/cm)	Dirt deposition	Detergency%
1	F1	Dark brown	Good foaming	5.58	20.11	0.012	18.21	28.45	Light	60.25
2	F2	Light brown	Good foaming	5.61	28.59	0.018	16.81	32.10	Light	62.55
3	F3	Dark brown	Less foaming	5.81	23.56	0.027	20.10	23.06	Medium	60.05
4	MS	Buff coloured	Good foaming	8.10	15.70	0.009	30.15	11.09	None	70.05

F1 to F3 are formulations; MS is a local market sample.

Table no. 3. Stability studies of Herbal shampoos

Parameters	F1			F2			F3		
	1 M	3 M	6 M	1 M	3M	6M	1M	3M	6M
Visual appearance (colour)	Dark brown	Dark brown	Dark brown	Light brown	Light brown	Light brown	Dark brown	Dark brown	Dark brown
P^H	5.58	5.53	5.50	5.61	5.64	5.70	5.81	5.88	5.90
Solid contents (%)	20.11	20.18	20.17	28.59	28.50	28.57	23.56	23.60	23.65
Surface tension(dyne/cm)	28.45	28.38	28.32	32.10	32.11	32.05	23.06	23.01	23.00
Viscosity (ps)	0.012	0.015	0.010	0.010	0.018	0.018	0.027	0.018	0.011
Foaming ability (ml)	48.50	48.48	48.46	43.50	43.00	40.50	30.50	34.50	38.50
Detergency ability (%)	60.25	60.15	60.20	62.55	61.25	60.15	60.05	58.25	52.20

*M= month
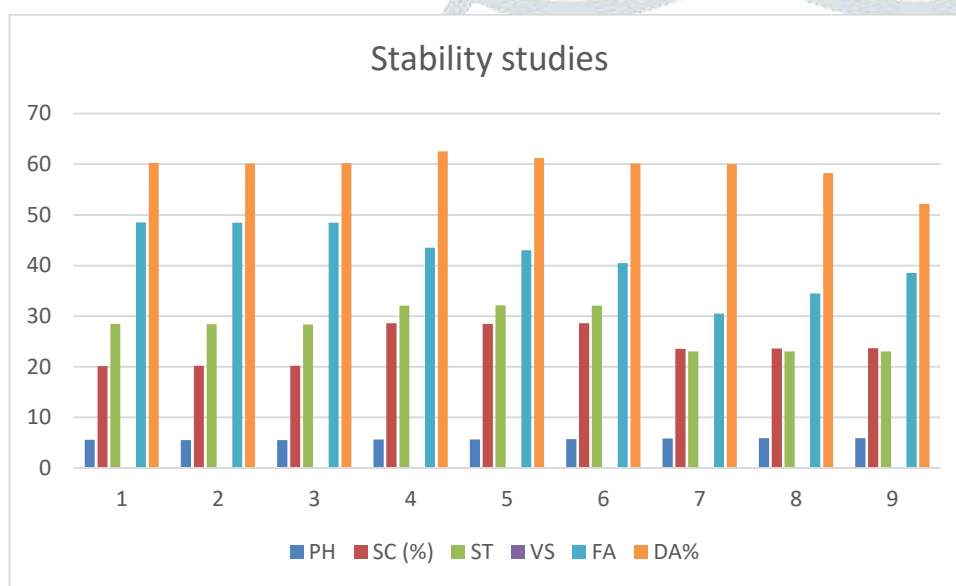
Graph.1. Stability of herbal shampoo formulations

PH= pH; SC= solid contents (%), ST= Surface tension(dyne/cm), VS=Viscosity(ps), FA=Foaming ability (ml), DA=Detergency ability(%)

Maka or Kesharaj (ruler of the hair*) Elipta alba* is considered one of the best Ayurvedic remedies for hair loss, premature graying, make hair dark, dense and lustrous [4]. Bhringaraj powder is a remedy for hair loss, premature graying, and skin allergies. It is used for healthy hair growth and to make hair lustrous. It helps to rid of hair ailments such as hair loss and balding. It cures alopecia. *Aloe vera* leaf is skin and hair products that contain certain emollients to help improve the skin, scalp, and hair texture [5]. It helps the skin by restoring it to its natural P^H balance and gives the skin a smoother appearance. The amino acids help the growth of new cells. The hyaluronic acid removes toxins and allows the astringent properties of the plant to work more effectively. *Acacia concinna* Linn. (Leguminosae) the fruits of this medicinal plant are used for washing hair. It contains almost 8.04 % saponin [6]. *Azadirachta indica* (Neem) is having antibacterial and antifungal properties [7]. Brahmi (*Centella asiatica*) is hair promoting medicinal plant [8]. Avala (*Emblica officinalis*) enriches hair growth herd pigmentation [9] and Ritha (*Sapindus trifolatus*) is surfactant [10].

Triethanol lauryl sulfate is a colourless liquid with a mild odor, it mixes with water. It reacts with strong oxidants. Ingestion causes mild irritation of the stomach, and contact with liquid irritates eyes. *Uritica dioica* often known as nettle leaf a member of Urticaceae *family. It* stimulates hair growth on scalp [11]. *Maticia Chamomilla* is called chamomile or scented mayweed is volatile oil it has a calming quality. It also improves tissue regeneration, and soothes the skin [12]. It is an essential oil that has a spicy relaxing

scent. *Cympogon citratus* (lemon grass) is also used as essential oil in the formulations [13]. As it is seen, all formulations had excellent characteristics concerning foaming. The proper pH of shampoos essential for improving the quality of hair. It also minimizes the irritation to the eyes and stabilizing the ecological balance of the scalp. The mild acidity of hair shampoo prevents swelling, promotes tightening of the scalp, and induces shining to hairs. So the F1 is acid balanced. The pH ranged from 5.50 to 5.90 is considered near to the skin pH. If the shampoo has too much content of solids, then it is hard to work into the hair and hard to wash out. The result of the percent of solids contents in between 15.10-28.59% is easy to wash out. The herbal shampoos showed high viscosity; this is a favorable property that eases the spreading of shampoo on hair. The shampoo that causes the ink to concentrate on the foam is considered poor quality; the dirt should stay in the water. Dirt that remains in the foam is difficult to rinse away and redeposits on the hair. The cleaning of dirt and sebum s the primary aim of a shampoo. As seen in different formulations, there is a significant difference in the amount of sebum removed by the different shampoos. The results showed that the percentage of detergency of formulation two is similar to marketed formulations. It was found between 52.50-60.25%. The reduction in surface tension by the herbal shampoos is an indication of their good detergent action. Although the cleaning of soil and sebum removal is the primary aim of shampoo, the detergency evaluation found difficult to standardize[14]. The results, showing that there is a significant difference in the amount of sebum removed by the different herbal shampoo formulations. Shampoo MS1 has the highest value, while F2 has the lowest value. The foam generation has little to do with the cleansing ability of shampoos; however, it is of great importance to the consumer. All four shampoos have shown comparable foaming properties. There is no direct correlation between detergency and foaming. It is found that the shampoo that foams well does not clean well. The final formulation produced stable foams as there is a little bit of change in foam volume. After the application of shampoo, no hypersensitive reactions were recorded. In market samples, preservatives are the main cause of skin reactions besides fragrances. The formulations did not show redness, edema, dryness, and scaling. All the physical and chemical properties of formulations during the storage period evaluated, and it shown significant stability of products.

IV. ACKNOWLEDGMENT

V. REFERENCES

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