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Research Article

EVALUATION OF PREPARED HERBAL SHAMPOO FORMULATIONS AND TO COMPARE FORMULATED SHAMPOO WITH MARKETED SHAMPOOS

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ABSTRACT

Shampooing is the most common form of hair treatment. Shampoos are primarily been products aimed at cleansing the hair and scalp. In the present scenario, it seems improbable that herbal shampoo, although better in performance and safer than the synthetic ones, will be popular with the consumers. A more radical approach in popularizing herbal shampoo would be to change the consumer expectations from a shampoo, with emphasis on safety and efficacy. We have evaluated and compared the herbal shampoo, which was formulated in previous study, with two marketed shampoos. The findings of this investigation reveal that synthetic preservatives have sometimes been the cause of adverse effects among consumers. We have used the physico-chemical approach to preservation and by formulating a self preserving shampoo, have avoided this risk posed by chemical preservatives. However, the aesthetic attributes, such as lather and clarity, of the laboratory shampoo are not comparable with the marketed shampoos. The foam volume was on a par. Although the retail products were not fare so well in the tests conducted by us, they enjoy market popularity, especially if they foam well. This is mainly due to the false notion among consumers that 'a shampoo that foams well, works well', and no real effort on the part of manufacturers to counter this fallacy.

Keywords: Herbal shampoo, Radical approach, Physico-chemical approach, Aesthetic attributes.

INTRODUCTION

Evaluation of shampoos comprises the quality control tests including visual assessment and physiochemical controls such as pH, density and viscosity. Sodium lauryl sulfate based detergents are the most common but the concentration will vary considerably from brand to brand and even within a manufacturer's product range. Cheap shampoos may contain a high detergent concentration while expensive shampoos may contain very little of a cheap detergent[1].Shampoos for oily hair can have exactly the same detergent at the same concentration as shampoos for dry hair. The difference is more likely to be a reduced amount of oil or conditioning agent in the shampoo for oily hair or the difference may even just be the packaging.

MATERIALS AND METHODS

Preparation of Herbal Shampoo

Decoction of *Maticia Chamomile, Urtica Dioica, Cymbopogon Citratus, Acacia concinna* was prepared in one part of water. Triethanolamine lauryl sulphate was mixed with other part of water.Mixing of both the solutions was done with constant stirring. water and perfume was added.

Evaluation of Herbal Shampoos

To evaluate the prepared formulations, quality control tests including visual assessment and physicochemical controls such as pH, density and viscosity were performed. Also, to assure the quality of products, specific tests for shampoo formulations including the determination of dry residue and moisture content, total surfactant activity, salt content, surface tension, thermal and mechanical stability and detergency tests were carried out. The results were compared with marketed formulations[2].

Physical appearance/visual inspection

The formulations prepared were evaluated in terms of their clarity, foam producing ability and fluidity[2].

Determination of pH

The pH of 10% shampoo solution in distilled water was determined at room temperature 25°C[3].

Determine percent of solids contents

A clean dry evaporating dish was weighed and added 4 grams of shampoo to the evaporating dish. The dish and shampoo was weighed. The exact weight of the shampoo was calculated only and put the evaporating dish with shampoo was placed on the hot plate until the liquid portion was evaporated. The weight of the shampoo only (solids) after drying was calculated.

Rheological evaluations

The viscosity of the shampoos was determined by using Brookfield Viscometer (Model DV-l Plus, LV, USA) set at different spindle speeds from 0.3 to 10 rpm3. The viscosity of the shampoos was measured by using spindle T95. The temperature and sample container's size was kept constants during the study.

Dirt dispersion

Two drops of shampoo were added in a large test tube contain 10 ml of distilled water. 1 drop of India ink was added; the test tube was stoppered and shakes it ten times. The amount of ink in the foam was estimated as None, Light, Moderate, or Heavy.

Cleaning action

5 grams of wool yarn were placed in grease, after that it was placed in 200 ml. of water containing 1 gram of shampoo in a flask. Temperature of water was maintained at 350C. The flask was shaked for 4 minutes at the rate of 50 times a minute.

The solution was removed and sample was taken out, dried and weighed. The amount of grease removed was calculated by using the following equation:

$$DP= 100(1-T/C)$$

In which, DP is the percentage of detergency power, C is the weight of sebum in the control sample and T is the weight of sebum in the test sample[4].

Surface tension measurement

Measurements were carried out with a 10% shampoo dilution in distilled water at room temperature. Thoroughly clean the stalagmometer using chronic acid and purified water. Because surface tension is highly affected with grease or other lubricants5, 6. The data calculated by following equation given bellow:

$$R_3 = \frac{(W_3-W_1)\, n_1}{(W_2-W_1)\, n_2} \times R_1$$

Where W_1 is weight of empty beaker.

W_2 is weight of beaker with distilled water.

W_3 is Weight of beaker with shampoo solution.

n_1 is no. of drops of distilled water.

n_2 is no. of drops of shampoo solution.

R_1 is surface tension of distilled water at room temperature.

R_2 is surface tension of shampoo solution.

Detergency ability

The Thompson method was used to evaluate the detergency ability of the samples. Briefly, a crumple of hair were washed with a 5%sodium lauryl sulfate (SLS) solution, then dried and divided into 3g weight groups. The samples were suspended in a n-hexane solution containing 10%artificial sebum and the mixture was shaken for 15minutes at room temperature. Then samples were removed, the solvent was evaporated at room temperature and their sebum content determined. In the next step, each sample was divided into two equal parts, one washed with 0.1 ml of the 10% test shampoo and the other considered as the negative control. After drying, the resided sebum on samples was extracted with 20 ml n-hexane and re-weighed. Finally, the percentage of detergency power was calculated using the following equation:

DP= 100(1-T/C)

In which, DP is the percentage of detergency power,

C is the weight of sebum in the control sample and T is the weight of sebum in the test sample3, 4.

Foaming ability and foam stability

Cylinder shake method was used for determining foaming ability. 50ml of the 1% shampoo solution was put into a 250 ml graduated cylinder and covered the cylinder with hand and shaken for 10 times. The total volumes of the foam contents after 1 minute shaking were recorded. The foam volume was calculated only. Immediately after shaking the volume of foam at 1 minute intervals for 4 minutes were recorded[7].

Skin sensitization test

The guinea pigs were divided into 7 groups (n=3). On the previous day of the experiment, the hairs on the backside area of guinea pigs were removed. The animals of group I was served as normal, without any treatment. Animal Group II, III, IV, V and VI were applied with shampoo formulation F1, F2, F3, MS1 and MS2 respectively. Shampoos were applied onto nude skin of animals of groups. A 0.8% v/v aqueous solution of formalin was applied as a standard irritant on animal Group VII. The animals were applied with new patch/formalin solution up to 72 hours and finally the application sites were graded according to a visual scoring scale, always by the same investigator. The erythema scale was as follows: 0, none; 1, slight; 2, well defined; 3, moderate; and 4, scar formation (severe)[4].

Eye irritation test

Animals (albino rats) were collected from animal house. About 1% shampoo solutions was dripped into the eyes of six albino rabbits with their eyes held open with clips at the lid. The progressive damage to the rabbit's eyes was recorded at specific intervals over an average period of 4 seconds. Reactions to the irritants can include swelling of the eyelid, inflammation of the iris, ulceration, hemorrhaging (bleeding) and blindness[4].

Stability studies

The thermal stability of formulations was studied by placing in glass tubes and they were placed in a humidity chamber at 45°Cand 75% relative humidity. Their appearance and physical stability were inspected for a period of 3 months at interval of one month[8, 9].

Table 1: Formula of prepared shampoo

S. no	Particulars	Part used	Quantity(10ml)
1.	*Urtica Dioica*	Leaf	0.25gm
2.	*Maticia Chamomile*	Flower	0.25gm
3.	*Cymbopogon Citratus*	Leaf	0.25gm
4.	*Acacia concinna*	Fruit	0.25gm
5.	Triethanol lauryl sulphate	-	0.1ml
6.	Water	-	Q.s
7.	Perfume	-	Q.s

Table 2: Evaluation of Formulation for physical appearance, pH and Solids

S. no	Formulation	Physical appearance	pH	Solid
1.	F1	Dark brown, good foaming	5.51± 0.02	22.11± 0.02
2	F2	Dark brown, good foaming	5.53± 0.07	24.51± 0.02
3	F3	Dark brown, good foaming	5.61± 0.02	29.31± 0.02
4	MF1	Dark brown, good foaming	5.81± 0.04	25.41± 0.02
5	MF2	Dark brown, good foaming	5.91± 0.01	28.21± 0.02

Table 3: Viscosities of herbal shampoos

S. no	Formulation	% Tor	Viscosity
1.	F1	15.31	50916.67
2	F2	21.90	33350.00
3	F3	32.86	40450.00
4	MF1	40.73	7598.33
5	MF2	51.70	11478.33

Table 4: Evaluation of Formulation for Cleansing, Surface tension and Detergency

S. no	Formulation	Cleaning (%)	Surface tension(dynes/cm)	Detergency (%)
1	F1	24.21± 0.03	32.15± 0.02	64.23± 0.32
2	F2	32.51± 0.09	33.22± 0.12	65.12± 0.02
3	F3	18.81± 0.08	31.37± 0.62	53.58± 0.09
4	MF1	33.61± 0.05	34.60± 0.32	67.69± 0.12
5	MF2	32.11± 0.02	33.61± 0.42	66.12± 0.42

Table 5: Foam stability of herbal shampoos

Time (Minutes)	Foam volume (ml)				
	F1	F2	F3	MS- 1	MS- 2
1	170	180	140	180	180
2	168	177	137	178	177
3	166	175	134	176	174
4	165	174	135	175	173
5	164	173	133	174	172

Table 6: Stability studies herbal formulations

Parameters	1month	2month	3month
Physical appearance/visual inspection	Clear	Clear	Clear
pH	5.51± 0.02	5.53± 1.02	5.61± 0.82
Solids contents (%)	22.51± 0.02	24.11± 0.92	26.51± 1.02
Surface tension measurement (dy. /cm)	33.22± 0.12	32.52± 0.32	35.20± 0.72
Rheological evaluations (cps)	94607.89	30647.63	57749.44
Detergency ability (%)	65.12± 0.12	67.10± 0.10	54.11± 0.52
Foaming ability and foam stability (ml)	170	180	170

RESULT AND DISCUSSION

Evaluation of Herbal Shampoos

Physical Appearance/Visual Inspection

The results of visual inspection of series of formulations are listed in table 2. As can be seen, all formulations had the good characteristics with respect to foaming.

pH

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[10]. The current trend to promote shampoos follower. pH is one of the ways to minimize damage to the hair. Mild acidity prevents swelling and promotes tightening of the scales, there by inducing shine. As seen from table 2, all the shampoos were acid balanced and were ranged 5.5 to 5.9, which is near to the skin pH.

Percent of Solids Contents

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 percent of solids contents is tabulated in table 1, and was found between 22-29%. As a result, they were easy to wash out.

Rheological evaluations

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. Secondly as the data showed the viscosity decreases with increase in rpm, so the shampoo formulations were shear thinning or pseudo plastic in nature. These formulations showed pseudo plastic behavior which is a desirable attribute in shampoos formulation. At low rpm the herbal shampoos showed high viscosity and increase in the shear rate the viscosity of the shampoos drops, this is a favorable property which eases the spreading of the shampoos on hair. The results obtained from the rheological studies were fitted into different flow behaviors, using the linear or non-linear regression. Table 2 shows the goodness of fitting indices for Newtonian, plastic and pseudo plastic flow behaviors. As can be seen in the table 2, all the formulations

Dirt Dispersion

Shampoo that cause 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. All five shampoos showed similar results. These results indicate that no dirt would stays in the foam; so prepared and marketed formulations are satisfactory.

Cleaning Action

Cleaning action was tested on wool yarn in grease. Although cleaning or soil/sebum removal is the primary aim of a shampoo, experimental detergency evaluation has been difficult to standardize, as there is no real agreement on a standard soil, a reproducible soiling process or the amount of soil a shampoo should ideally remove11. As seen from the results, there is a significant difference in the amount of sebum removed by the different shampoos. The results of detergency studies showed that the final formulation has significantly similar detergency ability, when compared with the marketed formulations and it was found in between 18-33%. The results are presented in table 4.

Surface tension measurement

It has been mentioned that a proper shampoo should be able to decrease the surface tension of pure water to about40 dynes/cm12. Surface tension reduction is one of the mechanisms implicated in detergency. The reduction in surface tension of water from 72.8 dynes/cm to 35.37dynes/ cm by the herbal shampoos is an indication of their good detergent action. The results are shown in table 4.

Detergency ability

Although cleaning or soil/sebum removal is the primary aim of a shampoo, experimental detergency evaluation has been difficult to standardize, as there is no real agreement on a standard soil, a reproducible soiling process or the amount of soil a shampoo should ideally remove. As seen from the results, there is a significant difference in the amount of sebum removed by the different shampoos. Shampoo MS1, MS2 being a frequent-use cleanser, was expected to have the maximum detergency. Shampoos F1, F2 and F3 also showed moderate detergency. The results are presented in table 4.

Foaming ability and foam stability

Although foam generation has little to do with the cleansing ability of shampoos, it is of paramount importance to the consumer and is therefore an important. Criterion in evaluating shampoos. All the five shampoos showed similar foaming characteristics in distilled water. All five shampoos showed comparable foaming properties. The foam stability of herbal shampoos is listed in table 4. A point to be noted here is that there does not seem to be any direct correlation between detergency and foaming, which only confirms the fact that a shampoo that foams well need not clean well. The final formulation produced stable foams there was little bet change in foam volume.

Skin Sensitization Test

In case of cosmetics containing higher percentage of potential irritants like hair dyes, shampoos, hair tonics and patches should not be sealed. These should be used as open patches. There were no hypersensitive reactions by those formulations. All formulations are good.

Eye Irritation Test

The all formulation showed no eye irritation after 2seconds but light irritation showed after 4 second of treatment by all formulation including marketed shampoos. The adverse reactions may occur to

one of the primary constituents of the cosmetic formulation or contamination or procedural misconduct. Preservatives are the second most common cause of skin reactions besides fragrances. In most cases, these are only mild or transient such as stinging and smarting and contact urticarial. In few cases, reactions may be more severe with redness, edema, dryness and scaling. There were no eyes irritations by all formulations. All formulations were good.

Stability Study

Stability and acceptability of organoleptic properties (odor and color) of formulations during the storage period indicated that they are chemically and physically stable. The stability of herbal formulation is listed in table 6.

CONCLUSION

The formulated shampoos were not only safer than the chemical conditioning agents, but also greatly reduce the hair loss during combing as well as strengthen the hair growth. The pH of the shampoos was adjusted to 5.5, to retain the acidic mantle of scalp. Synthetic preservatives have sometimes been the cause of adverse effects among consumers. We have used the physico-chemical approach to preservation and by formulating a self preserving shampoo, have avoided this risk posed by chemical preservatives. However, the aesthetic attributes, such as lather and clarity, of the laboratory shampoo are not comparable with the marketed shampoos. The foam volume is on a par. Although the retail products do not fare so well in the tests conducted by us, they enjoy market popularity, especially if they foam well. This is mainly due to the false notion among consumers that 'a shampoo that foams well, works well', and no real effort on the part of manufacturers to counter this fallacy. In the present scenario, it seems improbable that herbal shampoo, although better in performance and safer than the synthetic ones, will be popular with the consumers. Amore radical approach in popularizing herbal shampoo would be to change the consumer expectations from a shampoo, with emphasis on safety and efficacy. Formulators must play an active role in educating the consumers about the potential harmful effects of synthetic detergents and other chemical additives present in shampoos. There is a strong need to change the consumer perception of a good shampoo and the onus lies with the formulators.

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