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Formulation and Evaluation of Polyherbal Shampoo



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ABSTRACT

The study was aimed at formulating and evaluating a complete herbal shampoo containing only traditionally used plant materials. The shampoo contained aqueous extracts of fenugreek(seeds), ginger(rhizome), marigold(petals), orange(peel), hibiscus(leaves), eucalyptus(leaves), Bengal gram(seeds), soap nut(fruit), rose(petals). The physicochemical parameters such as color, clarity, pH, and skin irritation, the percentage of solid contents, dirt dispersion, foaming ability and foam stability, wetting time and stability studies were studied using recommended procedures. The organoleptic evaluations of the polyherbal shampoo showed good results. The pH of the polyherbal shampoo range to be 5.62, which was near to the skin ph. The percentage of solid content of prepared shampoo was found to be 25.2%. The surface tension of developed shampoo was found to be 33.16 dynes/cm respectively.



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INTRODUCTION:

Hair:

In humans it is a special and cherished feature, especially in females, but its main functions are in protection of the skin from mechanical insults and to facilitate home therapy, eyebrows, and eyelashes, for example, stop things entering the eyes, while scalp hair prevents sunlight, cold, and physical damage to the head and neck¹. It also has a sensory function, increasing the perception of the skin surface for tactile stimuli, and subserves important roles in sexual and social communication, considering the psychological impact on quality of life seen in hair disorders, such as hirsutism, hair loss, etc. In particular, regarding this last point, a significantly higher prevalence of personality disorders in subjects with androgenetic alopecia regarding the prevalence of such diagnoses in the general population has been reported².

Dandruff:

The word dandruff (dandruff, dandriffe) is of Anglo-Saxon origin, a combination of tan meaning tetter and drof meaning dirty. Dandruff is a chronic scalp condition characterized by scaling, itching, and redness of the scalp. It occurs when the scalp sheds epidermal cells in large clumps. Dandruff, the excessive shedding of dead skin cell from the scalp, is apparently caused by a fungus called *Malassezia restricta* and *M.globosa*. *Malassezia* formerly called *Pityrosporum* is a yeast causing infection of skin and scalp. The replacement of cells on the scalp occurs slowly and is not visible to the eye. The process of change is happening every month. If this process becomes faster, then there will be disruption on the scalp which we call dandruff. The warm and humid atmosphere, overcrowding and poor personal hygiene are ideally suited for the growth of *Malassezia*. Dandruff affects 5% of the population and mostly occurs after puberty, between 20-30 years and dandruff affects males more than females³.

Types of Dandruff:

Dandruff can be classified as disorders of the sebaceous gland or skin scaling disorders. Dry dandruff again can be mild or severe. Dandruff can be of two types,

They are:

1. Oily dandruff

2. Dry dandruff

Oily dandruff (*Pityriasis Steatoides*):

On the scalp, waxy, greasy, yellowish, thick scales crusts are present. Beneath the crusts, the scalp is red or pale but dry. The hair may be dull and flat without shine. There may be slight itching. If irritated eczematization complicates the condition to produce seborrhoeic dermatitis. Patients with pityriasis steatoides usually develop thinning and later loss of hair.

Dry dandruff (*Pityriasis sicca*):

The scales are fine, thin, furfuraceous, white or grayish and dry or only slightly greasy. The hair is dry and lusterless. There is mild to moderate itching. The scales fall freely on the shoulders. This type of dandruff is more common in winter than in summer. It signifies exaggeration of normal exfoliation of the horny layer of the epidermis. It usually affects people with dry integument and scalp. In nutritional disorders, scaliness of the scalp is exaggerated.

Shampooing is the most common form of hair treatment. Shampoos have primarily been products aimed at cleansing the hair and scalp. Selected ingredients of shampoo that have been popular with the consumer are currently under attack because of potential risks associated with their use (e.g. a Halogenated organic compound, formaldehyde, musk fragrance and crude coal tar).

Formulating cosmetics using completely natural raw materials is a difficult task. The challenge lies in selecting materials that can be rationally justified as 'natural' and formulating them into cosmetics whose functionality is comparable with their synthetic counterparts. Selecting the evaluation parameters of a shampoo is a challenging task, simply because of the multitude of both subjective and instrumental test methodologies available for this purpose. A more radical approach in popularizing herbal shampoo would be to change the consumer expectations from a shampoo, with an emphasis on safety and efficacy.

Causes of dandruff ⁴:

Dandruff can be caused by the fungus *Pityrosporum ovale* (*P. Ovale*), which is naturally present on the scalp and other parts of the skin. Generally, this fungus causes no harm. However, with the weather changes, hormonal, and stress, the scalp will produce more oil,

causing the fungus *P. Ovale* to proliferate. With the proliferation of the fungus, itching of the scalp skin cells and the loss of hair follicles and so-called dandruff will come. The exact mechanism of dandruff formation is the formation of enzymes called lipases. The *Malassezia* fungus uses these enzymes to break down sebum to oleic acid. The oleic acid then penetrates the top layer of skin and causes increased skin cell turnover in susceptible people. This, in turn, causes dandruff flakes and sometimes itching and redness.

Some of the causes of dandruff are:

- Abnormal keratinization of the epidermal tissue
- Excessive lipid secretion Excess sebum (skin oil) secretion from your skin.
- Abnormal proliferation of scalp bacteria
- Dry skin
- Insufficient/inappropriate cleaning of hair
- Scrubbing
- Excessive use of shampoos
- Being more sensitive to the chemical hair products
- Eczema
- Psoriasis in the hair.
- The excrement of microorganisms that thrive in the skin.
- Sensitivity and tolerance of the individual towards allergy and natural immunity.
- The other causes of compromising your lifestyle are:
 - Fatigue
 - Stress
 - Use of synthetic or chemical hair and skin products



- Harsh shampoos
- Loss of energy due to infection/illness
- Extremities of weather
- Improper diet.

Signs and Symptoms of Dandruff^{5,6}:

- Presence of fragments
- Itching of the scalp
- Redness around the scalp.
- Intense itching of the scalp where you will notice dead skin flaking off.
- Patches of skin scaling and turning red. The area of the skin that appears red are scalp, forehead, hairline, forehead, creases of nose and ears, eyebrows, mid-section of your back, armpit, groin, breastbone, ear canals, beard areas, or eyelids.
- If you have dark skin (the areas affected appear lighter than the rest).

TREATMENT OF DANDRUFF⁷:

Dandruff can be treated by using shampoo.

Shampoo:

Hair-care products may be defined as the preparation which is meant for cleansing, modifying the texture, changing of the color, giving life to the stressed hair, providing nourishment to the hair and giving the healthy look to the hair. The word revitalize truly symbolizes the term what is routinely called as re-nourish or conditioning. The real technology of cleaning the hair and scalp was developed in this century by the introduction of cake soap which was followed by the production of shampoo products.

The shampoo is a word derived from Hindi champo which means head massage with some form of hair oil.

A shampoo is a preparation containing a surfactant (i.e. Surface active material) in a suitable form – liquid, solid or powder – which when used under the specified conditions will remove surface grease, dirt, and skin debris from the hair shaft and scalp without adversely affecting the user.

They are expected to be non-irritating to skin and mucous membranes. Shampoos are liquid, creamy or gel like preparations.

FUNCTIONS:

The main aim of shampoo is to remove the unwanted particles such as dirt, oil, skin particles, dandruff, environmental pollutants and other contaminant particles from hair without losing much of sebum. Apart from the above-mentioned functions it also includes lubrication, conditioning, smoothing of hair surface and shining, anti-dandruff formulas etc., to specially styled and color-treated hair.

The primary function of shampoo is aimed at the cleansing of the hair necessitated due to accumulated sebum, dust, scalp debris etc. Various shampoo formulations are associated with hair quality, hair care habit and specific problems such as treatment of oily hairs, dandruff and for androgenic alopecia.

Ideal properties of shampoo⁷

- It should be easy to remove shampoo by rinsing leaving the hair soft, lustrous and manageable.
- It should impart a pleasant fragrance during use, masking the odor of wet hair.
- Ease of combing of the wet hair.
- It should effectively and completely remove dust or soil, excessive sebum or other fatty substances residues of hair setting lotions, dressing from hair and scalp. And loose corneal cells from the hair.
- It should be non-toxic.
- It should be effective in small amounts.

- It should produce sufficient foam, both in hard and soft water, to satisfy the psychological requirements of the user.
- It reduces the fluffiness and smoothens the hair shafts. It makes the hair soft and shiny.
- 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.
- To perform as a vehicle for the deposition of beneficial materials onto the hair and scalp.
- To be non-damaging to the tissues of the eye if inadvertently splashed.
- Should effectively wash hair.

TREATMENT OF DANDRUFF^{8,9}:



There are two choices in treating dandruff, chemical based anti dandruff shampoo and treatment, or the organic dandruff solution using herbal dandruff shampoo.

1. Synthetic shampoo (chemical shampoo)

2. Herbal shampoo

Synthetic treatment^{10,11,12}:

Current treatment options are available for the management of dandruff includes therapeutic use of Zinc pyrithione, Salicylic acid, Imidazole derivatives, Glycolic acid, steroids, Sulphur, Selenium sulfide, Tar derivatives, Piroctone olamine, Uncylenic acid derivatives

Herbal treatment:

The following list of the herbal ingredient is used in the treatment of dandruff

Soybean, Rosemary tree or essential oils, Burdock, Celandine, Comfrey tree, Ginger and Sesame, Liquorices, Plantain tree, Tea tree, Thyme and Sage, Vinegar and Apple cider, Peppermint, Marigold, Juniper.

Herbal shampoo^{13, 14}:

Herbal shampoos are the cosmetic preparations that with the use of traditional Ayurvedic herbs are meant for cleansing the hair and scalp just like the regular shampoo. They are used for removal of oils, dandruff, dirt, environmental pollutions etc.

Herbal Anti-dandruff shampoo^{15, 16}:

Herbal dandruff shampoo does not contain any unsafe elements unlike synthetic shampoo it is obtained naturally from organic ingredients and medicated specifically to treat dandruff problems. Herbal dandruff shampoo is safe for daily use and gives nutrients and other essential vitamins for your hair and scalp.

Advantages of Herbal Shampoo over Chemical Shampoo^{17, 18}:

Chemical shampoos might appear to be improving hair texture along the length but eventually end up damaging the roots and cause:

- Premature aging, graying of hair
- Scalp dryness and itchiness
- Split-Ends and Excessive hair loss

To combat all such problems, it is best to switch to an herbal shampoo which will make up for the loss of nutrients and nullify the damage way.

The advantages of this herbal formulation are,

- Free from the side- effects
- No surfactants eg: SLS,

- No synthetic additives,
- Good Stability.
- They are less harmful as compared to commercial shampoos.
- Exposure to harmful chemicals is kept to a minimum and as for the all natural one, there is no exposure to harmful chemicals at all.

The aim was to formulate a polyherbal shampoo containing natural ingredients with an emphasis on safety and efficacy, which will avoid the risk, posed by chemical ingredients and also reduce production cost.

MATERIALS AND METHODS

Collection of plants^{19,20}: Fresh parts of fenugreek(seeds), ginger(rhizome), marigold(petals), orange(peel), hibiscus(leaves), eucalyptus(leaves), Bengal gram(seeds), soap nut(fruit), rose(petals) were collected from the market and washed under running water to remove contaminants. They are dried in shade, converted into coarse powders and sieved using 60 meshes. The extracts were prepared by decoction method. And the prepared extracts were stored in well-closed containers.

Preparation of plant extract:

Extracts were prepared by decoction method individually.

Procedure: 50g of powdered fenugreek(seeds), ginger(rhizome), marigold(petals), orange(peel), hibiscus(leaves), eucalyptus(leaves), Bengal gram(seeds), soap nut(fruit), rose(petals) were placed in a stainless steel vessel and poured 287.5 ml of distilled water and covered. The mixture was kept for boiling until the water reduced to one quarter then strain and filter. Filtered product is concentrated.

Formulation of Shampoo²¹:

Formulation of polyherbal shampoo was prepared by using different proportions of the ingredients, values are given in the Table NO.1). The ingredients were well triturated in a mortar using a pestle and blended until an ideal homogenous dispersion was achieved. The mixture was then stirred well with slow stirring on a magnetic stirrer and there was no

sediment remained at the bottom. P^H of the shampoo was adjusted between 5 and 7 with a small amount of sodium hydroxide solution.

Table: 1. List of Ingredients Used In Formulation of Poly Herbal Shampoo:

S.No	Particulars	Parts used	Use	Quantity for 100ml
1	Fenugreek	Seeds	Moisturizing agent	13ml
2	Marigold	Petals	Anti-dandruff agent	7ml
3	Orange	Peel	Anti-dandruff agent	13ml
4	Ginger	Rhizome	Anti-dandruff agent	10ml
5	Chamomile	Petals	Anti-dandruff agent	7ml
6	Bengal gram	Dried seeds	Cleansing agent	7ml
7	Soap nut	Seeds	Foaming agent	16ml
8	Hibiscus	Leaves	Conditioning agent	10ml
9	Eucalyptus	Leaves	Conditioning agent	7ml
10	Rose	Petals	Flavoring agent	10ml

Evaluation of formulated poly herbal shampoo²²:

To evaluate the quality of prepared formulation, several quality control tests including visual assessment, physicochemical controls conditioning performance tests were performed.

Physical appearance/visual inspection:

The prepared formulation was evaluated for the clarity, color, odor, and foam producing ability.

Determination of pH²³:

The pH of 10% v/v shampoo solution was determined at room temperature 25°C.

Determination of percentage of solids contents²⁴:

A clean dry evaporating dish was weighed and add 4 grams of shampoo to the evaporating dish. The dish and shampoo were 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.

Wash ability²⁵:

The formulation was applied on the skin and then ease and extent of washing with water was checked manually.

Wetting time^{26, 27}:

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

Dirt dispersion²⁸:

Two drops of shampoo were added in a large test tube containing 10 ml of distilled water. 1 drop of India ink was added; the test tube was stoppered and shakes it ten times.

Surface tension measurement²⁹:

The surface tension of 10% V/V shampoo was determined by using stalagmometer using chromic acid and purified water. Because surface tension is highly affected with grease or other lubricants. The data calculated by the following equation given below:

$$R_3 = (W_3 - W_1) n_1 r_1 / (W_2 - W_1) n_2$$

Where,

W_1 is weight of empty beaker.

W_2 is the 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 the surface tension of distilled water at room temperature.

R_2 is surface tension of shampoo solution.

Cleaning Action³⁰:

Cleaning action was tested on wool yarn in grease. Although cleaning or removal of soil/sebum 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.

Skin irritation test³¹:

Prepared herbal shampoo was tested for skin irritation test.

Foaming ability and foam stability³²:

Cylinder shake method was used for determining foaming ability. 50ml of the 1% shampoo solution was put into a 250 ml graduated cylinder and cover the cylinder by 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 1,2,3,4,5,10,15,20,25 and 30 minutes were recorded.

Stability studies:

The thermal stability of the formulation was studied by placing in glass tubes and they were placed in a humidity chamber at 45°C and 75% relative humidity. Their appearance and physical stability were inspected for a period of 3 months at an interval of one month.

RESULTS AND DISCUSSION:

Physical Appearance/Visual Inspection

The results of the visual inspection of the formulation were listed in the following table 2. As can be seen, the formulated shampoo had the good characteristics and is listed in table 2.

Table: 2. physicochemical properties of Polyherbal shampoo

S.No	Parameter	Observation
1	Color	Brown
2	Odor	Good
3	Transparency	Opaque

pH:

The pH of formulated shampoo 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. 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. The formulated shampoo is acid balanced and was ranged 5.64 which is near to the skin pH and values are given in table 4.

Percent of Solids Contents:

If the formulated shampoo has too many solids it will be hard to work into the hair or too hard to wash out. The result of a percent of solids contents are tabulated in table no. 4 and was found between 26.4%. As a result, they were easy to wash out.

Wash ability:

The formulated shampoo was easily washable.

Wetting time:

The wetting ability of a surfactant is dependent on its concentration and is commonly used to test its efficacy. The canvas disc method is a quick, efficient and reliable test to evaluate the wetting ability of a shampoo. The wetting time of herbal shampoo was found to be 14 sec and given in table.4.

Dirt Dispersion:

Shampoo that causes the ink to concentrate in the foam is considered as a poor quality, the dirt should stay in the water. Dirt that stays in the foam will be difficult to rinse away. It will redeposit on the hair. The formulated shampoo shows good results. These results indicate that no dirt would stay in the foam; so prepared formulation is satisfactory.

Surface tension measurement:

It has been mentioned that a proper shampoo should be able to decrease the surface tension of pure water to about 40 dyne/cm. Surface tension reduction is one of the mechanisms implicated in detergency. The reduction in surface tension of water from 72.8 dynes/cm to

34.70 dynes/cm by the herbal shampoos is an indication of their good detergent action. The results are shown in table 4.

Cleansing Action:

The cleansing action was tested on wool yarn in grease. Although cleaning or removal of soil/sebum 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 formulated shampoo. The results of detergency studies showed that the final formulation has significantly similar detergency ability, it was found in between 26.5%. The results are presented in table 4.

Skin irritation test:

The skin irritation tests revealed that the herbal shampoo shows no harmful effect on the skin. This is due to the absence of synthetic surfactants. Most of the synthetic surfactants produce inflammation and causes irritation to the skin. But in this formulation, the uses of all ingredients are obtained naturally. So it does not produce any harmful effect on the skin.

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 important. The formulated shampoo showed similar foaming characteristics in distilled water. The formulated shampoo showed the comparable foaming property. The foam stability of formulated shampoo is listed in table 3 and shown in figure no.1 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.

Table: 3. Foaming stability of poly herbal shampoo respected to time

S.No	Time in minutes	Height(cms)
1	0	175
2	1	173
3	2	170
4	3	164
5	4	163
6	5	162
7	10	154
8	20	150
9	30	137

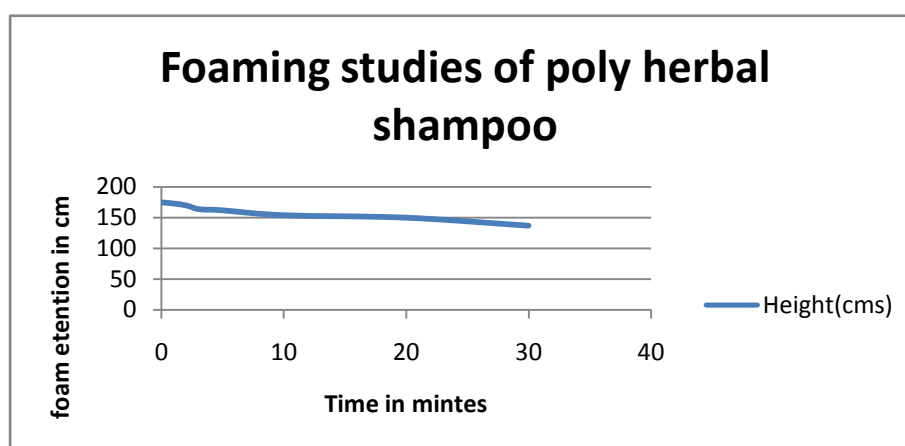


Figure 1: Foaming stability of polyherbal shampoo

Stability Study: Stability and acceptability of organoleptic properties (odor and color) of the formulation during the storage period indicated that they are chemically and physically stable. The stability study of polyherbal formulation is listed in table 4 and stability studies on foaming ability is shown in the figure no.2.

Table 4: Stability studies of polyherbal shampoo

S.No	Parameter	Initial	2nd month	3rd month
1	Color	Brown	Brown	Brown
2	pH	5.64	5.63	5.62
3	Washability	Good	Good	Good
4	Wetting time	14 sec	13 sec	13 sec
5	Dirt dispersion	Good	Good	Good
6	Foam stability	175	164	161
7	Percentage of solid contents	26.4	25.4	25.2
8	Cleansing action	26.5	26.3	25.2
9	Surface tension (dynes/cm)	33.16	32.62	33.65

Stability studies of foaming ability

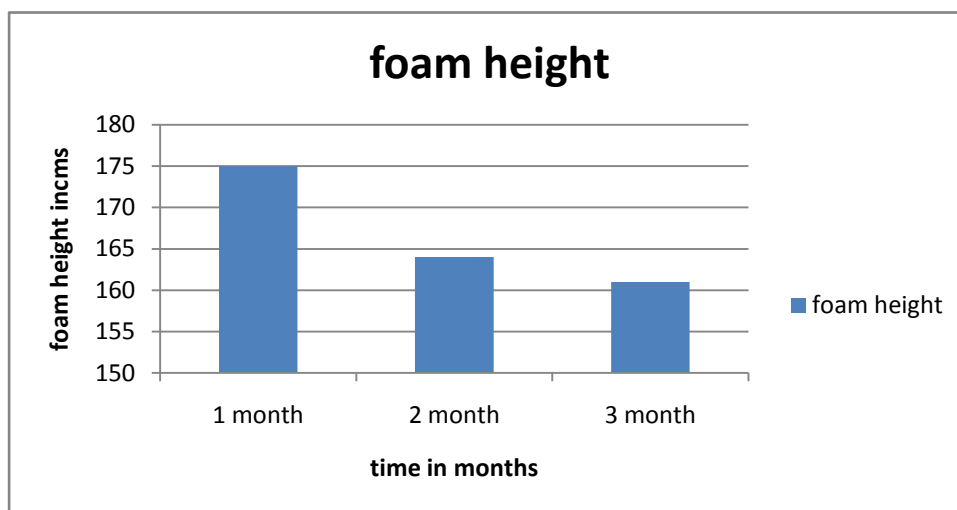


Figure 2: Stability studies of foaming ability

DISCUSSION

Based on the literature review shows that Medicinal plants used in the formulation of polyherbal shampoo were found as the rich source of novel drugs. These plants were fenugreek, ginger, orange, marigold, hibiscus, eucalyptus, soap nut, chamomile, rose oil, Bengal gram, had been reported for hair growth and conditioning. The various quality control parameters were checked. All parameters such as color, odor, pH, washability, wetting time, dirt dispersion, the percentage of solid contents, surface tension, cleansing action, foaming ability and foaming stability give a favorable result. The result obtained on the present study shows that the active ingredients of these drugs when incorporated in shampoo gives more stable products with the good aesthetic appeal. The pH of the shampoo has been shown to be important for improving and enhancing the qualities of hair, minimizing the irritation of the eyes and stabilizing the ecological balance of the scalp. Soap nut gives good foaming ability. And the prepared formulation gives good dispersion and good wetting time. The skin irritation tests revealed that the herbal shampoo shows no harmful effect on the skin. So it does not produce any harmful effect on the skin. The stability study of formulation for 3months shows stable enough at 45⁰C /75%RH. The current trend to promote shampoos of lower ph is one of the minimizing damage to the hair. Such results are estimated out of a formulation to establish strong results for the usage and good results of the product. Though the product is in dry form in spite has the wonderful wetting capacity and being dry and is having good stability for the storage.

CONCLUSION

The study was undertaken to formulate combination of herbal anti dandruff agents to formulate poly herbal shampoo. The formulation was also evaluated for the physicochemical properties using recommended procedures. The shampoo revealed ideal characteristics of a shampoo. The shampoo was devoid of any harmful chemicals and can be used as an alternative to its synthetic counterpart.

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REFERENCES:

1. Tortora.G.J, Derrickson.B.H. Principles of Anatomy and Physiology, 12th Edition. Universal Publishing Corporation.1:55. 2009.
- 2.Virtue's Family Physician. 1st edition. Published by Virtue and Company limited. 3:116.1981.
3. Maderson.P.F, Mammalian skin evolution: a reevaluation. Exp Dermatol.; 12: 233–236.2003.
- 4..Randall.V, Botchkareva.N.V. The biology of hair growth. Ahluwalia.G.S, Cosmetic Application of Laser and Light-Based System. Norwich.N.Y, William Andrew Inc. 2009, 3–35.
5. Randall.V.A. Is alopecia areata an autoimmune disease? Lancet. 358: 1922–1924.2001.
6. Maffei.C, Fossati.A, Rinaldi.F, et al. Personality disorders and psychopathologic symptoms in patients with androgenetic alopecia. Arch Dermatol., 1994; 130: 868–872.
7. Agarwal.U.P, Prajakta.S, Patki.S, Prahlad Mitra.S.K. Evaluation of clinical efficacy and safety of "anti-dandruff hair cream" for the treatment of dandruff: The Antiseptic,2009, 106: 37-39.
8. Arora.P, Nanda.A, and Karan.M. 2011. Shampoos based on synthetic ingredients vis-à-vis shampoos based on herbal ingredients: A review. International Journal of Pharmaceutical Sciences Review and Research, 2011,7 (1), 42- 46.
9. Balsam.M..S, Sagarin.E.Cosmetic Science and Technology. 2nd Edition. 2:73, 2008
10. Balsam.M.S, Sagarin.E. Cosmetic Science and Technology. 2nd Edition. 2:74, 2008.
11. Deshmukh. S, Kaushal. B, and Ghode. S, Formulation and evaluation of herbal shampoo and comparative studies with herbal marketed shampoo.International Journal of Pharma and Biosciences, 2012,638-645.
12. Jaya Preethi. P, Padmini. K, Srikant. J, Lohita. M, Swetha. K, A Review on Herbal Shampoo and its Evaluation, Asian J Pharm. Ana 3 (4), 2013, 153-156
13. Abu-Jdayil.B, Mohameed. H.A. Rheology of Dead Sea shampoo containing the anti-dandruff climbazole. Int. J. Cosmet. Sci., 2004, 26: 281-289.
14. Al-Achi.A, Baghat.T, Chukwubeze.O, Dembla.I. Rheological Profile, Specific Gravity, Surface Tension, and pH of Fifteen Over-the-counter preparations. Int. J. Pharm. Comp., 2007, 11(3): 252-258.
15. Arzhavitina.A, Steckel.H. Foams for pharmaceutical and cosmetic application Int. J. Pharm., 2010, 394: 1-17.
16. Gholamreza Dehghan Noudeh, Fariba Sharififar, Payam Khazaeli, Ehsan Mohajeri, Javad Jahanbakhsh. Formulation of herbal conditioner shampoo by using extract of fenugreek seeds and evaluation of its physicochemical parameters. African Journal of Pharmacy and Pharmacology 5(22); 2011: 2420-2427.
- 17.Mohamed Halith.S, Abirami.A, Jaya prakash.S, Chitra Karthikeyini, Kulathuran.K, Mohamed Firthouse.P.U. Effect of Ocimum sanctum and Azadiracta indica on the formulation of antidandruff herbal shampoo powder. Scholars Research Library 1(2); 2009: 68-76.

18. Khaloud Al Badi, Shah A. Khan, Formulation, evaluation and comparison of the herbal shampoo with the commercial shampoos beni-suef university journal of basic and applied sciences 3(2014) 301-305.
19. Trease and Evans Pharmacognosy, 16th edition, Elsevier, New York, 2009.
20. C.K. Kokate, A.P. Purohit, S.B. Gokhale, Textbook of Pharmacognosy, 15th edition, Nirali publications, 2014.
21. Ashok.K, Rakesh.R.M, Evaluation of prepared shampoo formulations and to compare formulated shampoo with marketed shampoos. Int J Pharm Sci Rev Res 2010;3(1):1206.
22. Baran.R, Maibah.H.I, Cosmetic Dermatology in children. Textbook of cosmetic dermatology. 2nd ed. London: CRC Press; 1998. p. 50-78.
23. Firthouse.P.U. Effects of Ocimum sanctum and Azadiracta indica on the formulation of antidandruff herbal shampoo powder. Der Pharm Lett 2009;1(2):68-76
24. Gaud.R.S, Gupta.G.D. Practical physical pharmacy. 1st ed. New Delhi: C.B.S. S.S.Publisher and Distributor; 2001, 81-105.
25. Ishii.M.K. 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. Pg:261-302.
26. Kapoor.V.P. Herbal cosmetics for skin and hair care. Nat Product Radiance 2005;4(4):306-14.
27. Khushboo.P.S, Jadhav.V.M, Kadam.V.J, Sathe.N.S. Psoralea corylifolia Linn.d "Kushtanashini". Pharmacognosy Rev 2010;4(7):69-76. Klein.K. Evaluation of shampoo foam. Cosmet Toilet Mag 2004;119(10):32-5.
28. Mahran.G.E, Glombitza.K.W, Mirhom.Y.W, Hartmann.R, Michel.C.G. Novel saponins from Ziziphus spina-christi growing in Egypt. Planta Medica 1996;62(20):163-5.
29. Manikar.A.R, Jolly.C.I. Evaluation of commercial herbal shampoos. Int J Cosmet Sci 2000;22(5):385-91.
30. Manikar.A.R, Jolly.C.I. Formulation of natural shampoos. Int J Cosmet Sci 2001;23(1):59-62.
31. 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 2011;7(1):41-6.

