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Formulation and Evaulation of Herbal Anti-Dandruff Shampoo

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***Abstract*— The aim of the present study is to formulate and evaluate herbal anti-dandruff shampoo containing natural ingredients with an emphasis on safety and efficacy. It clears dirt, dandruff, promotes hair growth, luster, strengthens and darkness the hair. The shampoo sector is probably the largest unit of among the hair care products. Since the shampoos are one of the cosmetic products used in daily as the hair is special and cherished feature of humans.[1]**

Majority of ingredients in the shampoo are chemicals and hence have been under sever attack due to its potential risk of side effects with its usage.

The main objective of this work is to formulate and evaluate a herbal anti-dandruff shampoo for cosmetic purpose containing herbal ingredients such as neem, amla, shikakai, alovera, hibiscus. All the ingredients were obtained from plants of medicine garden and were dried, powdered and formulation was prepared and evaluated.

Among the five formulations F_1, F_2, F_3, F_4,F_5 F_6, F_7, F_8 and F_9 displayed better properties in comparison to other four formulations when evaluated for their physical appearance, P^H, percentage of solid content, foaming ability, foam stability, dirt dispersion, density, viscosity and stability study.[2]

***Keywords*—Anti-dandruff shampoo, shikakai, formulation, stability study.**

I. INTRODUCTION

The main goal of present research was to formulate and evaluate the anti-dandruff activity of shampoo which is prepared from herbal plant. Dandruff can be completely eliminated but can only be managed and effectively controlled.[4] Shampoo is a hair care product, typically in the form of a viscous liquid that is used for cleansing hair .The goal of using shampoo is to remove the unwanted build-up in between the hair without stripping out so much sebum as to make hair unmanageable.[3]Herbal shampoo is most probably utilized herbal cosmetics which commonly used for cleansing hair and scalp in a daily routine life. Now a days, herbal plants and formulations are widely used for herbal cosmetics. Prepared herbal shampoo is applied on wet scalp surface, massaging into hair, and cleansed by rinsing with water.[5]There are large number of medicinal plants which are reported to have a beneficial effects on hair and commonly used in formulation of shampoo. These plant products may be used in their powdered form, crude form, purified extraction or derivative form.[6]

The with various objective of the present research work is to formulate and evaluate an herbal shampoo herbs for multipurpose use by eliminating all traditionally incorporated synthetic ingredients. This shampoo clears sebum, dirt, dandruff, promotes hair growth, strengthens and darkens hair. Moreover, it also acts as conditioning agents. This herbal shampoo powder performs all these actions without affecting damaging hair.[7]

Herbal shampoo helps in preventing the hair shaft damage and many scalp disease are treated by active ingredients that are added to formulation. Shampoos are typically composed of four main ingredients-

1. Cleansing agent
2. Additives that contributes to the stability and comfort of the product
3. Conditioning agent
4. Special care ingredients, designated to cure specific problem (eg: dandruff, grease hair etc)[9]

Many people have greater trust in natural remedies for fewer adverse effects .The formulation of herbal shampoo comprising various plants has commendable effort in this direction.

Hence, the present study was undertaken to fabricate and evaluate herbal anti-dandruff shampoo made of herbal plant leaves.

Types Of Shampoo

1. Colorprotection shampoo
2. Dry shampoo
3. Moisturizing shampoo
4. Regular shampoo
5. Anti breakage shampoo
6. Anti-dandruff shampoo
7. Volumizing shampoo

Benefits Of Herbal Shampoo

- More shine
- Less hair loss
- Long lasting color
- Stronger and more fortified hairs
- All natural, no chemicals

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- Won't irritate skin or scalp
- Pure and organic ingredients
- Free from side effects
- No synthetic additives
- Earth and skin friendly
- No problem based ingredients[5]

Functions Of Herbal Shampoo

- Keep healthy natural oils
- It should effectively and completely remove dirt or soil
- It should effectively wash the hair
- It should produce 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 effects or causes irritation to the skin and eye
- Conditioning[5]

- Herbal dandruff shampoos are the cosmetic formulation which contains herbal ingredients such as a plant extracts and essential oils. These herbal shampoos are generally used to remove the dandruff, to add natural color to the hair, to remove the extra oil content of the hair for the healthy growth of the hair, to remove the dust, dirt and scales of the scalp, to prevent hair falling, to impart softness and smoothness of the hair shaft .
- It is assumed that they can penetrate to the root shafts, stimulate the sebaceous glands, enhance the blood circulation and impart greater strength to the hair root shafts. They are also used against alopecia, thinning, clubbing and graying of hair and hair shaft roughness and breaking. They are large number of plants which have beneficial effects on hair and are commonly used in shampoo.[14]
- Neem leaves has potential immune- stimulant action by acting on serum interleukin-2(IL-2) and glucosamine. Neem leaf extract dilates blood arteries and show significant inhibition against dengue virus tyoe-2. It also has anti-fungal, antimicrobial, anti-fertility, anti-malarial, anti-diabetic, antitumor and anti-cancer activities[.15,16]

Fig 1: Neem Leaves

- Amla has been used in Ayurvedic medicines for thousands of years. Amla is good for skin getting rid of dandruff, dry skin on our scalp, and improve our hair quality. It gives boost to our immunity and it's important for children, adults and elderly due to rich I vitamin c.[20] It has several health benefits including lower blood sugar, cholesterol, blood pressure as well as reduced risk of cancer, diabetes, heart disease and age related illness of the brain.

Fig 2: Amla fruits

- Shikakai can help reduce hairfall in teenagers and in adults. It helps in promoting hair growth, treats dandruff, improved hair texture, strengthens hair strands, prevents breakage, add shine, softness hair, prevent lice, prevents premature graying and nourishes scalp and hair.[23]

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Fig 3: shikakai pods

- The petroleum ether leaf extract of Hibiscus rosa sinensis was proven to be good hair growth promoter in a study involving wister albino rats. it also as anti-microbial, anti- inflammatory, anti-pyretic, anti-cancer, anti-fungal, anti-oxidants, anti-bacterial, antitussive activites. it also has wound healing, dermatological, urinary and neuroprotective activites.[24,25]

Fig 4: Hibsicus flower

- The edible portion of flower reported to have following nutrients like nitrogen, calcium, phosphorus, fats, irons, thiamine, ascorbic acid and niacin. Petals of hibiscus rosa sinensis were reported to contain quercetin, 3-di-o-beta-d-glycoside, quercetin-3-7-di-o-beta-d-glycoside, quercetin and kaempfeol.[26,27]

- Alovera is contains over 200 active components including vitamins, minerals, amino acids, enzyme, polysaccharides and fatty acids.
- It acts as a natural fighter against all sorts of infection an efficient anti-oxidant, help in treating of digestion related problems, heartburn, arthritis, stress, diabetes, rheumatism pain, asthma, cancer, aids. It also acts as a laxative, beauty enhancer and studies have shown that it has an effect on lowering blood sugar levels in diabetes.

Fig 5: Alovera

II. Methods Of Prepartion Of Herbal Anti-Dandruff Shampoo

A. Preparation :

Step 1: Prepare the herbal infusion(Neem, Alovera, Shikakai)

1. In a small beaker, add a distilled water to boil.
2. Mix neem, alovera and shikakai powders;
    - Add 2g of neem powder, 2g of alovera powder and shikakai powder to the boiling water.
    - Stir well to dissolve the powders.
    - Let the mixture simmer for about 5 minutes, allowing the herbs to infuse into the water.
    - After simmering, strain the mixture to remove any solid particles. Let the

Step 2: Prepare the emulsifier and surfactant

1. *Cetylstearyl alcohol:* In a separate container, melt 2g of cetyl stearylalchol in ethanol.

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2. *Sodium lauryl sulfate:* In a small container, dissolve 3g of SLS in a small amount of water and stir until it dissolves completely.

Step 3: Prepare methyl cellulose and glycerol

1. Mix 1g of methyl cellulose with small amount of water to form a gel like consisitency.Let it sit for about 5-10 minutes, so methyl cellulose hydrates fully.
2. Add 2.5ml of glycerol to methyl cellulose mixture.

Step 4: Combine all ingredients

- Once the herbal infusion has cooled, slowly add it to methyl cellulose and glycerol mixture. Stir well to combine the ingredients into smooth liquid base.
- Gradually add the cetyl stearyl alcohol to the mixture.
- Slowly add the dissolved sls solution into the mixture, stir continuously to combine with surfactant with the rest of shampoo base.
- Add 0.05g of methyl paraben to the mixture.
- Add 3-4 drops of essential oil such as citrus sinesis or lavender oil.
- Once the mixture is well combined and the desired consistency is reached, transfer it into a sterilized bottle.

Fig 6: Herbal Infusion (Neem, Alovera,Shikakai)

Fig 7:Herbal Anti-dandruff Shampoo

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TABLE I:
INGREDIENTS OF HERBAL ANTI-DANDRUFF SHAMPOO

S.No	Ingredients	Quantity								
		F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9
1	Neem	1gm	1.5gm	2gm	1gm	1gm	1gm	1gm	1gm	1gm
2	Alovera	1gm	1gm	1gm	1gm	1.5gm	2gm	1gm	1gm	1gm
3	Shikakai	1gm	1gm	1gm	1gm	1gm	1gm	1gm	1.5gm	2gm
4	Cetosteryl alcohol	2gm	2gm	2gm	2gm	2gm	2gm	2gm	2gm	2gm
5	Sodium lauryl sulfate	3gm	3gm	3gm	3gm	3gm	3gm	3gm	3gm	3gm
6	Methyl cellulose	1gm	1gm	1gm	1gm	1gm	1gm	1gm	1gm	1gm
7	Methyl paraben	0.05gm	0.05gm	0.05gm	0.05gm	0.05gm	0.05gm	0.05gm	0.05gm	0.05gm
8	Glycerol	2.5ml	2.5ml	2.5ml	2.5ml	2.5ml	2.5ml	2.5ml	2.5ml	2.5ml
9	Citrus sinesis essential oil	0.5ml	0.5ml	0.5ml	0.5ml	0.5ml	0.5ml	0.5ml	0.5ml	0.5ml
10	Purified water	QS	QS	QS	QS	QS	QS	QS	QS	QS

III. Formulation Of Herbal Anti-Dandruff Shampoo

Shampoo was formed using simple mixing process. Neem, shikakai extract was mixed with other ingredients as give in formulation.

Preformulation Studies

- Neem – Antibacterial, wound healing activity skin ulcers, fever, cardiovascular disease, liver problem.
- Alovera – Used in abrasion and skin irritation, anti-inflammatory.
- Shikakai – Anti-dandruff, anti-fungal, nourish follicles.
- Cetosteryl alcohol – Opacifer in shampoo, emollient.
- Sodium lauryl sulfate – Fat emulsifier, detergent in cosmetics.
- Methyl cellulose – Thinning agent.
- Methyl paraben – Antifungal, preservative.
- Glycerol – Minimizing the water loss.
- Purified water – Solvent, conditioning agent
- Citrus sinesis essential oil- Flavouring agent.

Evaluation Studies On Herbal Anti-Dandruff Shampoo

To evaluate the prepared formulations, quality controls tests including the visual assessment and physico – chemical controls such as P^H, density and solid content were performed. Also, to assure the quality of the product specific tests for shampoo. Formulation including dirt dispersion, foam stability were carried out. The results obtained were compared with standard values.

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

2. Determination of percentage of solid 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 shampoo was calculated only and put the evaporating dish with shampoo on the hot plate until the liquid portion was evaporated. The weight of the shampoo only (solids) after drying was calculated.

3. Determination of P^H: The P^H of 10% shampoo solution in distilled water determined at room temperature 25^0C.

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4. Foaming ability and foam stability: Cylinder shake method was used for determining foaming ability. 50ml of the 1% shampoo solution was put into 250ml graduated cylinder and cover the cylinder with hand. Shake it for 10 times. The total volume of foam contents after 1mins shaking was recorded. The foam volume was calculated only. Immediately after shaking the volume of foam at 4mins were recorded.

5. Dirt dispersion: Two drops of shampoo were added I a large test tube containing 10ml of distilled water. 1 drop of Indian ink was added. The test tube was stopper and shakes it for 10min.The amount of ink in the foam was estimated as none, light, moderate or heavy.

6. Skin irritation: All the formulation showed no irritation, erythema and edema during irritancy study. Hence, it is safe for the use on skin. The formulation also gives glowing, soft and dirt- free impact on the skin.

7. Wash ability: Application of the formulation of the skin was followed by a manual examination of the formulation's suitability foe washing with water.

8. Density test: The density measurement of herbal shampoo act as guide for the formulation process and helps to influence the overall quality of manufactured product.

Procedure for determination of density

1. Clean thoroughly the specific gravity bottle with chromic acid or nitric acid.
2. Rinse the bottle at last two or three ties with distilled water.
3. If require, rinse the bottle with an organic solvent like acetone and dry.
4. Take the weight of empty dry bottle with capillary tube stopper (W_1).
5. Fill the bottle with unknown liquid and place the stopper, wipe out excess liquid form outside the tube using tissue paper.
6. Weight bottle with unknown liquid on analytical balance (W_2).
7. Calculate weight in grams of unknown liquid (W_3) = (W_2-W_1).
8. The density of unknown liquid is calculated by this given formulation-

$$(W_2-W_1)/W_1=D \text{ (density)}$$

9. Viscosity: The viscosity of herbal shampoo was determined by using Ostwald's viscometer. The viscosity of the herbal shampoo accounting drops of herbal shampoo from mark to bottom.

10. Stability studies: Formulation were stored for a month at various temperatures as part of a study on the stability of the formulation after they had been made. Physical characteristics including appearance, color, odour, texture and p^h were assessed for the packed glass vials of formulation held at room temperature and 40^{0C}.

IV. Results And Discussion

1. Physical appearance: The results of visual inspection of all formulations are listed below.

Table II:
Formulation Of Herbal Anti-Dandruff Shampoo

S. No	*Evaluation parameters*	*F_1*	*F_2*	*F_3*	*F_4*	*F_5*
1	Nature (Appearance)	Viscous Liquid	Viscous Liquid	Viscous Liquid	Viscous Liquid	Viscous Liquid
2	Color	Brown	Brown	Brown	Brown	Brown
3	Odour	Aromatic	Aromatic	Aromatic	Aromatic	Aromatic
4	Texture	Smooth	Smooth	Smooth	Smooth	Smooth

The herbal shampoo had a cosmetically leasing appearance, smooth texture and good foaming according to the results. The odour of prepared formulations was good acceptable which is desirable for cosmetics formulations.

2. pH: The pH of shampoo has been shown to be important for improving and enhancing qualities o hair, minimizing irritation of eyes and stabilizing ecological balance of scalp. The current trend to promote shampoos of low p^H is one of the ways to minimize damage hair. Mild acidity prevents swelling and promotes tightening of scales, including shine. All formulations are acid balanced and ranged to 6 which is near to skin pH

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Table III:
Ph Of The Prepared Formulations

S No	*Formulations*	*pH*
1	F_1	6.25
2	F_2	6.36
3	F_3	6.42
4	F_4	6.45
5	F_5	6.49
6	F_6	6.50
7	F_7	6.52
8	F_8	6.54
9	F_9	6.57

Fig 8 :Digital pH meter

The P^H of the recently prepared shampoo fell within the suitable range of skin P^H, ranging from 6.5 to 6.7 . All the formulations approached the desired skin pH(as shown in table 3).

3. Percent of solid content: If the shampoo has many solids it will be hard to work into hair or hard to wash to wash out. The results of percentage of solid contents were found to be between 8.1% . They were easy to wash out.

Table IV:
Percentage Solid Content

S.No	*Formulation*	*Solid content percentage(%)*
1	F_1	8.1
2	F_2	9.8
3	F_3	8.9
4	F_4	9.3
5	F_5	10.5
6	F_6	10.8
7	F_7	10.9
8	F_8	11.1
9	F_9	11.3

4. Dirt dispersion: Shampoo that causes the ink to concentrate in the foam is considered as poor quality that should stay in water. Dirt that stays in foam will be difficult to rinse always. It will re-deposit on hair. All formulations showed similar results that stay in foam. So prepared formulations safe satisfactory.

Fig 9: Dirt dispersion

5. Foaming ability and stability: Although foam generation has little to do with cleansing ability of the shampoos, it is of paramount importance to the consumer and therefore important criterion in evaluating shampoos. All formulations having similar foaming characteristics and foam heights are given table 5.

Table V:
Foaming Stability

S No	*Formulation*	*Foam volume*	
		0 min (cm)	4 min (cm)
1	F_1	176	138
2	F_2	165	116
3	F_3	157	111
4	F_4	154	109
5	F_5	168	136
6	F_6	170	140
7	F_7	174	145
8	F_8	178	147
9	F_9	180	150

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A point to be noted here that doesn't 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.

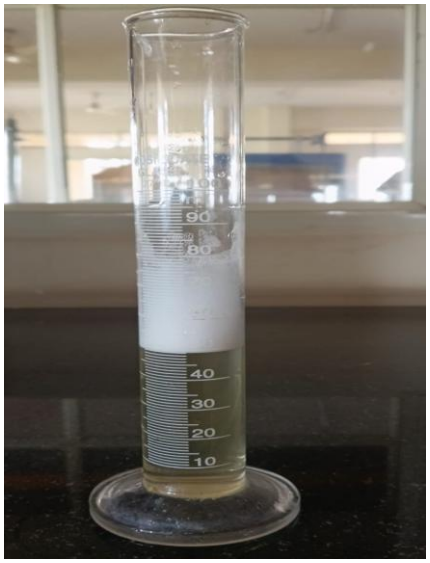

Fig 10: Foaming ability and stability

6. Skin irritation: All the formulation showed no irritation, Erythema and edema during irritancy study. Hence, it is safe for the use of skin. The formulation also gave glowing, soft and dirt-free impact on the skin.

Table VI:
Skin Irritation Test

S No	*Formulation*	*Irritation*	*Erythema*	*Edema*
1	F_1	Nil	Nil	Nil
2	F_2	Nil	Nil	Nil
3	F_3	Nil	Nil	Nil
4	F_4	Nil	Nil	Nil
5	F_5	Nil	Nil	Nil
6	F_6	Nil	Nil	Nil
7	F_7	Nil	Nil	Nil
8	F_8	Nil	Nil	Nil
9	F_9	Nil	Nil	Nil

7. Washability: The shampoo can be easily washed off from hair with normal water.

Table VII:
Washability

S No	*Formulation*	*Observation*
1	F_1	Easily washable
2	F_2	Easily washable
3	F_3	Easily washable
4	F_4	Easily washable
5	F_5	Easily washable
6	F_6	Easily washable
7	F_7	Easily washable
8	F_8	Easily washable
9	F_9	Easily washable

8. Density: Density of herbal shampoo was found to be 1.53 g/ml which was good enough for its compactness.

Table VIII:
Density Of Herbal Shampoo

S No	*Volume bottle(ml)*	*Weight of empty bottle (g)*	*Weight of bottle with sample(g)*	*Density(g/ml)*
1	25	17.27	43.71	1.53
2	25	17.27	43.94	1.54
3	25	17.27	44.05	1.55
4	25	17.27	44.85	1.59
5	25	17.27	44.98	1.60
6	25	17.27	45.61	1.62
7	25	17.27	45.75	1.67
8	25	17.27	45.80	1.70
9	25	17.27	45.94	1.71

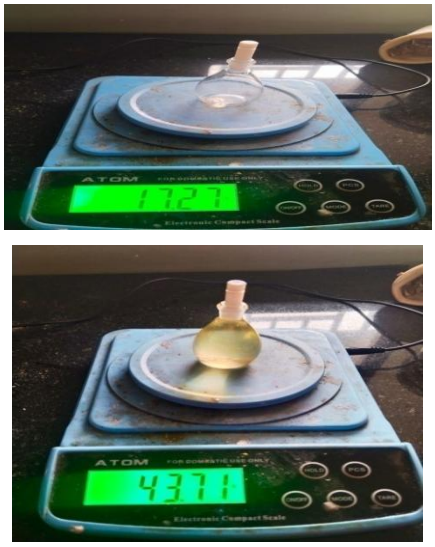

Fig 11: Density

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*9. Viscosity:*Viscosity of herbal shampoo was I the range of 15.7 mPas .This indicates that the herbal shampoo is easily spreadable by small amount of shear. After there were stored for 1 month, the viscosity of F_1 didn't differ from the original herbal shampoo. While the viscosity of F2, F3, F4and F_5 changed.

TABLE IX:
VISCOSITY OF HERBAL SHAMPOO

S No	*Formulation*	*Viscosity (mPa.s)*
1	F_1	15.7
2	F_2	14.7
3	F_3	16.8
4	F_4	15.2
5	F_5	17.1
6	F_6	17.6
7	F_7	17.9
8	F_8	18.5
9	F_9	18.9

Fig 12: Viscometer

10. Stability studies: The stability studies showed no change in color of the formulation which was stored at 40^0C and at room temperature. The stability studies showed a slight change in pHof the foundation, which was stored at 40^0C and no changes were observed at room temperature. The odour of the formulation was not changed after one month of stability studies at 40^0C and room temperature

Table X:
Stability Studies

S No	*Parameters*	*Observation*	
		Room temperature	40^0C
1	Appearance	Viscous liquid	Viscous liquid
2	Color	Brown	Brown
3	Odour	Aromatic	Aromatic
4	Texture	Smooth	Smooth
5	P^H	5.69	5.56
6	Density	1.12	1.10
7	Viscosity	15.7	15.4

V. CONCLUSION

The purpose of this study was to develop a herbal shampoo that addresses the shortcomings of existing chemical-based shampoo and to evaluate its physiological qualities. Shampoo was formulated using dried powders of neem, shikakai, and alovera powder

Five formulations F_1, F_2, F_3,F_4, F_5, F_6, F_7, F_8, and F_9 were prepared using dried powders of neem, shikakai and alovera. All compositions were tested for organoleptic, pH, viscosity, irritancy, dirt dispersion, foaming stability, density, stability studies. The pH of the formulations was confirmed to be appropriate for topical preparation. The produced mixture had good spread ability and consistency and did not cause skin irritation. Out of five formulations, F1 has shown better properties.

The herbal shampoo offers high nourishment to the hair while using fewer chemicals to protect the hair from various hair related problems. The herbal shampoo contains vitamins and anti-oxidants that can benefit the hair by improving the texture and growth of hair gradually. It is gentle on hair and scalp, making it suitable especially for hair since natural ingredients are used. It is inexpensive since it was made with simple materials and a simple way of preparation. Ingredients like neem, shikakai, and alovera powder. Powder. Herbal anti-dandruff shampoo properties include anti-fungal and anti-inflammatory actions to combat flakes, natural cleansing agents that remove dirt without stripping oils and moisturizing ingredients to hydrate the scalp and hair, leaving it soft, shiny and smooth. More research is needed to scientifically validate the formulation's action.

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