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Formulation and Evaluation of Herbal Shampoo from *Spinacia Oleracea* Leaves, *Ipomoea Batatas* Extracts

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Abstract: The current aimed to formulate herbal shampoo and to evaluate the various property of herbal shampoos. The herbal shampoo was formulated by adding the extracts of *Spinacia Oleracea* leaves, *Ipomoea batatas* roots, *Acacia concinna*, *Sapindus Indica*, *Cymbopogon citrus* in different proportions to a 100 ml. Small amount of gelatin and citric acid were also added for viscosity and pH respectively. Several tests such as visual inspection, pH, dirt dispersion, rheological evaluation and skin irritation test etc, were performed to determine the physicochemical properties of prepared shampoos. The formulated herbal shampoo was clear and appealing. It showed good cleansing and detergency and good foam stability. The results indicated the formulated shampoo is having excellent conditioning performance, similar to commercially available shampoo. However, further research and development is required to improve its quality and safety.

Keywords: Herbal shampoo, *Spinacia Oleracea* leaves, *Ipomoea batatas*,

I. INTRODUCTION

Hair is one of the external parts of our body, acting as a protective appendage on the body, and is associated with sebaceous glands, and sweat glands. Hair care products are the preparations that are used to cleanse, change the texture, change the color, provide nourishment to the hair, and maintain its health of the hair. Shampoos are cosmetic hair care products, in the form of a viscous liquid. The main motive for using shampoo is to remove the unwanted buildup between the hairs without extracting so much sebum that the hair becomes unmanageable. Herbal shampoo is a cosmetic formulation that uses herbs from plants and is used to clean the hair and scalp just like a normal shampoo (1-3). It is an alternative to the synthetic shampoos available in the market. Synthetic shampoos show harmful effects on hair, skin, and eyes; this is the reason to adopt herbal products, due to fewer side effects with affordable cost.

It is applied to wet hair, then gently massaged into the hair, and washed out with water. *Spinacia oleracea* is commonly known as “Spinach” belonging to the family Chenopodiaceae. Spinach is used as a vegetable in India as well as in others countries due to its dietary nutrition. It is a rich factory of chemical content this leafy green is a chief across numerous diets worldwide and is loaded with vitamins, minerals, and antioxidants. It keeps hair, skin, and nails healthy with vitamin A and also protects the skin from ultraviolet rays and the presence of biotin a mineral that helps treat brittle nails. It contains minerals, vitamins A, C, D, K, and folic acid. Vitamin C can promote collagen synthesis; magnesium and iron boost hair health, and reduce hair loss shown in table 1.

Ipomoea batatas is commonly called “Sweet Potato”, dicotyledonous plant belonging to the family Convolvulaceae, it is commonly known as “Sweet Potato”.

It roots possessing numerous of macronutrients such as manganese, copper, potassium, iron, vitamin B complex, vitamin C, vitamin E, and pro-vitamin A (as carotenoids mostly in yellow and orange-fleshed varieties), and all vitamins are also helpful to protect from COVID-19. (4-6) Vitamin A deficiency can cause hair problems like dull, gray, and splitting hair by their action as radical scavengers and protection against macular degeneration, cardiovascular diseases, and tumor formation. Also include starch, dietary fiber, and protein. Carotenoids are yellow, orange, or red pigments that widely exist in fruits and vegetables having those colors (carrots, tomatoes, papaya, sweet potatoes etc.), but also in green leafy vegetables such as lettuce, spinach, and kale where chlorophylls conceal the color of these compounds. In the current study we by formulate and evaluate the hair growth herbal shampoo which contains *Ipomoea batatas* and *Spinacia oleracea*.(7-8)

Table 1: Medicinal plants with their biological role

S.No	Common name	Scientific name	Plant parts used	Purpose
1	Sweet potato	<i>Ipomoea batatas</i>	Root	Hair growth
2	Spinach	<i>Spinacia oleracea</i>	Leaves	Reduce hair loss
3	Soapnut (Reetha)	<i>Sapindus indica</i>	Fruit	Foaming agent
4	Shikakai	<i>Acacia concinna</i>	Bark	Foaming agents
5	Lemon Grass	<i>Cymbopogon citratus</i>	Leaves	For Aroma

II. MATERIALS AND METHODS

The plants *Spinacia Oleracea* leaves, *Ipomoea batatas* roots, *Acacia concinna*, *Sapindus Indica*, *Cymbopogon citratus* were purchased from the local market of Delhi, India. However few plants like Ritha fruits, *Sapindus Indica* were collected from Ayurvedic store from the Gurugram Haryana, India. All plants parts were washed and cut in to small pieces, leave were dried under the shade for 5 to 8 days, crushed and stored in air tight container. (9-10)

A. Extraction of Carotene

One gram of sweet potato powder was put into a flask with 20 ml of acetone. The acetone concentration and extraction time were based on the response surface Methodology (RSM). The flask was sealed to prevent acetone from evaporation then placed in a water-bath. The temperature was maintained at 25°C. After 30 min extraction, the mixture was filtered to remove solids. Fresh solvent was added into the collected filtrate to compensate the evaporation loss of acetone,(11-13)

B. *Spinacia Oleracea*, *Sapindus indica*, *Acacia concinna* extract

About 100 g of each plant material boiled with distilled water for 4 hours, filtered dry using rotatory evaporator (14)

C. Essential oil Extraction

Cymbopogon citratus essential oil extracted by steam distillation method. (15)

D. Preparation method of Herbal Shampoo

The plant extracts were mixed in different concentration to obtain a compatible consistency shampoo whose formula is shown in table 2. Herbal extracts was mixed with shaking in 10% gelatin solution for 20 min, lemon juice (1 mL) added slowly with stirring. Finally the pH of the solution was adjusted using 1% citric acid solution. Few drops of essential oil were also added for aroma and final volume was made to 100 mL with gelatin solution. (16-18)

Table 2: Composition of formulated Herbal Shampoo

Plants material	Quantity
<i>Ipomoea batatas</i>	20ml
<i>Spinacia oleracea</i>	5 gm.
<i>Sapindus indica</i>	10ml
<i>Acacia concinna</i>	10ml
<i>Cymbopogon citratus</i>	1ml
Gelatin solution	q.s
Citric Acid	q.s

III. EVALUATION OF HERBAL SHAMPOO

Evaluation is most important step of any formulation. The prepared herbal shampoo evaluate its activity and characteristic by using standard methods of general evaluation, organoleptic evaluation, microbiological evaluation and chemical evaluation including pH, detergent content, solid content, viscosity, foaming ability. (19-21)

- 1) *Physical Appearance /visual Assessment:* The prepared formulation were evaluated its clarity, consistency, color and odor against the clarity apparatus.(9,10)
- 2) *Determination of pH:* The pH of prepared shampoo determined by previously calibrated digital pH meter. 10% of shampoo solution was dissolve in distilled water then measured the pH by using digital pH meter. An ideal pH enhances and improves the hair quality and make good balance between the scalp health and hair. It also minimizing irritation to the eyes.(11)
- 3) *Determine Percentage of solids Contents:* A dry, clean evaporating dish was weighed and then added 4gm prepared herbal shampoo, weigh and put on the hot plate to evaporate the liquid portion. After daring again weight dish and calculate percentage of sold content.
- 4) *Rheological Evaluation:* To evaluate deformation and flow behaviors of the shampoo was calculated by using Brookfield viscometer.
- 5) *Dirt Dispersion:* dirt dispersion done to evaluate the cleaning action of the sample by taken 2 drops of shampoo was added in the test tube with 10 ml of distilled water then added one drop of ink in the test tube, shake for ten times. Observe the amount of ink in the foam. The resulted grade as none, light, moderate or heavy.(16)
- 6) *Skin Sensitization Test:* This test was done very carefully on skin of human and checks whether it irritation on skin or not.
- 7) *Foaming Ability and Foam Stability:* To check the foam ability and stability of sample chose Cylinder shake method.1% sample solution dissolve in the 50 ml of distilled water, then hand shake for 10 minutes and recorded the volume of foam content in the cylinder. After shaking record the volume of foam at one minute intervals for four minutes.(18)
- 8) *Wetting Time:* Testing wetting time of the shampoo by using canvas disc method because is an effective, accessible, and constant method. The prepared shampoo shows the wetting time of the about 89 sec. The maximum of time for wetting indicate that the shampoo have low ability of cleanser.(11,12)
- 9) *Cleaning Action:* Cleaning action was tested on non-adsorbent cotton by using grease. It check the efficiency of prepared formulations to remove the grease applied on the cotton plug was estimated. Then wash out the cotton by formulated shampoo and dried it. After dried calculate the percentage of cleaning action. (15)
- 10) *Stability Test:* The formulation was taken and kept at room temperature ($30 \pm 20^{\circ}\text{C}$) as well as refrigerator ($4 \pm 20^{\circ}\text{C}$) for duration of one month. Then samples was tested physical appearance, pH, % cleaning action and foam stability. Storage period of sample was 1 months that indicated the shampoo was chemically and physically stable.
- 11) *Accelerated Stability Test:* Prepared shampoo was held at exaggerated stress conditions for a period of 1 weak. This stability evaluate the formulation at stress condition its chemical and physical properties are stable or change. For accelerated stability test, sample put in hot air oven at 50°C and 80°C for 1 week. After one weak test the sample its physical appearance, pH, foam ability, cleaning action.

Table 3: Physicochemical study of the herbal shampoo

Evaluation test	Formulated herbal shampoo
Physical appearance	Light brown, Pleasant ,Thick
pH	6.05
% Solid content	23%
Formability	Foam volume 100 ml at 5 min
Wetting time	17 sec
Viscosity	842 centipoises.
Cleaning Action	20%
Skin sensitization	none

Table 4: Accelerated Evaluation Studies of the herbal shampoo

Evaluation test	25°C	50°C	80°
Physical appearance	Light brown, Pleasant, Thick	Light brown, pleasant, thin	Light brown, pleasant, thin
pH	6.05	6.85	6.25
% Solid content	23%	%	%
Formability (foam volume)	30ml at 5 min	26 ml at 5 min	22min at 5 min
Wetting time	17 sec	10 sec	7 sec
Skin sensitization	None	None	None

IV. RESULT AND DISCUSSION

In the current study we prepared herbal shampoo with the extracts of *Spinacia Oleracea leaves*, *Ipomoea batatas roots*, *Acacia concinna*, *Sapindus Indica*, *Cymbopogon citrus* in different proportions to make 100 ml. Several tests were performed the evaluation such as visual inspection, pH, dirt dispersion, rheological evaluation and skin irritation test etc and their results showed clear preparation with pleasant odor, pH was found to be between 5 to 7, which is good for hair scalp, % of sold content was 23 %, good for herbal shampoo, wetting time was 17 sec and the data of accelerated stability studies was showed the formulation is stable for longer period of time without losing it constancy and physicochemical properties, which is similar to commercially available shampoo.

V. CONCLUSION

The aim of this study was to formulate a completely herbal shampoo by using plant extracts which are commonly used traditionally and lauded for their hair cleansing actions across globally. All the ingredients used to formulate shampoo are safer and not causing any harmful effect on hair. Instead of using cationic conditioners we have used, *Sapindus Indica*, *Cymbopogon citrus* extracts to provide the conditioning effects. Several tests were performed to evaluate and compare the physicochemical properties and results showed that our prepared shampoo showed comparable result but further research and development is required to improve its overall quality.

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A. Conflict of Interest

We, authors declare that we have No Conflict of interest

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