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Formulation and evaluation of herbal shampoo

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Abstract
Marketed (Synthetic) available shampoo contains artificial ingredients that are bad for the skin, damages hair follicles, irritates the scalp and some negative effects. Because consumers are now aware of the negative effects that synthetic products can have on their skin, hair, and eyes, they choose herbal products over synthetic ones. The adverse effects of herbal products are minimal so herbal products over synthetic ones. Herbal Shampoo is belonging to the cosmetic preparation using herbs and purpose of the hair care products are prepared to eliminate excess oil, dirt, and dandruff from the scalp and hair. The main aim of the present study is to formulate and evaluate polyherbal shampoo by using ingredient from the natural sources. The herbs used in the process of the preparation shampoo are Hibiscus flower (*Hibiscus rosea*), Neem leaf (*Azadirachta indica*), Shikakai fruit (*Acacia concinna*), *Aloe vera* (*Aloe barbadensis*), Soap nut (soap berries), Amla (*Emblica officinalis*), Black Sesame seeds (*Sesamum indicum* L.), Reetha (*Sapindus mukorossi*), Fenugreek powder (*Trigonella foenum-graecum*). The formulations were evaluated for physical appearance, pH, Wetting test, Viscosity and Surface tension tests, foam stability test, dirt dispersion, determination of percent solid content, antimicrobial activity, skin irritation test and stability testing. Stability studies were conducted for 1-2 months for the prepared shampoo shows slight changes in their evaluation tests.

Keywords: Sun screen, *Hibiscus rosa sinensis*, sun protection, UV rays, SPF

Introduction
Hair is one of the vital parts of the body derived from ectoderm of the skin and is protective appendages on the body and considered accessory structure of the integument along with sebaceous glands, sweat glands and nails [1]. Hair care products can be characterized as a preparation designed to eliminate excess oil, dirt, and dandruff from the scalp and hair. Products for hair care also nourish hair and give it a healthy appearance. The invention of cake soap and the subsequent development of shampoo products in this century marked the beginning of the real technology for cleaning the hair and scalp. The Indian subcontinent is the source of the world of shampoo. It comes from the Hindi word shampoo, which means to massage the head using hair oil, and dates back to 1762A shampoo is a hair and scalp cleansing cosmetic preparation. Its main purpose is to rid the hair of built-up sebum, scalp debris, and hair grooming product residue. Shampoos also serve as lubricants, conditioners, medications, and other additional purposes. Surfactant serves as the primary ingredient in the preparation of the shampoo, with additional ingredients serving to boost the product's efficacy [2].

Market-available shampoo contains artificial ingredients that are bad for the skin. The common surfactant sodium lauryl sulphate damages hair follicles and irritates the scalp when used in shampoo. Preservatives like formaldehyde are also added to shampoo formulas, which increases the sensitivity of the skin. Because consumers are now aware of the negative effects that synthetic products can have on their skin, hair, and eyes, they choose herbal products over synthetic ones. The adverse effects of herbal products are minimal. There are many different types of shampoos, including medicated shampoos, liquid herbal shampoos, lotions, powders, clear liquids, and solid gels [3].

Sufficient amount of certain vitamins to meet your needs this means that the nutrients you ingest nourish essential processes like brain function before non-essential tasks like hair growth. As a result, a vitamin deficiency may cause slower hair growth, more fragile strands, a decrease in sebum (your natural scalp oil), and even hair loss. By supplementing your diet with vitamins, you give your body and hair follicles the nutrients they need to strengthen and thicken your hair growth [4-7].

Table 1: Importance of Vitamins [4-7]

S. No	Type of Vitamin	Uses
1	Vitamin A	• Antioxidant property which helps in clean up reactive radicals and protect hair follicle cells. • Improved blood circulation, spurring hair health and regeneration. • prevents scalp dryness by keeping your sebaceous glands functioning properly, producing more sebum oil for your skin and hair shaft, and giving you lush and full tresses.
2	Vitamin B B7, B5, B6, B9, B12	• Production of red blood cells, which transport oxygen and nutrients to your scalp and hair follicles, making them essential for lustrous hair growth. • Natural micronutrient that promotes healthy hair and nail growth. • Increased melanin production
3	Vitamin C	• Excellent for immune system maintenance; however, it is also one of the best vitamins for hair. It protects the body from free radical damage. • Absorption of iron, the formation of collagen, and the transport of oxygen throughout your body, resulting in long and elastic hair growth
4	Vitamin E	• Antioxidant, reducing oxidative stress and free radicals in your body, which can lead to cellular damage to your skin, including the skin on your scalp. • Dilates your blood vessels and prevents platelet aggregation (blood clots), which would otherwise obstruct blood flow, allowing blood to circulate through your body to your scalp to deliver vital follicle nutrients

Materials & Methods

Collection of the herbs

The different parts of the plants were selected for the study having hair care property. The plants are menthi powder, Hibiscus flower (*Hibiscus rosea*), Neem leaf (*Azadirachta indica*), Shikakai fruit (*Acacia concinna*), Aloe leaf (*Aloe barbadensis*), Soap nut (soap berries), Amla (*Emblica officinalis*), Reetha (*Sapindus mukorossi*) Black sesame seeds, Fenugreek powder.

Aloe vera Extraction

The gel extraction from *Aloe vera* leaves, had been carried out by removing of its exudates and its mucilage was scraped out with blunt edged knife. This mucilage was stirred vigorously in a blender to make it uniform. This solution was strained through a muslin cloth and filtered [8-9].

Table 2: Herbs used in the preparation of shampoo and their Biological source, use [10-15]

S.No	Name of the Herb	Uses	Image
1	**Shikakai:** It consists of fruits of the plant *Acacia concinna*, belonging to the family Leguminosae	Promotes hair development, controls hair fall, battles dandruff, and adds bounce and shine to lifeless hair, used as conditioner for rich content of saponins, natural foaming agent, maintains healthy hair environment	
2	***Aloe vera*:** Aloe is the juice collected by incision, from the bases of the leaves of various species of aloe, belonging to the family Asphodelaceae.	Used in herbal shampoo, also reduce inflammation, which can help people with dandruff symptoms, such as itchiness. It is an antifungal and antibacterial properties of *Aloe vera* may prevent Dandruff, restore the pH of scalp and increases the growth of the hair. *Aloe vera* cleaned the hair shaft efficiently, striping of extra sebum and residues from hair	
3	**Reetha:** It consists of fruits of the plant *Sapindus mukorossi*, belonging to the family Sapindaceae	Shows cooling effect and excellent cleansing effect on the skin, prevent the scalp from drying	
4	**Neem:** Neem consists of fresh or dried leaves and seed oil of *Azadirachta indica*, belonging to the family Meliaceae	Use in herbal shampoo. clean the scalp, clears the clogged pores and improves hair growth, extremely essential for the treatment of dandruff, endowed with antiseptic and healing properties, used for a variety of hair problems, helpful for removing dandruff using neem. According to Ayurveda, the herbs- Amla, Neem, Reetha, and shikakai are needed for enhancing hair growth	
5	**Hibiscus:** Hibiscus is the flowering plant of Hibiscus sabdariffa, belonging to the family Meliaceae	Most beneficial ingredient for hair, used for the growth of hair, its regrowth, and hair loss, carries amino acids, Vitamin A, C and alpha hydroxyl acids along with other nutrients that are highly beneficial for hair and scalp, keep scalp healthy and minimize the chances of dandruff from hair.	

6	**Amla:** It consists of fruits of the plant *Emblica-officinalis*, belonging to the family Phyllanthaceae	Strengthen the scalp and hair, stimulate hair growth, reduce hair loss, prevent or treat fungal and bacterial hair and scalp infections.	
7	**Fenugrrek:** It consists of seeds and leaves of *Trigonella foenum-gracum*, belonging to the family Fabaceae.	Rich in protein mucilaginous fiber, which encourage the moisturizer barrier in hair strand, also act as the simonising agent, and use to remove a dandruff	
8	**Black Sesame:** It consists of seeds of *Sesamum indicum* L. is a herbaceous annual plant belonging to the Pedaliaceae family.	Sesame seeds are abundant in omega fatty acids, Nourish the hair, improve hair growth with vitamin A and E, Blacken white hair especially black sesame seeds	

Preparation of Plant Extract

All the herbs were accurately weighed by using digital balance. The crude herbs were collected and these ingredients were size reduced using hand driven mixer individually grinded into powder, fine powder was passed through sieve number. 120 and separately mixed with 100 ml distilled water and kept for boiling till water gets reduced to one quarter. After boiling, the extract was cooled at normal room temperature and then filtered with muslin cloth to get the final filtrate [8, 9].

Preparation of Herbal Shampoo

Take a bowl and add Shikakai, Reetha, Amla, Fenugreek and Hibiscus powder
↓
Mix them well to get in equal composition
↓
Later add Black sesame seeds powder and add neem powder
↓
Mix all the components for 15-20 mins with *Aloe vera* gel
↓
Heat the total mixture on a Hot plate
↓
Add Sodium carboxy methyl cellulose and Preservative.
↓
Cool the mixture and finally add Rose water

Table 3: Formulation of Shampoo

S. No.	Ingredients	Quantity	Purpose
1	Amla	5% W/V	Strengthen the scalp and hair
2	Neem	5% W/V	Antibacterial
3	Shikakai	5% W/V	Foaming agent
4	Reetha	5% W/V	Foaming agent
5	*Aloe vera*	5% W/V	Conditioning agent
6	Black sesame seeds	5% W/V	Improve hair growth, Blacken the white hair
7	Sodium carboxy methyl cellulose	2% W/V	Thickening agent
8	Methyl paraben	0.5 ml	Preservative
9	Rose water	1 ml	Perfume
10	Distilled water	Q.S	Vehicle

Evaluation parameters of Herbal Shampoo [16-28]

1. **Physical appearance:** The attractiveness of shampoos for consumers tends to be judged visually to observe clarity, colour, odour it shows physical appearance of the formulation.
2. **pH:** The pH levels of the shampoo tested in 1% and 10% solutions were evaluated using a pH meter at a room temperature of 25±2 °C.
3. **Dirt dispersion:** 1% solution of shampoo solution with water from that 10 ml of diluted shampoo was taken and 01 drop of India ink was added; the test tube was stoppered and shaken 10 times. The amount of ink in the foam was estimated as none, light, moderate, or heavy. Shampoos that cause the ink to concentrate in the foam are considered poor quality. The dirt should remain in the water portion. Dirt that remains in the foam will be difficult to rinse away and will be redeposited on the hair.
4. **Foaming ability and foaming stability:** The cylinder shake method is the most widely used method for determining foaming ability. At room temperature, 50 ml of of the shampoo solution was filled into a 250 ml graduated cylinder, which was then covered by hand and shaken ten times. The total volume of the foam content after 60 sec of shaking was recorded. The height of the foam generated was measured immediately. To evaluate foam stability, the same procedure was performed and the foam volume after 20 min was measured.
5. **Percentage of solid contents:** Four grams of formulated shampoo was placed onto a clean, dry evaporating dish. The evaporating dish holding the shampoo was weighed using electronic balance, and the total weight was recorded as W_1. Then, the evaporating dish was placed on the hot air oven at 50 °C and was kept until the liquid content was completely evaporated. Finally, the cooled evaporating dish holding the solid content was weighed and recorded as W2.
   The percentage (%) of the solid content was calculated as $[(W_1-W_2) \div W_1] \times 100$.
6. **Measurement of surface tension:** In this method, stalagmometer is used by drop count method. Surface tension measures the strength of the cohesive forces of liquids. For example, water has strong cohesive forces, so surface tension is more. On the other hand, liquids such

as benzene have weak cohesive forces and hence, exhibit low surface tension compared to water. Lower the surface tension of the liquid, smaller the size of drops formed. Then more number of drops are formed for the same volume of a liquid. Hence, simply counting the number of drops for an unknown liquid and water is sufficient to calculate surface tension.

7. **Rheological evaluation:** Viscosity of liquid is determined by using capillary viscometer ie., Ostwald viscometer. When a liquid flows through the capillary tube, the time required for the liquid to pass between two marks (A and B) is determined. The time of flow of a liquid under test is compared with the time required for the reference sample of known viscosity (normally water is used).
8. **Skin Irritation Test**: Prepared polyherbal anti-dandruff shampoo was applied on skin for 5 minutes after washed and test for irritation or inflammation on the skin.
9. **Washability:** Wash your hands after applying of shampoo to hand.
10. **Wetting Time:** Wetting time of a substance is a function of its concentration. Drave's test is the official test but generally canvas disc method is used as it is easy and time saving. A canvas paper discs shape with smooth surface placed on the surface of herbal shampoo solution the stopwatch started. The time required for the disc to begin to sink was noted down as the wetting time.
11. **Antimicrobial Activity:** In this method the agar is melted, cooled at 45 C, inoculate with the test microorganism and then pour in the sterile petri plate. In this method when the agar plate has been solidified then holes about 9mm in diameter in the medium with sterile cork borer, Then the antimicrobial agent is placed in the hole and in another hole placed marketed formulation acts as standard, the diameter of zone of inhibition were measured after inoculation at 30-350C for 2-3 days. The diameter of zone of inhibition gives an indication of the relative activity of different antimicrobial substance against tested microorganism.
12. **Stability studies:** The stability studies for the herbal formulations were performed according to ICH guidelines. The formulations were tested for their physical appearance, % solid content, transparency, and PH.

Results & Discussion

Table 3: Evaluation tests for formulated shampoo

S. No.	Evaluation Test	Result	Image
1	Physical appearance	Brown colour, Aromatic odour, Smooth appearance	
2	pH	7.12±0.23	
3	Dirt dispersion	Light	
4	Foaming ability and foaming stabilit	15 ml and stable for more than 5 mins	
5	Percentage of solid contents	22.3%	
6	Measurement of surface tension	37.34 dyne/cm	

7	Rheological evaluation	21.33 cp	
8	Skin Irritation Test	Non- irritant	
9	Washability	Easily Washable	 
10	Wetting Time	90 sec	
11	Antimicrobial Activity	2.5 cm	

Table 4: Stability Studies for formulated shampoo

S. No	Evalution parameter	Initial value	After 30 days	After 60 days
1	Colour	Brown	No change	No change
2	Solid content	22.3%	22.3%	22.0%
3	Transparency	Thick	No change	No change
4	pH	7.12±0.23	7.09±0.23	7.05±0.23

Conclusion

The herbal shampoos are the preparations which are used for the washing and cleaning of hairs and to provide nourishment. The herbal shampoos are widely used due to their no or less side effects as compared to conventional shampoos, because it contains pure natural or herbal ingredients rather than synthetic chemicals. Herbal shampoo does not require animal testing and it is earth and skin friendly. The herbal liquid shampoo was formulated by using the various herbal ingredients. From the overall results showed neutral pH, non-irritant to the skin. Evaluation studies showed good results of appearance, wash ability, non-irritant to the skin, foam stability, dirt dispersion activity, anti-microbial activity, Rhelogical and surface tension tests.

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